

“Playing with” Museum Exhibits: Designing Educational Games Mediated by Mobile Technology

Nikoleta Yiannoutsou^a, Ioanna Papadimitriou^a, Vassilis Komis^a and Nikolaos Avouris^b

^aDepartment of ESECE, ICTE Group,

^bDepartment of ECE, HCI Group

University of Patras Campus,

Rion, Achaia, 26504 GREECE

+30 2610969339,

nyiannoutsou@gmail.com, {iopapad, komis, avouris}@upatras.gr

ABSTRACT

In this paper, we describe two educational games mediated by mobile technology which were designed for use in the context of a traditional historical museum by young children. Our analysis focuses on the principles of the educational design, on the use of mobile technology and on the envisaged interaction between the exhibits and the children. The main argument of the paper is that mobile technology can support the play with the exhibits of a museum -instead of just viewing them in the more traditional way– and in this context the spectrum of children interaction with the exhibits can be broadened and enriched.

Categories and subject descriptors

H.5.1 Multimedia Information Systems, H.5.3 Group and Organization Interfaces, K.3.1 Computer Uses in Education, K.8.0 Games.

General Terms

Design, Experimentation.

Keywords

Museums, educational games, mobile technologies.

1. BACKGROUND

Mobile technologies can find in museums an important area of implementation as they are a natural aid to support museum visits which are structured around motion and in addition, they support visitors during and not just after or before the visit, as with more traditional desktop computer technologies [10, 14].

A museum visit which is supported and mediated by mobile technologies can activate the visitors' motivation by stimulating their imagination and engagement. It can also provide opportunities to reorganize and conceptualize historical, cultural and technological facts about the exhibits in a constructive and meaningful way. Design process should take into account the specific context of use, social and constructivist aspects of

learning and pedagogical approaches.

Reviews of existing cases of use of mobile technologies for educational purposes in museums can be classified in three main categories. The first category includes applications that mainly deliver information to the visitor. These applications aim to enhance the learning process by supplying multimedia and context-related content [12]. The second category includes applications aiming to enrich the interaction between the user and the exhibits. Such examples are the applications developed for Exploratorium, a science museum in San Francisco. [3] and the Sotto Voce System [4]. The third category includes applications designed around a specific educational scenario where the users, mostly children aged 5-15, are challenged to act a role and complete carefully designed pedagogical tasks. Examples include the MUSEX application deployed in the National Museum of Emerging Science and Innovation in Japan [13], the Scavenger Hunt Game in the Chicago Historical Society Museum [7], the Myartspace service for gathering multimedia information during museum visits[14], the archeological site game discussed in [1], etc.

One important characteristic of museum visits mediated by mobile technologies is that museum artifacts become tangible: distant museum exhibits that were out there for the visitors allowing them just to observe now can be virtually touched, opened, turned and decomposed. Technology here provides the key to the user to open up the exhibit, explore it and construct an experience out of it.

The exhibit-visitor interaction process in a traditional museum involves reading of information on a tag or the guide and observation of the exhibit. This is considered as one-dimensional “information flow” from the exhibit to the user. Mobile technology facilitates the transformation of the one dimensional relationship to a dialectic relationship. Furthermore, this relationship can now include another important component of the museum environment: the other visitors. By providing a record of user-exhibit interaction for other visitors to see, reflect upon and transform, technology can support social activities of communication, co-construction etc., between the visitors.

To sum up, mobile technology mediates three types of interaction between visitors and the environment of a museum: : a) “exhibit – visitor” interaction (e.g. information about the exhibit provided to the visitor) b) “visitor – exhibit” interaction (e.g. annotation of the exhibits, or comments about the exhibits by visitors) and c) “between the visitors” interaction concerning exchange of

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information and comments among the visitors. This enrichment of interaction between visitors and the museum might result in offering more or different learning opportunities [2].

In addition, the use of mobile devices provides a new and attractive way of interacting with the museum content especially for young children [5]. In particular when the visitors are young children, these new ways of interaction with the exhibits, may be exploited in order to enhance the visit experience through educational games. There are many studies on the role of play in learning (see for example [11]) that have been revisited lately due to the expansion of electronic games. Our perspective in this study is to view educational game as a context where information about the museum exhibits becomes meaningful and can be used for a specific purpose [6]. Situating information in context facilitates knowledge construction by offering the practices, the tools, and the relevant background along with the objectives towards which learning is directed and has a specific meaning or a special function, as information or furthermore “knowledge” is used for a specific purpose [8].

2. CONTEXT AND DESIGN PRINCIPLES

The educational games discussed in this paper and the technology supporting them, have been designed for the Museum of Solomos and Eminent Zakynthians, a traditional historical and cultural museum in Zakynthos, Greece. The museum exhibits are mainly paintings, personal belongings, original works of historical persons of the region, that is mostly literary people, like poets, writers, composers etc. Both game activities are mediated by Personal Digital Assistants (PDA) and the children are expected to use them in order to play the games.

The design of the game activities and the accompanying software followed a set of principles which are briefly presented here:

a) *Design in respect to the organization (museum)*. Technology was smoothly embedded in the museum ecology without demanding extreme changes of the arrangement of this traditional museum. Furthermore, the new computing infrastructure built tried to support and enrich the accumulated knowledge about the exhibits that existed before the addition of technology (i.e. clustering of exhibits, predefined thematic routes etc.)

b) *Design for unobtrusive presence*. Technology was infused into the museum exhibits and it was designed so that it is fine tuned to the visitors’ actions and intentions. This means that the software was designed so that it does not become an obstacle for the visitors to play the games. The underlying principle was to keep technical aspects (e.g. avoid issues of the type “what do I have to do in order to link one clue to an exhibit”) out of the attention of the visitors and provide functionalities that will help them focus on the game and the exhibits involved.

c) *Design for engaging the users* i.e. “playing with exhibits” instead of just viewing them. The exhibits and the relevant information are situated in the context of a game. This approach offers to the young visitors the opportunity to use the exhibits and the information about them in a meaningful way. The difference between viewing and playing with the exhibits would be like learning geometry for knowing it or learning geometry because you need it to construct something [9].

d) *Design for enriching the spectrum of interaction between the museum and the user*: The games designed and the technology which supports them allows two dimensional interaction:

interaction with the exhibits and interaction with other visitors. The aim here is to see the museum visit also as a structured social activity.

e) *Design for collaboration*: The activities are designed so that collaboration is an integral part of the game activity which means that the users need to collaborate in order to play the game and complete it. In the first game called Donation inter and intra group collaboration takes place. In the second game called Museum scrabble, users collaborate within their group but they also need to take into account the actions of the opponent group.

3. THE EDUCATIONAL GAME ACTIVITIES

In this section we describe two educational games that were developed according to the principles presented earlier.

3.1 Donation

The “Donation” is a group activity that aims at the engagement of children in collection and manipulation of information about the museum exhibits. It is based on a scenario, according to which the children are asked to discover a specific exhibit in order to help an imaginary art benefactor to donate an artifact to the Museum. Children scan with their PDAs the RFID tags and receive information about the exhibits. In the collected information they have to locate some hidden hints. These hints describe the sought exhibit. The players can store these hints in a notepad in their mobile devices and use it in order to solve the given problem. Two teams play the game. They are asked to exchange hint phrases between them as an encouragement for collaboration. Collaboration is also encouraged through a set of restrictions that do not allow teams to collect all available hints. Each team can collect only up to three of the six available hints. So, teams need to exchange their pieces of information in order to obtain a meaningful description of the exhibit they are looking for. Also agreement on the exhibit is needed between the two teams. Both teams need to point, by using the PDA, to an exhibit to check if it is the exhibit they are looking for. This activity is completed successfully once both teams point to the correct exhibit.

3.2 Museum Scrabble

The *Museum Scrabble* game is based on the idea of linking exhibit properties with other exhibits. The basic components of the game are the clues, the triggers and the exhibits. Clues are pieces of textual information associated to a specific exhibit that contain triggers for linking to other exhibits. These links have varying strengths, and thus the challenge for the young players is to identify the stronger links, thus collecting more points. Clues might refer to those exhibits which are the focus of the visit (e.g. the works of an author or the paintings of the specific period). The main information about the exhibit is stored in the game as items/triggers of the relevant clue. Each trigger can be linked to more than one exhibits giving points to the player according to its relevance to the trigger. Thus, a more relevant to the trigger exhibit when linked to it, adds more points to the score than a less relevant one. Potentially all exhibits can be linked to a trigger but not all of them add points to the score.

When the game starts, the clues are automatically stored in the PDA, the players can select any clue they want, check out its triggers and decide if they will play with the specific clue or they will move on to another clue. In order to link the exhibit to the trigger of the clue, the children have to search in the museum for

the most relevant exhibit and point to it using their PDA. Once the exhibit is stored in the PDA children can decide if they will link it to the trigger they are working with or if they will keep it stored for another trigger. Thus the trigger provides a point of view, or a criterion for searching in the museum for the relevant exhibit.

The game is designed so that a group plays against another group. Hence when an exhibit is linked to a trigger, then this exhibit becomes no longer available for linking to the other group. Only the group that built a link between a trigger and an exhibit can break this link and make the exhibit – and the trigger- available again. Each group is aware of the score of the rival group and is also aware of which triggers the opponents have already linked. The game ends when all clues are linked to exhibits and the winner is the group who has the highest score. The game can be either played by two individuals – playing one against the other- or by two groups of children.

The rationale behind the design of this game is to offer some basic information about a set of key exhibits and engage students to use this information as a point of view for searching for other relevant exhibits. Thus a trigger (i.e. a property of an exhibit) and an exhibit might share the same colour, might involve the same theme (e.g. two different paintings of the same theme), might have the same property (i.e. they are both works of the same artist), might involve the same historical event etc. Like the known scrabble game any link is possible as long as there is a common point between the linked objects. The educational aim is to help students focus on specific information about a set of key exhibits, think about this information and use their imagination and their skill to observe as tools for searching and finding relevant exhibits in the museum.

4. THE MEDIATION OF MOBILE TECHNOLOGIES

Why do we need mobile technologies to support these games? Our answer to this question is that the mediation of mobile technologies contributes in enriching children interaction with the museum in the following ways:

- a) Store, manipulate, exchange information
- b) Transform the one dimensional relationship between the exhibit and the user (flow of information from the exhibit to the user) to dialectic relationship (the user can interact back with the exhibit, by asking for info, clues or hints, by linking it with other exhibits)
- c) Support the process of making museum visit a social activity rather than an individual matter (status awareness of the co-players, awareness of the other players interaction with the exhibits, exchange of information, etc).

5. EXPECTED INTERACTION – CHARACTERISTICS

The dialectic relationship between the user and the museum artifacts, mediated by mobile devices, might offer chances for analysis of the exhibit, experimentation with it, hypothesis formulation and testing, construction of interpretation, information processing and organization, reflection and many more, according to the educational activity designed around the proposed games. Collaboration and communication about the exhibits and information processing about them makes possible socio-constructive learning activities. If we compare these elements of the learning process to the reading of information or listening to information about the exhibits (which is a the starting

point for a traditional museum visit) we might realize that mobile technology has the potential to offer an active role to the visitor: she can choose the information she wants to see, open up and de-construct an exhibit if she is interested in it, see how other visitors have interacted with a certain exhibit, discuss about it with them, exchange information, store information for further processing and use etc.

6. PRELIMINARY FINDINGS

The games presented here have been used in two pilot studies in order to test the functionalities and to observe how visitors respond to the games characteristics. The outcome of our observation was used as input for fine tuning and refining of the details of the educational games.

The *Donation* was used during the museum visit of two groups of children which participated in this study. The first group consisted of seventeen 11 year old elementary school pupils. The second group consisted of twenty 14 year old junior high school children. Children played in pairs. Each pair could use one PDA. Data were collected by video cameras, mp3 recorders, while questionnaires and interviews were also used. Dialogues, observation notes and log files were used for the evaluation of the activities. Preliminary data analysis indicated that children developed “a task oriented way” of treating exhibit information (i.e. there were just few cases where students read information meticulously, many cases where they read exhibit information and searched for clues and many cases where they were scanning exhibit information just searching for clues). According to the reports students compiled after the visit, it seems that this task oriented practice helped students to formulate a concrete and clear idea about the exhibits they played with. In addition, the activity appeared to be engaging and pleasant for the students.

The *Scrabble* game was tested so far just with grown-ups. The results of the relevant pilot study were similar to those of the *Donation* with respect to user engagement. In addition, the study offered valuable feedback with respect to the design of the activity, because it was found that some exhibits were more appropriate for being used as clues in comparison to others, so special effort should be put in identifying their characteristics, thus re-designing the content of the game and developing design principles for future implementations.

7. CONCLUDING REMARKS

The experience of designing the presented games, helped us draw some general remarks with respect to use of mobile technologies. An enriched interaction with the museum exhibits was observed: Children interacted with the exhibits, used their information in order to play the games and searched for relevant exhibits. The technology used and the design of the games added a social dimension in the museum visit because it supported and invoked interaction and collaboration between the visitors of the museum. Finally, the educational games have been designed so as to offer a context where the exhibit information became meaningful and useful, i.e: children used this information in order to play the games and achieve their goals. Thus the exhibits and their information were not treated as something for the users just to see and know about but as something that can play with, think with and have fun with in a purposeful manner.

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