Serious games: Valuable Tools for Cultural Heritage

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Abstract. Wishing to connect cultural heritage, games and social networks, the present work describes games to be used within the framework of a European H2020 project. For the purposes of supporting the museum visit, before, during and after, 5 games were designed for social networks to accomplish user profiling, to promote the museum and the application through social network dissemination, to introduce museum items and themes and to also function as visit souvenirs. The games are also presented in a generic framework for games in cultural heritage, which has been used successfully in the past.

1. Introduction

The Horizon 2020 European project "CrossCult: Empowering reuse of digital cultural heritage in context-aware crosscuts of European history" [1] aims at changing peoples' point of view regarding history and to foster numerous interpretations and re-interpretations of the European past through cross-border interconnections among cultural digital resources, citizen viewpoints and physical venues. Moreover, it uses cutting edge technology in order to enhance the visitor's experience with several digital recourses and personalized interactive experiences. In this way, cognitive and emotional responses for vigorous history engagement can be created. Apart from the stimulation of reflection, people have the opportunity to explore historical events and information and to perceive history in an all-encompassing way.

Within the framework of CrossCult a pilot will be implemented for the Archaeological Museum of Tripolis (Greece), a small museum and less known or popular among tourists. This pilot aims to provide guests with an unexpected way of connecting with the museum's historical artifacts, by encouraging crosscutting and transversal viewings of them. Such connections will allow visitors to go deeper than customary method of museum presentations (e.g., type of a statue, construction date, its place of origin). The use of this pilot should facilitate reflections and prospective interpretations according

to the specified topics regarding women in ancient and modern times, including subtopics such as women's appearance, female divinities, ancient female names and meaning, women's status, among many others, all relevant to the museum's physical objects.

Games are a central element in CrossCult used in all project pilots, since they can be highly engaging, attract new visitors and provide cultural content in a way that can lead to long lasting experiences [2]. In particular, for the Archaeological Museum of Tripolis, games were employed as (a) tools for user profiling, (b) mediums to introduce specified thematic topics to the potential museum visitors, (c) an advertising technique to promote the venue, but also the mobile app and (d) a tool for creating souvenirs for the visitors that could be used in social media to remind them of their visit.

2. Related work

In recent years, gamification methods in cultural spaces play an increasingly important role. Foni et al. [3] assert that serious games are a promising tool in this field. Serious games are able to attract more visitors, unfamiliar with art and history. For instance, serious games have been built to draw the interest of more users to the archaeological places' websites and thus to make these archaeological sites known and possibly to increase physical visits to the sites themselves [2]. Similar studies have been conducted and it has been found that games can successfully promote cultural heritage and tourism [4]. Projects such as Travel in Europe (TiE) [5] and Second China [6] have attempted to make users aware of cultural heritage places. In detail, the Travel in Europe (TiE) application allows users to virtually interact with cultural heritage artifacts (e.g., buildings, artworks) of different European cities through simple treasure hunt games.

In spaces of cultural heritage, contextualization of museum exhibits through serious games will lead people to recognize and appreciate their value, as suggested by Belloti et al. [7]. Serious games can provide player engagement by creating a fun experience for users while also supporting them to achieve learning objectives [8]. Games can also aid in familiarizing young people with unpopular cultural heritage topics, such as art history, and significantly increase their interest levels and engagement [9]. In addition, it has been observed that user participation and contribution towards the creation of digital libraries (e.g., heritage collections) has often been unsuccessful, as low user motivation and participation leads to empty or underutilized collections. To tackle this problem, [10] reports on an experimental platform to build a collection of heritage images through the "SaveMyHeritage" Facebook game. To identify the optimal technique for motivating user participation towards the creation of a heritage collection, two different approaches were compared. Direct user competition through gaming was found to be more effective in motivating user participation when compared to a badge system.

Furthermore, it has been discovered that there an association exists between game playing and personality factors [11]. In recent studies such as EXPERIMEDIA Blue[12] and CHESS [13], user characteristics and preferences have been extracted through games in order to be used for profiling purposes and in particular for museum profiling purposes, since other direct profiling methods might be more time consuming and inappropriate for use in cultural heritage[14]. In this light, games can be used to

provide solution to the problem of visitor profiling, in order to maximize the effect of cultural visits through content personalization [15,16].

According to Antoniou et al. [2], it is important that different types of games with different characteristics and mechanics are designed for the wide range of spaces, which are categorized as cultural heritage sites (e.g. museums of different types, ancient/modern cities, temples of different religions, etc.) due to the fact that they do not shape a homogeneous group. In addition, other researchers also assert that not all games are appropriate for all spaces; for instance De Amicis et al. [17] present a holistic methodology for designing games is applied in three different sites, adjusted to their specific characteristics. The educational potential of the platform approach to gaming has been explored by Apostellis and Daradoumis [18] for dome theatres, and by De Paolis et al. [19] in a variety of different types of sites. Similarly, De Paolis et al. [20] applied a gaming platform approach to assist learning of medieval history. A generic approach for games for cultural heritage is presented by Mikovec et al. [21] based on ten years of experience; in 2012 Bellotti et al. [7] also proposed a holistic model for the design of serious games in spaces of cultural heritage. Finally, Bellotti et al. [5] described the different cognitive elements that games can support which were later incorporated in the framework for the design of cultural heritage games proposed by Antoniou et al. [2], which is also used here to demonstrate the games designed for the Tripolis museum.

3. Descriptive model for cultural heritage games

The descriptive model for the use of games in cultural heritage, fully explained by Antoniou et al [2], will be used here to describe the 5 games for the archaeological museum of Tripolis (Table 1). The model is divided into three major categories: (a) game characteristics, (b) player characteristics and (c) organization characteristics.

The game characteristics include: (a) the cognitive skills that the game tries to enhance, (b) the learning objectives of the game which direct to the improvement of player's skills (i.e., knowledge, comprehension, application, analysis, synthesis, and/or evaluation, following Bloom's taxonomy of educational objectives, [22]), (c) the numbers of players, (d) the game's theme (e.g., adventure, strategy, action), (e) the interaction mode (1st person, 3rd person, adaptive, etc.), (f) the target audience (e.g. schools, families, adults), (g) the game flow, (h) the game play, (i) the mechanics, (j) the game aesthetics, (k) the interface design and (l) the technology (e.g., mobile, virtual reality, desktop). Player/visitor characteristics can be divided in situation/visit independent, such as personality factors (i.e., cognitive and learning style, age), and situation/visit dependent, such as visitor type factors (e.g., if the visitor is alone or in a group) and other situational factors (e.g., time of the day, tiredness levels, time constraints). The organization characteristics include (a) information about site/museum type (e.g., archaeological), (b) different organization characteristics and resources (e.g., personnel, budget), (c) the main goals set by the organization for the use of games and (d) the level of *museumness*. Museumness refers to visitors' perceptions on a certain physical or virtual space and whether this space forms a typical museum or not. These perceptions influence the acceptance of different elements in those spaces including games [23].

4. Game Design

The games designed here can be used independently of the museum visit (before or after it) as well as during the visit. As a consequence, the museum experience will be enhanced and in the same time the experience can move beyond the museum walls. To increase the visibility of the games, they will be made available and promoted through social networks such as Facebook, while they will also be made available through the mobile application for the Archaeological Museum of Tripolis. These games are the following: (1) "Your face in a statue!", (2) "Who is your guardian goddess?", (3) "Anthroponymy", (4) "Your status in the ancient society" and (5) "Old-fashion".

It is important to note here that all the games developed will be appropriate for all users and all age groups. Although, they focus on ancient culture themes, the games will not only target museum goers but all interested users, since they can function independently as well. In this light, there are no specific user characteristics to consider other than people accustomed to mobile and/or social network technology, in order to be able to play the game either on social networks or the mobile museum app or both. However, despite the required familiarization with such technologies, the game interface will be user friendly, easy to learn and handle, and will not require high cognitive resources. Finally, the game interface design will respect guidelines for both desktop and mobile applications.

All games described below are mini games for single player that are used for 3 main reasons, to:

1. promote the museum and the application using quick dissemination channels such as social media,
2. acquire sufficient information in order to create user profiles
3. allow users to engage with museum material before and after the visit, offering a continuity of the experience.

In this light, learning was not a main objective in the design of the games, which function rather as an introduction to the museum content. However, some of them have the potential to support learning elements. Using Bloom's taxonomy [22], most of the learning objectives that can be supported are of the lower levels of the taxonomy since learning was not the primary design goal.

The first game "Your face on a statue!" follows the paradigm of online "Face in a Hole" games. In this game, players aim to capture self-portraits and present themselves with the body of an ancient statue of their choice. According to the proposed model of Antoniou et al. [2],"Your face on a statue!" is a mini game. The task of the player is to reassemble an ancient statue by collecting its different parts. When the statue is fully reconstructed, the players can claim a picture with their face on the statue as a reward. Thus, the theme of the game is observingness. This game is designed for players of all ages and it would be a different way of creating souvenirs for the museum visitors. This particular game is foreseen to function as a social network profile picture and it is believed that will quickly gain popularity with social network users. In addition, since statues from the museum items will be also used, the game can also function as a visit

souvenir with a personal twist. This particular game does not have an explicit learning goal, as it rather aims at promoting the application and allow the users to explore the museum content further by using museum items. Having said that, an indirect link to learning is however implied, since the player uses museum content for the game, which could support the further exploration. Since learning though was not a main feature in the design of this game, its learning objectives cannot be further discussed. The game's activity diagram is presented in Figure 1.

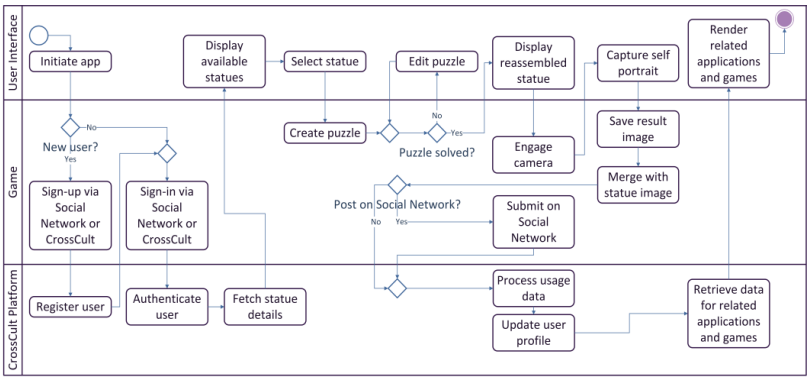

Fig. 1. Activity diagram of the "Your face on a statue!" game.

The second game "Who is your guardian goddess?" is a short quiz game, with historical, archaeological and mythological questions regarding the Greek ancient religion and Greek ancient gods. At the end of the game, the player is matched with a goddess as her protector (e.g., Hera/marriage. Artemis/birth, Aphrodite/love). Through this game, cognitive skills such as reflection and low-level learning can be supported, since players learn about the ancient religion and see how this is relevant to their own lives. The target group of this game can be people of all ages. However, this game is designed to also reveal the cognitive style of the player, since while users answer questions to find out their protector goddess, the game collects valuable visitor profiling information to be used later during the museum visit. The quiz questions are based on MBTI (Myers-Briggs Type Indicator) tool for assessing individuals' cognitive styles, which has been successfully used in the past to identify users' personality traits in a game for cultural heritage in social networks [24]. The quiz will assess players cognitive style, by asking questions related to personality preferences (e.g. in the question "What is your favorite animal?", the different possible answers can be linked to specific dimensions in the MBTI tool (for games that reveal personality traits a detailed explanation is presented in [12]. Figure 2 presents the game's activity diagram.

The third game "Anthroponymy" is based on the classic game "PacMan" which is categorized as a maze/action game. The goal of the players is to solve a maze in order to receive the etymology of their name. They can achieve this by unlocking paths inside the maze through anagrammatizing words related to archaeology, within a specific time limit. The faster they find the word, the more points they can earn (Fig. 3). This game targets players of all ages who have to retrieve knowledge regarding word spelling. The

game's themes are knowledge and adventure. This specific game will introduce to players terminology used in the area of archaeology and a specific theme of the Archaeological Museum of Tripolis (an important archaeological object is housed at the Tripolis museum about ancient female names) and it is believed to attract Facebook gamers due to its short duration and the personal element that analyzes the name of the gamer. In regards to learning, this game can target the first three levels in the Bloom's taxonomy (i.e. Knowledge, Comprehension and Application), since the user is engaged in anagrammatizing words and trying to apply previous knowledge to unlock game paths.

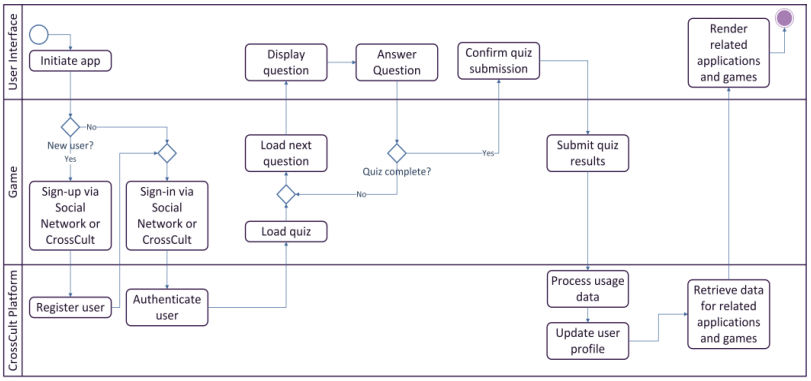

Fig. 2. Activity diagram of the "Who is your guardian goddess?" game.

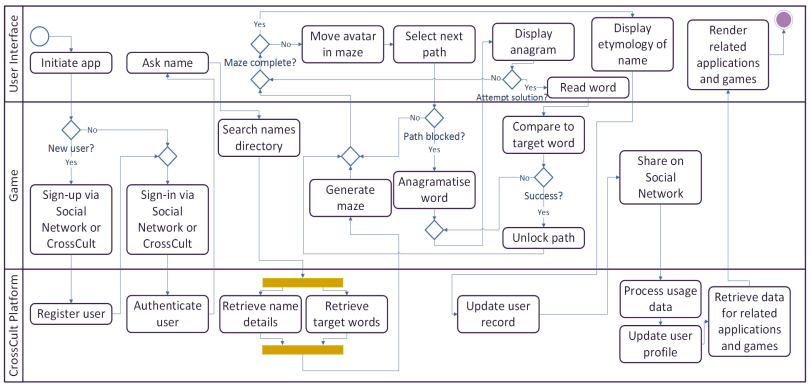

Fig. 3. Activity diagram of the "Anthroponymy" game.

The fourth game "Your status in the ancient society" is a short quiz game in which players have to answer questions regarding ancient citizens' social status. At the end of the game, players can see their total score and receive extra information about ancient society and the kind of citizen they would be, based on their personalities. This pop psychology quiz, again based on MBTI-targeted questions, will allow users to discover things about themselves and will also collect user profiling information. " Your status in the ancient society" is a mini game which will help us identify the user's profile in the same manner as the "Who is your guardian goddess?" game, with the same learning

objectives. It is hypothesized that pop psychology games like the ones described here, will be quickly disseminated through Facebook and will possibly attract new app users and/or museum visitors (Fig. 4).

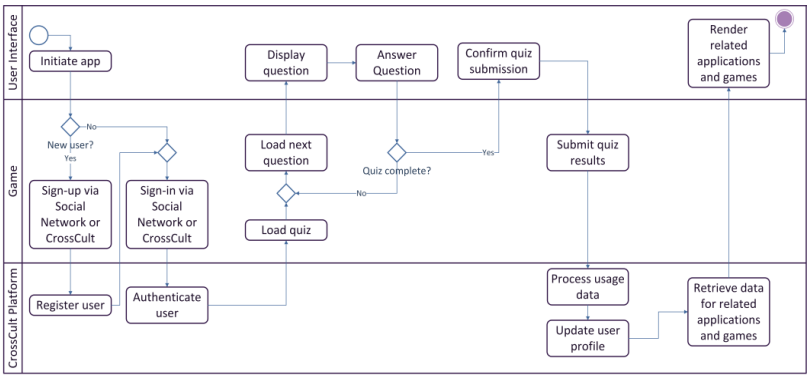

Fig. 4. Activity diagram of the "Your status in the ancient society" game.

The fifth game “Old-fashion” is based on the online “Dress-up” games. In this game, the players’ objective is to create new fashion styles and learn about fashion of different cultures by selecting low, middle and upper parts of clothes from different eras and areas and combining them. At the end of the game, players can get a digital custom postcard with the outfit they created as a souvenir (Figure 5). In this way, players will be taught about the alterations of the dresses that occur in various locales, periods or social statuses, which will also introduce an important museum theme (women’s appearance) (Knowledge level in the Bloom’s taxonomy). The game’s theme is observingness, and it can been played from people of all ages and especially children but it can be also used as a design tool for exploring fashion possibilities. Similarly to the previously mentioned games, this one will also function as an advertising tool to promote both the application and the museum.

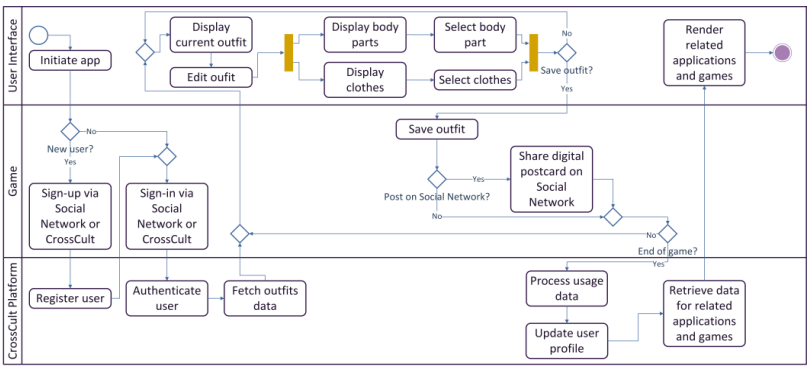

Fig. 5. Activity diagram of the “Old-fashion” game.

Table 1 summarizes game, player and organization characteristics, following the descriptive model by Antoniou et al. [2].

Table 1. Summary of games, using the descriptive model by Antoniou et al. [2]

			You face on a statue!	Who is your guardian goddess?	Anthropo-nymy	Your status in the ancient society!	Old-fashion!
Game Characteristics	Cognitive skill	Observation	√				√
		Reflection		√		√	
		Action			√		√
	Learning objectives	Knowledge		√	√	√	√
		Comprehension		√	√	√	
		Application			√		
		Analysis					
		Synthesis					
		Evaluation					
	Degree of complexity	Mini	√	√	√	√	√
		Complex					
	Number of players	Single	√	√	√	√	√
		Multiplayer					
	Theme	Strategy					
		Action					
		Adventure			√		
		Shoot 'em up					
		Board					
		Role					
		Knowledge		√	√	√	
		Observingness	√				√
	Mode	Interactive games					
	Audience	All users	√	√	√	√	√
		Specific target group					
	Game concept	As described above for each game					
	Game description	As described above for each game					
	Scope	As described above for each game					
	Mechanics	As described above for each game					
	User interaction	As described above for each game					
	Technology	Online	√	√	√	√	√
		Desktop					
		Mobile	√	√	√	√	√
Player Character-istics	Players are described in terms of age, cognitive style, whether they visit alone or in a group, etc.						
Organization Characteristics	Level of muse-umness	High levels of museumness (Archaeological Museum)					
	Budget	H2020 European Project					
	Demands on person-nel	No demands of museum personnel					

5. Conclusions

Cultural heritage can be greatly benefited by the use of games. For this reason various frameworks for the holistic design of cultural heritage games have been developed, one of which was used here as a descriptive model for the presentation of 5 games. Currently the authors are also involved in the enrichment of the framework used here to present the 5 games, since important elements (e.g. affective impact of games) are not included in the present version. Affective elements, such as game engagement, triggering emotions, etc. will be studied in detail in our future work and will enhance the existing framework.

All games presented are designed under the scope of the CrossCult project in order to enhance the museum experience. In addition, a small, peripheral museum, like the archaeological museum of Tripolis can use such games to promote the exhibition and the museum visit in social networks and possibly attract new visitors, to introduce the thematic areas of the different exhibitions and to allow the interpretation of the past before, during and after the visit. Hopefully these mini games will become viral on social media and serve the purposes of the project pilot. All the games will undergo an extensive user evaluation and the results will be soon ready for presentation.

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