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Edutainment and gamification: a novel communication strategy for cultural heritage

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Abstract

'Edutainment' and 'gamification' have become recurring terms in the fields of education and cultural communication. The present debate on how to promote public interest in our archaeological heritage focuses on innovative processes versus the Disneyization of cultural sites, as their administration must be ready to manage the processes of social transformation. Video games are now considered by many as a powerful educational tool capable of communicating in very effective ways, even with complex subject matter. Furthermore, using video games as an actual teaching tool can be a winning strategy: since the younger generation is not particularly interested in cultural matters, and video games can effectively teach cultural matters, they are a means of making a traditional museum exhibit more attractive to the young public. This article describes the design methodology and the software implementation of two video games used as educational tools at the Brettii and Enotri Museum in Cosenza. They aim to enhance the learning of historical and archaeological contents acquired during the visit, and to turn the visit itself into an experience of both leisure and culture.

Keywords

Edutainment, videogames, public archaeology, museum, cultural communication.

Introduction

The debate on the enhancement of archaeological heritage (Mancuso 2004, pp. 49-65; Manacorda 2007) focuses today on communication skills. Archaeological sites and museums, like all historical testaments, are custodians of extraordinary cultural value, which sometimes is not fully understood or acknowledged, especially if it is not properly conveyed through a well-structured design addressed at different target audiences (Francovich & Zifferero 1999). In fact, today many authors are observing a disaffection towards cultural sites and a scarce consideration of cultural heritage - two fundamental values that define Italian identity (Settis 2002; 2010). Perhaps the reason can be found in the scarce attention paid to communication in the management of historical parks and museums, as the main focus has been on specialized scientific research, overlooking the wide-range promotion and communication of the results of the research itself (Anichini & Gattiglia 2014; Manacorda 2014; Dal Maso & Ripanti 2015).

These observations should be considered as part of the wider and more complex sociological issues of 'liquid modernity' and post-modern society (Bauman 2000), and it should be noted that the real challenge

for the preservation of a 'solid' reality (such as cultural and archaeological heritage) is the ability to govern its process of liquefaction, giving the utmost importance to cultural needs and to the best ways to adapt their communicative methods to current social transformations (Melotti 2013).

In recent years, more attention has been paid to the younger generations, which should be the primary target audience of cultural facilities, aiming to spread knowledge about cultural heritage through the redesign of learning pathways in museums or archaeological sites, and the creation of appropriate educational tools based on a user-oriented rather than expert-oriented approach (Antinucci 2004).

The use of multimedia technology in the cultural heritage field is aimed at the preservation and protection of cultural heritage, but, above all, as a way to experience its enormous wealth of contents. Thanks to the potentialities of information technology (IT) in terms of 'democratization' of contents, today there is a wealth of educational media and tools which make contents accessible and understandable, expanding the possibilities for the exploitation of cultural heritage (Fossetti 2015). Among the various opportunities made available by IT tools, the development of video games for promoting cultural heritage has turned out to be one of the best strategies, returning excellent results in terms of learning. Indeed, the level of interaction in this type of application is very high: for a pleasant and instructive experience, it is crucial to allow the user to interact with the contents, so that he/she can learn the targeted information in a stimulating way.

While video games stand as a very effective educational tool for the transmission of targeted educational contents, their design requires different skills in the field of cultural heritage and presents a challenge in terms of coordination and management of team work (Aldrich 2005). The choice of the most suitable technologies is still a complex task, as there is a wide range of solutions both for hardware devices and software development kits, not to mention the creation and selection of the contents to be offered and of the cultural goals to be achieved.

Edutainment in museums

The term 'edutainment,' an American English neologism that comes from the fusion of 'education' and 'entertainment,' refers to all those activities put in place to foster learning in a more pleasant way. When applied to the cultural heritage sector, this term involves a thoughtful reflection that arises on the one hand from the role that heritage has and must have in building the sense of belonging to a nation's identity toward the only way possible, i.e. knowledge pathways, and on the other by the need to foster and promote its specificity with any strategy and by any means.

The term - even if its use started quite recently in the field of cultural heritage promotion - is very well-known in learning practices (Anderson 2004), but, above all, has the merit of shifting the focus from a purely educational point of view to a more learning-oriented perspective, where interactivity is at the heart of the processes of knowledge (Panzeri 2010).

Edutainment has a very wide field of application, ranging from museum exhibits to cultural events, video games, web sites, etc., and allows to communicate cultural content in a funny and exciting way, creating an experiential approach to culture (Cervellini & Rossi 2011). In the specific case of museums, edutainment stands as an advancement of the traditional didactic methods used in museums - which have had to adapt over time to the changes and the evolution of the museum itself - and is now becoming a significant practice aimed at meeting the expectations of an increasingly demanding audience, willing to experience novel initiatives that go beyond the traditional educational approaches. In the case of archaeological museums, edutainment can be a valid tool to innovate and create more modern, technologically advanced knowledge pathways and proposals for a museum, if compared with fixed and traditional installations. In particular, when designed in a clever way, edutainment is the key for a

novel relationship between new technologies and cultural heritage, which strengthens the importance of museum education and offers the opportunity to renovate museums, their management and their ability to communicate with the outside world, possibly increasing their attractiveness among the younger generations (Valentino & Delli Quadri 2004).

Since education is one of the primary activities of the museum in relation to the current and potential demand, it is considered a strategic part of the museum's mission. Therefore, an edutainment project requires a specific interaction process able to motivate a different use of the museum and its collections. The project has to meet the requirements of the museum's experts and its proposals must be responsive and consistent with the research results. It also has to meet the end-user demands through an active participation in the process of learning thanks to the edutainment interactivity proposals themselves.

Video games for archaeology

The countless occurrences of words such as 'serious games,' 'entertainment games' or 'gamification' in scientific literature clearly demonstrates the fair amount of interest around video games for archaeology. An interesting state of the art on serious games for cultural heritage (Falk Anderson et al. 2010) cites over 200 articles focused on these topics.

The most accepted definition in science has been given by Michael Zyda, who states that "applying games and simulations technology to non-entertainment domains results in serious games" (Zyda 2005). An interesting state of the art on serious games for cultural heritage considers that "all the selected games were created primarily for entertainment, but their historical accuracy allows them to be used in educational settings as well" (Falk Anderson et al. 2010). Recently this position was confirmed by an extensive portrait of the current offer of serious games in the cultural sector, highlighting the educational objectives of games in this domain and analysing the complex relations between genre, context of use, technological solutions and learning effectiveness (Mortara et al. 2014).

In literature there are several works on particular case studies, but the most significant might be those in which the main strategies adopted for archaeological video games are clearly identifiable, i.e. type of technology used (virtual reality or mobile), game environment (browsing a site or management of exhibits) and game strategy.

De Paolis, Aloisio, Celentano, Oliva and Vecchio describe the development of a multi-channel and multi-sensory platform for edutainment in cultural heritage for the realization of a digital didactic game oriented towards the knowledge of medieval history and society by means of the integration of human sciences and new data processing technologies (De Paolis et al. 2011). Moreover, the paper introduces the theoretical questions related to the use of virtual reality technology for educational purposes, for tourist information and for gaming. Ardito, Buono, Costabile, Lanzilotti and Pederson describe a system designed to support young students in their visit to an archaeological site through mobile technologies (Ardito et al. 2007). The approach is based on a video game that helps players to acquire historical notions and makes archaeological visits more effective and exciting. One point of strength of the system is that, by running on the visitors' own smartphones, it requires only minimal investments and small changes to the existing site exhibition. In Tanguy et al. (2013) authors describe a pervasive serious game for use in museums, running as a smartphone app. During the museum visit, players are invited to create their own exposition and are guided by the application in doing so. The aim is to provide a learning effect during a visit to a museum exhibition. Moreover, the application stimulates the visitor to look at cultural heritage elements in a different way, permitting the construction of personal narratives during the creation of a personal exposition. Finally, Doulamis, Liarokapis, Petridis and Miaoulis present a serious game with a treasure hunt scenario, where players have to collect medieval objects (Doulamis et al. 2011).

The *Brettii and Enotri Museum* of Cosenza: a case study

The analysis of scientific literature shows that different technologies can be used, as well as several game strategies, but all of them share a common goal: to stimulate learning in a more effective way during the visit of a museum or an archaeological site.

The video games developed for the *Brettii and Enotri Museum* (dedicated to two pre-Roman populations, Oenotrians and Brettii) are part of a traditional didactic offering that the museum is supplying since 2009, when it was reopened and refurnished in the new, prestigious site of the convent of Saint Augustine (Cerzoso & Vanzetti 2014). These video games were especially designed for this place. They are part of a specific programme to enhance the value of the museum (Mancuso 2014), which is identified as the core of the archaeological offer in Cosenza and a promoter of specific teaching and educational proposals that fulfil the mission of the museum itself. Hence, the video games end up being perfectly consistent with the contents of the visits and are an integral part of the museum's cultural offer; they should not be considered as a singular recreational-educational activity. The goal was to design the video game as an occasion to focus on the contents acquired during the visit, and consolidate them through an 'experiential-laboratorial' virtual activity.

The innovative aspect of the proposed methodology is that the design stage of the video games began with a reflection on the traditional museum experience and the ways its collections are organized, with the desire to focus on a highly distinctive stage of the history of Cosenza: the time when it was *metropolis* of the Brettii and then became a Roman colony. In fact, the collections were created at the end of the 19th century with a focus on the history and archaeology of the northern part of Calabria, mostly made up of Oenotrian objects found in the area of ancient Sybaris. By contrast, there was little archaeological evidence belonging to the Brettian and Roman ages of Cosenza. For this very reason, it was decided that the themes and contents of the video games should focus on the most characteristic historical features of the ancient city, revealed by recent excavations.

Once the general themes were defined, the next step was to establish three basic elements for the design of a video game:

1. the definition of the target (the age group);
2. the content to be highlighted and the ways to deliver it;
3. the definition of the use of the applications in the context of a visit to the museum.

The target was set on the age group between 10 and 16 years. The design of the experience to be provided to the target audience allowed for a much simpler and more consistent definition of the content to be highlighted and the strategy to be adopted for the creation of video games. In particular, it was decided to build the first video game around the virtual construction of *Consentia*, Brettii *metropolis*, following a managerial approach, while the second game had to focus on an archaeological dig with a puzzle-game approach.

The games were designed for mobile technology, as they were built using Unity 3D and implemented on the Android platform. In this way, they could be used even on low-end devices with a limited hardware performance (referring, in particular, to mobile devices owned by the visitors themselves).

Ultimately, the special features of the proposed video games can be summarized as follows:

- they were designed as elements of a precisely given didactic pathway;
- they were designed by providing references to a specific historical context and to a method of research, with the aim of stimulating and gaining confidence with a specific cultural content;

- they were designed as tools for 'experiential-laboratorial' virtual activity;
- they were designed to be used on mobile devices.

Consentia

The video game *Consentia* focuses on the history of Brettii that uniquely characterizes the city of Cosenza, once the capital of the people who, according to the Greek historian Strabo, freed themselves from the Lucanian domination in the middle of the 4th century BC. The city dominated the political and historical scene of Calabria until the 2nd century BC. Archaeological evidence of the Brettian settlement is poor and is the result of scientific investigations only carried out in the last thirty years, as Cosenza is a multi-layered city, with subsequent Roman, Medieval and Renaissance stratification. The goal of the game is to build a fortified town - as *Consentia* was in the ancient world - reconstructed from a scientific perspective and relying on historical, archaeological and topographic analyses, but 'invisible' to most onlookers, especially to young people. This managerial game leads the player to acquire specific knowledge about customs, economy, activities, resources, organization of urban spaces, and the unique traits of the Brettian culture, as far as these can be reconstructed according to historical sources (De Sensi Sestito 1995; Intrieri & Zumbo 1995). The player builds the settlement in a gradual and organic way, building after building, relying on the very same resources - animal husbandry and war - that allowed the strong and powerful Brettian people to develop into a regional power. At the end of the game, the virtual settlement features all those architectural elements and facilities that, according either to sources or to assumptions derived from the traces found in other settlements, are thought have been present in the original Brettian city.

The development of *Consentia* required meticulous planning of the game dynamics, so that the game experience could effectively combine the data gathered from historical sources and studies, both on the city of Cosenza and on the Brettian people, with the need to maintain a high 'fun factor' - the main element of a game by definition. Much attention has been paid to the usability of the game. The player, by starting the game, is faced with an almost bare land, part of which is enclosed within the city walls (whose perimeter has been traced on the assumptions made by scholars since the early 20th century, on the basis of those sections of walls that were found during the studies). The modelled territory comprises the hill called Pancrazio, the two rivers Crati and Busento and their confluence, which have always characterized the settlement history. Within this articulated space, subdivided by roads, the user can build the virtual city of the Brettii. The player is not allowed to build freely; some limitations are in place, in order to make players understand that, behind the foundation of every building, there was some kind of planning and each area of the settlement had its own specific use. A tutorial allows to consult some basic information, such as how to navigate through the available menus and the methods to construct every building (Figure 1).

Fig. 1. Consentia. *The layout.*

The player progresses through the game trying to create, building after building, its own fortified settlement, like *Consentia*. To raise the buildings, the players should manage the available resources in the best possible way, but resources can be obtained only through some specific work. Each building has its own cost (Figure 2), stimulating the player to carefully manage its resources in order to progress in the game. There are 24 buildings available, each with its own purpose, and the player should

understand the needs of his/her settlement. To train soldiers, for example, weapons need to be manufactured, and this requires the creation of at least one forge and the presence of an iron source to be mined. From the development of the simplest building, the sheepfold, up to the construction of the temple on the hill of Pancrazio, the difficulty of the game gradually evolves, as the construction of some buildings is mandatory to gain the ability to build other more complex facilities.

However, the acquisition of resources is not enough to advance in the game. Many buildings require the training of the population in some trades that have characterized the economy of Brettii and, in general, the economy of the ancient world.

The necropolis is located outside the defensive walls. It automatically expands as the population grows, and is composed by chamber and *cappuccina* tombs. The game also needs some degree of dynamism, so there are some battles to be fought against the enemies who are trying to conquer the hill of Pancrazio, and the fortified centre may be attacked at any time by Roman troops. Therefore, the player must take this into account and train a sufficient number of soldiers to counter the threat, otherwise some resources will be lost (Figure 3).

The game provides the alternation of day and night for a greater involvement of the player. The time of day varies according to the hour shown on the device on which the game is installed, and after 6:00 PM the colours on the screen turn toward a deep blue while people light their camp fires, and the background music changes (the chirping of cicadas and sparrows is replaced by crickets and owls).

From a technical point of view, the game has been entirely designed for Android systems and has been tested on different devices, always returning positive results. The game takes place entirely in a two-dimensional environment with an orthographic camera. This technique, borrowed from the most famous role-playing games of the 2D era, is widely used in this kind of video game. Nevertheless, a considerable amount of prototyping was necessary to create convincing graphics.

The reproduction of the various buildings, all carefully reconstructed according to

Fig. 2. Consentia. *Screenshot of the video game showing some of the construction menus.*

Fig. 3. Consentia. *Some stages of the battle.*

Fig. 4. Consentia.
View of a building within the settlement.

archaeological studies, required a meticulous preparatory stage, where colors, materials and architectural details of the Brettian culture were reproduced. Where primary sources were not available, some Greek elements were used as substitutes (Figure 4). Each element was then modelled in 3D CAD software on the basis of the available archaeological findings and subsequently rendered to be inserted in the game in the form of a two-dimensional sprite. Great attention was paid to the management of the memory device, by taking some precautions to avoid the overload of 2D elements on the screen. To reduce the complexity of the final product, it was necessary to simplify controls as much as possible, trying to create an intuitive interface for every single action that the player might take. From dragging the buildings on the map to scrolling menus, the controls have been designed in the most intuitive way possible by carrying out a benchmarking on the most successful games of the same class, trying to replicate their key features as closely as possible.

Archeologìo

The second videogame, *Archeologìo*, proposes a virtual archaeological dig. The player is immediately placed into the shoes of an archaeologist in a user-oriented fashion, as the name and the graphics of the game suggest. After choosing his/her avatar, the player is instructed on the main tools to be used for the archaeological dig and their different uses, on the correct digging methodology to 'leaf through' the ground, and on the history linked to the different materials - from the newest to the oldest - distributed in the various stratigraphic layers.

The game is structured in two stages, according to the typical principles of puzzle games.

In the first stage, the game starts in a modern urban context. There are two reasons for this choice:

1. give a symbolic representation of the city of Cosenza, one of the most significant examples of urban archaeology in Calabria;
2. contextualise the game in the present times.

Starting from the skyline of a city, the interface shows the layering below the buildings, characterized as archaeological stratifications.

So the stratigraphy, sectioned in the foreground, scrolls from top to bottom, while a tool bar placed on the top right of the screen invites the player to select the most appropriate tool for each stage of the game (Figure 5). The game interface is simple and intuitive: the player selects the tool for digging and removes

the soil by moving his/her finger horizontally across the screen, discovering the buried remains. By proceeding in this way, he/she gradually reaches the deeper and more ancient layers. There are various selectable tools in the game that can be used to accomplish the goal: excavator, hand pick, hand mattock, trowel and broom. The bigger the instrument used, the faster the earth layers will be removed, but at the same time there will be a higher risk of damaging the buried artefacts. For this reason, the player should be able to switch skilfully among the different instruments, so as to complete the level with the highest score in the shortest time possible. The score is calculated on the basis of the number of findings and their preservation status. Every exhibit, in fact, is associated with a bar that indicates its state of preservation: if the player accidentally damages the findings using destructive tools, the preservation status will be compromised, even risking its destruction (if the find is shattered into pieces, no score will be added); but if he/she will be able to properly clean up the artefact, this will automatically be included among the identified findings and collected in boxes, then a numerical value related to the preservation status will be added to the total score (Figure 6). The recovered findings are virtual replicas of the objects currently hosted by the *Brettii and Enotri Museum*. Some of the objects that were recovered in a fragmentary state will be restored in the second stage of the game: the virtual restoration of the findings. In fact, after the completion of the first stage, the player is invited to recompose the fragments and reconstruct the objects by defining specific forms. The player, aided by the artefacts depicted in the background, will place each fragment with a simple drag & drop to reconstruct the whole find or, if he/she is unable to find all the fragments, just a part of it (Figure 7). It should be noted that, in addition to the finds and especially in the upper layers, there are many other 'junk' elements (as car tires, computers, tin cans, etc.): these are intended not only to report the most recent history of the surface layers, but also to highlight the formation of accumulations over time. These traces of human activities will be used in the reconstruction of the historical ages.

Archeologìo puts players in competition with each other by comparing the scores obtained during the two stages of the game. In this way, the game becomes more challenging and leads users to improve their scores in subsequent attempts.

From the technical point of view, the game was developed exclusively - for the time being - for the Android platform. A key feature is the good balance between performance and graphic detail. Once the product design was completed, the game was tested on different types of mobile devices, from low-end smartphones to high-end tablets, always returning positive results. The first level was built using voxels that are generated dynamically as the soil is removed. This solution, although it requires a greater computing power than a conventional 2D method, allows for achieving a better graphic performance, as it returns a 3D

Fig. 5. Archeologìo.
The main interface.

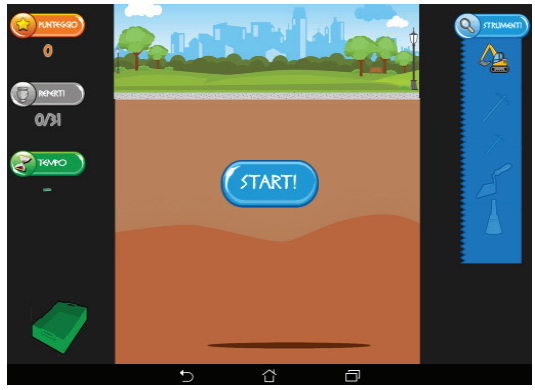

Fig. 6. Archeologìo.
Stages of the game.

Fig. 7. Archeologìo.
Screenshots of the reconstruction stage.

effect that wouldn't have been possible with other methods. Each artefact is a 2D sprite programmed to detect when the player comes in contact with it, to calculate its state of preservation, and to establish whether it was fully cleaned or if, on the contrary, it had been destroyed. Moreover, some advanced graphic techniques were used to ensure a good rendering, such as the particles that simulate the rise of dust during the excavation stage.

From a cultural point of view, the project tends to reproduce the profession of the archaeologist, whose mission does not rely on the discovery of mighty treasures, but rather on investigating the past through a proper methodology. This is experienced by the user in a simple way, as he/she can feel the thrill of discovering and recovering lost virtual objects. The video game created for the museum can be proposed to the user both at the beginning and at the end of the visit, with a dual purpose:

1. to stimulate the visitor to recognise and appreciate in the game the artefacts seen during the visit;
2. to create a sort of treasure hunt, which encourages users to look for the recovered objects in the showcases and in the different sections of the museum.

Conclusions

This paper describes two applications developed for the *Brettii and Enotri Museum* of Cosenza, designed with the aim of extending its usability and to propose an innovative, virtual, and experiential activity on some of the cultural paths proposed by the museum. These video games are not intended as an alternative to a visit to the museum, but rather to consolidate the knowledge gained during the tour and to interact with the collections of the museum.

The results of this experiment - which was carried out as part of a project funded by the Regional Council of Calabria - are linked to two principal aspects. The first being methodology efficacy in terms of costs and model replication, the second relates to feedback during the testing phase of the videogames. Regarding the first aspect, with an overall cost of 20,000 euros it was possible to experiment with two different applications. From the methodological point of view, *Archeologìo* can be easily replicated, since it can be set in any ancient historic context by changing the objects which are more closely identified with it. In fact, this videogame represents an archaeological excavation, the simulation of which is one of the typical workshop activities offered by archaeological museums. Archaeological excavations are carried out in a virtual manner, giving the user the possibility to modify, change, substitute and implement objects, and stimulating a more active participation of the user through the award winning mechanism. *Consentia*, on the contrary, refers to a specific historical reality, the Brettii *metropolis*, and therefore would not seem to be replicable in other Brettii contexts characterized by archaeological evidence differing from the city model. However, the specificity of this game – defined at the design stage - is that of building the first node of the territorial network of Brettii centres which characterized the ancient population of central

Calabria. Indeed, the greater part of the specific cultural content of the game can be easily replicated in different Brettii contexts, where only the specific topographic and geographic elements will have to be changed.

As for the second aspect, it must be stated that the videogames promotion in the museum will start in 2017, consequently at the moment there is no available data monitoring the use of videogames by visitors to the museum, which totalled around 2,000 in 2016. However, on two separate occasions testing activities were carried out to analyse the public's reaction to this alternative and innovative didactic activity. The first test involved 4 classes from a secondary high school, two first year and two second year classes, making a total of 84 students. Both virtual applications were monitored and in both cases, and maximum satisfaction rates on the part of the students were recorded: for the game level and game satisfaction as well as for the general comprehension of the contents. A second test was organised on Family Day, celebrated in museums all over Italy on 9/10/2016. Activities were different for adults and children. Children's activities included reading workshops, a treasure hunt, the virtual archaeological excavation and the construction of the Brettii city. Out of 48 participants, most of the children chose to play on the tablets displaying an interest and curiosity which went well beyond the workshop hours.

Although this data is too limited to provide a general evaluation, the tests carried out are indicative of the attraction capacity represented by videogames within the didactic proposals of the *Brettii and Enotri Museum*. Therefore the museum – which is among the top museums in the South - is now equipped with technological educational tools that enhance the possibilities for its didactic activities.

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