

# Touch By Touch: Promoting Cultural Awareness With Multitouch Gaming

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**Abstract**— This paper presents a work in progress focused on facilitation of cross-cultural awareness between citizens of two European cities. We aim to engage visitors of telecom museums in Athens and Luxembourg to learn more about both cities by means of collaborative games played on multitouch tables. We also explore how live video-to-video streaming influences players' behaviour and collaboration with remote players.

**Keywords**— *Serious gaming; museum exhibits; telepresence; distributed collaboration; video to video; multitouch displays*

## I. INTRODUCTION

Multitouch interaction has received a considerable attention in recent years due to its simplicity and intuitiveness for users. Several industrial and research projects investigate various aspects of interaction with multitouch displays in public spaces [1, 2], in urban environments [3] and museums [4]. Moreover, internet technologies provide a way to bring together people, communities and business. This is particularly true for video-to-video platforms such as Skype and social networks such as Facebook. Yet to date there is little bringing together of museums, cultural venues or twinned cities using recent technologies.

In this paper we present a work in progress employing playful interactions settings to facilitate learning of museum exhibits by visitors. In contrast to the existing work focused mainly on single-table studies, we explore international multiplayer scenario. The system is designed to allow for visitors at two locations in Athens (Telecom Museum) and Luxembourg (P&T Post Museum) to interact with one another in a "joint experience", the aim being to promote awareness of each city to visitors at both locations. The final design will also use live video-to-video streaming to enhance interaction.

Our vision is to provide a set of tools that allow for people at twinned locations, whether they are in a museum or city hall, to learn more about their own and remote location through interacting with people at the other venue. This will lead to improved cultural exchange between people, reduce digital borders between different European countries and provide new interaction possibilities. It is important to note that while the test platform is for use within museums it can be extended to twinned towns, cities or schools.

The paper is structured as follows. Firstly we present our requirements capture study and the system evaluation criteria it identified. Then we introduce several game design prototypes

corresponding to the requirements. Finally, a brief summary concludes the paper.

## II. REQUIREMENTS CAPTURE

Game designs were undertaken and a requirements capture study was carried out using interviews and focus groups. The work was on two primary levels, firstly at a high level to identify issues relating to general museum exhibit design. This involved people with experience of curating, developing and managing museum exhibits but who were not specifically related to the setup we are creating. At a specific level we also worked extensively with one of the museums involved in the experience to identify their individual requirements. The other museum is one of the project partners and has provided substantial information on their requirements, including visitor demographics etc. As our intention is to develop a platform usable by any twinned location, e.g. cities or museums, we needed to balance specifics against more general design requirements.

As a result of the study, the following evaluation criteria have been identified:

**Technical indicators:** multimedia quality, network latency (acceptable at around 60 ms).

**User indicators:** application failures, average game playing time, number of users leaving without finishing the game, number of times assistance is required, frustration expression, game usability, number of complaints, social co-presence, personalisation, whether the service provoked discussions or not, social networking interactions.

**Process indicators:** how many people are using the exhibits, how many users are using the application, visit time, number of first time visitors, number of returning visitors.

Moreover, the participants of the study suggested several methods of assessing the above indicators: questionnaires, log files, data mining users' public posts on social networking websites.

Regarding the game designs, we have identified a number of general requirements:

- The game should be familiar for the prospective players or intuitive enough so that museum visitors could engage into the game without instructions.

- Game concept should be easily adjustable to specific topic (exhibition, venue, event).
- Given the international nature of the interaction, the game should rely on graphic metaphors rather than text. This would also make the game more accessible for young children.
- The game should increase players' cross-cultural awareness and enhance their knowledge of the topics covered by both local and remote museum exhibitions.
- In order to augment cross-cultural presence and playing experience, the game should naturally support multiplayer settings, where the same game is simultaneously played by visitors at different cities.

While the games must be designed to support multiplayer activity, occasionally the latter may not be feasible due to the unpredictable timing of museum visits (except for advance group reservations). Therefore, the game should remain playable even without remote players. Once arrived, remote visitors can join the game in progress or start a different game.

Apart from multiplayer gaming mode, remote presence is facilitated by the video-to-video (v2v) communication provided by the v2v platform of LiveCity project [5]. High-definition cameras and displays to be installed in each museum will cover multitouch table proximity area and show that of the remote site.

In order to allow for the exhibit to be used after the project has ended at other locations a content management system is being developed which will allow other venues or cities to add their own content to the standard games.

### III. GAME DESIGN PROTOTYPES

Following the requirements presented in the previous section, we have identified a number of suitable game concepts, which are well-known or intuitive, naturally integrate multitouch interaction, and can easily be fit for different content.

#### A. Jigsaw / Mosaic

In this game, players at different sites collaborate to reconstruct an image or a video from a set of mixed tiles (Fig. 1). The puzzle is based on graphic content (either static or dynamic), such as images or video. In the latter case, the game can be based on a live video streamed from the other player's webcam. The content is split into a set of equally sized tiles, each showing its part of the original graphics. The objective of the game is to arrange the jumbled tiles so that they combine up into the original image or video.

This game benefits from multitouch interaction, since the latter enables the players to arrange the tiles in an intuitive manner, as well as to collaborate for reaching the game objective in shorter time.

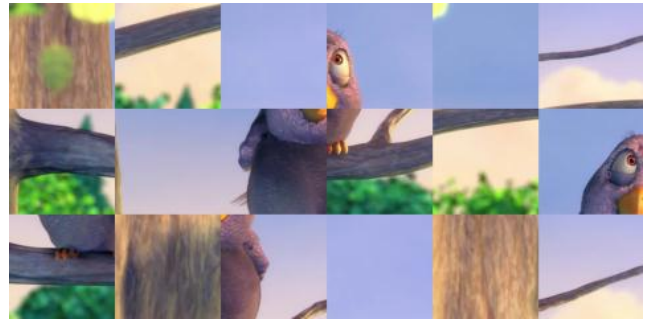


Fig. 1. Mosaic game example.

#### B. Put-in-order

In the put-in-order game, the players are provided with a "map" with blank spots and a set of objects. The objective of the game is to correctly arrange objects on the screen, covering each blank spot with a relevant object. This game concept is highly flexible and can be adapted to wide variety of use cases, such as arranging planets in the Solar system, country flags on a map (Fig. 2), exhibits on a museum floor plan, historical events on a timeline, and so on.



Fig. 2. Put-in-order game example.

#### C. Memory

Memory is a tile-matching game [6]. Each tile contains an image, initially hidden from the players. Every tile in the game has a corresponding pair tile with the same content. The players can open two tiles at a time to view and remember the images. When the opened tiles are the same, they remain open (see Fig. 3). The game objective is to open all the tiles in minimal time. Clearly, this requires the players to remember well the content of previously opened tiles, which explains the game name.

In our setup, the same-image criterion is extended to a "related-images" one, where paired tiles contain visually different but semantically coherent content (for example, an object and its name, a device and its inventor, same word in different languages, a letter and its Morse code, and so on). Apart from memory training, the game motivates the players to learn associative links between objects and concepts in the game topic.



Fig. 3. Memory game example.

#### D. Treasure hunt

The games described above focus mainly on interaction with multitouch tables at a fixed place. In order to improve players' mobility and to motivate them to explore the museum, we plan to extend the games with a "treasure hunt" component involving mobile devices. In particular, we will exclude certain important objects from a table-based game, and suggest the players to find these objects among museum exhibits in order to make them available within the game. Finding the object should be confirmed by scanning a nearby barcode, RFID tag or directly typing a code.

This approach is expected to ensure that the multitouch table does not become a stand-alone artifact, but rather integrates into the exhibition.

### IV. CONTENT MANAGEMENT SYSTEM

In the previous section we introduced a number of game design prototypes, which are generic enough to be modified to target a specific knowledge area. Our objective is to enable creation of game sets targeting specific topics, so that the games are adjusted scheduled thematic school visits or reflect special exhibitions occasionally performed in the museums. However, typical users of the system are school teachers and museum curators, who are not IT experts and cannot be expected to manually edit configuration files.

To address this issue, we implement a content management system (CMS) which provides the users with an intuitive and easy web interface which allows adding new multimedia content, creating new game instances, managing scheduled events around the exhibit and monitoring players' performance. Since certain actions may require special credentials, the user should be authenticated. Our implementation of the CMS is based on web2py [7] – a free, open-source web framework for agile development of secure database-driven web applications.

We have preliminary identified several user roles for the system, such as contributor, who can submit new multimedia content to create new game instances, moderator, who decides whether contributed content complies with ethical and

aesthetical requirements, curator, who can schedule and update events (such as school visits), and player, who can view his/her game performance (scores, number of games played, other metrics). Clearly, one user may have multiple roles.

An interesting opportunity to be explored by the project is enabling school children to create game instances with custom content and offering these games for scheduled school visits in another country's museum. Thus, Luxembourgish pupils would create challenges for Greek museum visitors and vice versa (Fig. 4). The implicit competition in game creation and playing is expected to increase participants' engagement and facilitate learning of the subject by both game creators and players.

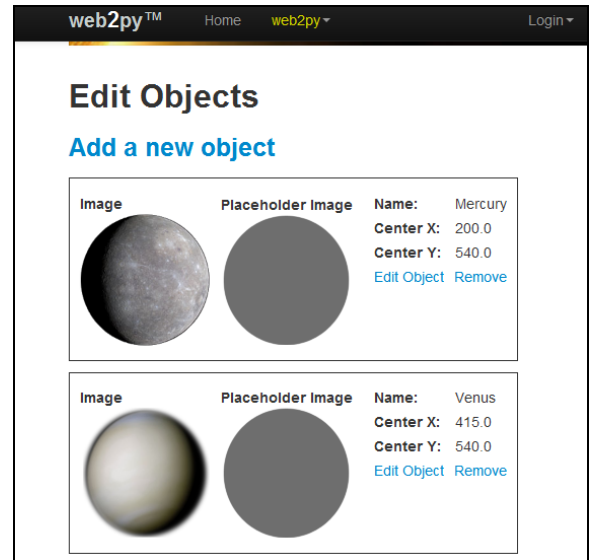


Fig. 4. Put-in-order game content editor.

The online part of the CMS is complimented by a game control panel running on multitouch tables in the museums (Fig. 5). The panel is a gateway for the visitors, providing access to information about the museum and its exhibits, educational videos, and the main functionality – the games. The visitors can choose the game of interest from the list of available games instances and their content (fetched in real time from the CMS). Since each game is multiplayer by design, the panel displays the number of remote players already involved in the game, so that local visitors can either join the running game or start their own.

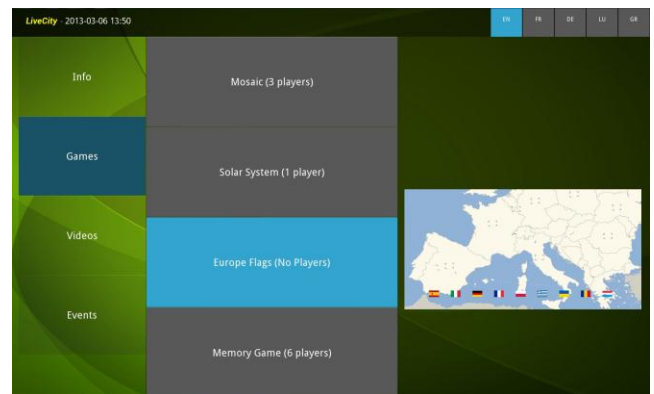


Fig. 5. Game control panel prototype.

## V. FUTURE WORK

In addition to the performance indicators identified earlier the platform will also be evaluated for usability and sense of presence. We will use a variety of methods including video analysis, questionnaires and interviews. From a pure usability perspective we will explore aspect such as the frequency and severity of errors made by users when completing designated tasks, in addition we will also explore the levels of subjective satisfaction gained from using the system. The subjective and objective data will then be used to conduct semi-structured interviews with the end-users. As LiveCity project is focused around the concept of telepresence we also plan to explore the degree of social presence between users. Of particular interest will be exploring the impact of allowing a high degree of interaction between users at remote locations. Planning for the studies is currently on-going and will take place in mid-2013 and the results will be used to refine the design as well as to assess its overall success.

## VI. CONCLUSION

The presented interactive museum exhibit, based on a multitouch table, is designed to give a new cultural experience to the visitors. By joining together two distant locations it

allows city dwellers to explore the culture of another city simply by playing games together. The key performance indicators have been identified and the system is being in the development state.

## ACKNOWLEDGEMENTS

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