

Masada, the Desert Fortress. Discovering the Archaeological Site by Gaming

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In the last decades the interest in the use of serious games as learning tools has grown and the awareness of how the game is effective in the transfer of information from the object to the user is consolidated. The paper discusses the possibilities that this type of tool offers in terms of learning and dissemination of Cultural Heritage. Through the consolidated methodologies of survey and representation, the key points are highlighted for the realization of an interactive 3D model that can be used through 'playable' modalities. The interaction between the information contents and the visualization tools required a reflection on the quality of the graphic system and the virtual design. Everything must be designed to be an expression of an effective graphic language, starting from the narrative plot up to the rules of the game and the scenario. Special attention is given to the creation of the graphic interface, the buttons, the layout, and the color palette. A possible game platform designed about the Masada fortress in Israel is still developing and, as well as representing an instrument for sharing Cultural Heritage, supports the conservation of artifacts; at the same time it allows to know and protect the intangible assets that make up the identity of the places represented.

Key words:

Serious Game, Gaming, 3D reconstructions, Archaeology, Masada.

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INTRODUCTION

This paper is focused the theme of the access to Cultural Heritage through the most recent digital technologies developed in recent decades. The entertainment industry in general, and more specifically that concerning videogames, is now considered the most promising in order to bridge the gap, generated by the contemporary, between those who 'create' or preserve the Heritage and those who enjoy it. For this reason, a particular study is dedicated to the theme of serious games, a potential tool for the re-appropriation of museum spaces and all those places that no longer arouse the spontaneous interest of people.

Today there is a clear need to preserve the Heritage from the test of time in order to ensure the preservation of the 'memory'. The museum structures, together with all the disciplines that regulate its functioning, have available 'new tools' to reach these purposes [Tramontana 2007]. The potential of the most innovative technological systems and their use within museums, both real and virtual, can be exploited [Solima 2011].

The disciplines of survey and representation in the current digital age have in turn become digital and the tools they use are developed hand in hand with technological innovation. Representation models are increasingly used in 3D models, even if they are constantly supported by traditional graphic systems [Remondino 2011].

3D models as well as providing design support are important for permanently recording the shape of existing architectural works and artifacts, in order to achieve the future generations. The 3D model therefore becomes an important 'tool' of the discipline of representation, useful for the construction of virtual scenarios for the use of the Heritage [Guidi et al. 2005].

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This work concerns the complex case study of the archaeological site of Masada in Israel, under UNESCO protection, and the construction of the digital archive obtained through the use of integrated digital survey methodologies and 3D modeling.

The research presented aims at the definition of a methodological process that, starting from a digital database, rich in information obtained by archival research, photographic and digital survey campaigns, allows to 'translate' this data and these 'materials' in contents accessible and usable by the general public. For this reason within this research a serious game called 'Masada Museum' was designed and partially developed as a potential tool in order to increase the potentiality of the current museum structure.

BACKGROUND

The first 'classic contemporary' publication about "play" is the essay entitled *Homo Ludens* by the historian Johan Huizinga which defines "play" as a 'propeller of art' and of all human activities from which culture is developed in all its different forms [Huizinga 1949]. Next to the *homo faber*, who creates and transforms things according to his needs, there is the *homo ludens*. After Huizinga, other scholars have defined the concept of 'play' and have described its dynamics, such as Roger Callois in his essay *The Game and the Men* of 1958 [Callois 2014].

According to Chris Crawford, a computer game designer who incorporates some theories expressed earlier, the concept of 'play' is linked to the 'art' one: the artist in the strict sense of the term usually creates a work or an experience that the public meet directly, while for the game the artist creates the conditions and the rules but it is the public himself who creates his own personal experience. Games unlike other forms of entertainment such as cinema, theater and reading books can be defined as 'participatory', where the player can create the story through the consequences of his actions. A story usually unfolds in a linear way through immutable cause-effect relationships and is meant to be 'experienced' only once, whereas a game with its own multi-pronged narrative structure [Crawford 1984] becomes a multi-purpose experience because it is possible to choose different 'branches'. The advantage of an interactive and participatory representation of video games allows the exploration of all parts and aspects of a story.

The role played by the game designer today is that of a real 'artist' able to identify and deduce the moves of a possible player, his expectations regarding the storytelling and the graphics, so as to create credible 'twists' that provide the player with an unexpected and unusual experience. In this regard Crawford affirms that

"...computer games are much like candy, comic books, and cartoons. All four activities provide intense or exaggerated experiences. Whether they use sugar, exclamation points, or animated explosions, the goal is the same: to provide extreme experiences..."

[Crawford 1984].

Interaction plays a crucial role for the success in creating these sensations because it allows the player to feel an active part of the storytelling and the computer screen, in the case of video games, becomes a sort of space for experimentation and innovation.

Video games can be considered the heirs of the popular arts, "one as appropriate for the digital age as those earlier media were for the machine age" [Jenkins 2005], are lively art that has the ability to provoke strong and immediate reactions [Seldes 1957].

During the 20th century, many scholars have discussed the concept of 'game' and all aspects related to it, have described the characteristics of different video games and have been classified according to specific criteria but have never been formulated formal definitions.

A definition of the Italian dictionary (Treccani¹) defines the 'game' as any freely chosen activity to which children or adults are dedicated, individually or in groups, without any other immediate purpose than recreation and leisure; physical, manual and intellectual capacities are developed and practiced at the same time. This definition suggests that the player influences the result with his own abilities and at the same time consolidates or develops new ones. This awareness of the player to play an active and dynamic role in the development of the storytelling and the possibility of acquiring new skills and being able to exploit them in the game itself, emerges strongly also in video

¹ <http://www.treccani.it/vocabolario/gioco/>

games. These therefore represent a medium of great relevance in the digital era and can be exploited even in non-entertainment fields, overcoming the 'cultural' obstacle that the videogame is an enemy of education and learning, and also an element distraction from traditional activities.

The historical studies on serious games, such as those on games, has not followed a consistent linear path of legitimization, but instead moves in stops and starts [Wilkinson 2016] and the research was based mainly on studies of social sciences, psychology and information technology. Digital technologies today offer more representative possibilities than traditional systems and digital games represent a field of experimentation and innovation for the contemporary world [Jenkins 2005].

The games have always occupied a special place in the minds of intellectuals and scholars and serious games, despite some sporadic uses for learning and training, have only become established since the 21st century. Serious games with their interdisciplinary nature and being inter-contextual provide a wide field of research for the development of tools and systems for the dissemination of Cultural Heritage (Fig.1). However, having an interdisciplinary character and being often the subject of temporary interest by 'amateurs', the definition of the notion of serious game and their integration with the theories of learning and representation has found difficulties.

The term 'serious game' was coined by Clark Abt, developer of military computer games, who describes them analyzing that

“...we are concerned with serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement.”

[Abt 1970]

When Abt wrote his theories, many war-games had already been published and according to him [Abt 1970] serious games are an extension of the previous simulation-based learning approach, a practice strongly supported by Richard D. Duke [1974].

Despite the technological development of the last decades and the awareness of the last few years of how video games can be considered a powerful tool for conservation but also for communication and the dissemination of Cultural Heritage, there are still very few experiences and experimentations in this direction, both from the scientific community and the 'insiders'. The serious game is a tool that can be useful to museum institutions in order to create thematic paths full of participatory and interactive content, which arouse curiosity towards the museums themselves and their contents, and more generally the awareness towards the Heritage. The combination of technological tools, such as those used for “Augmented Reality” (AR) and “Virtual Reality” (VR) is able to create experiences for the exploration of the Heritage of great emotional impact, suitable at the same time to perform functions for cognitive development.

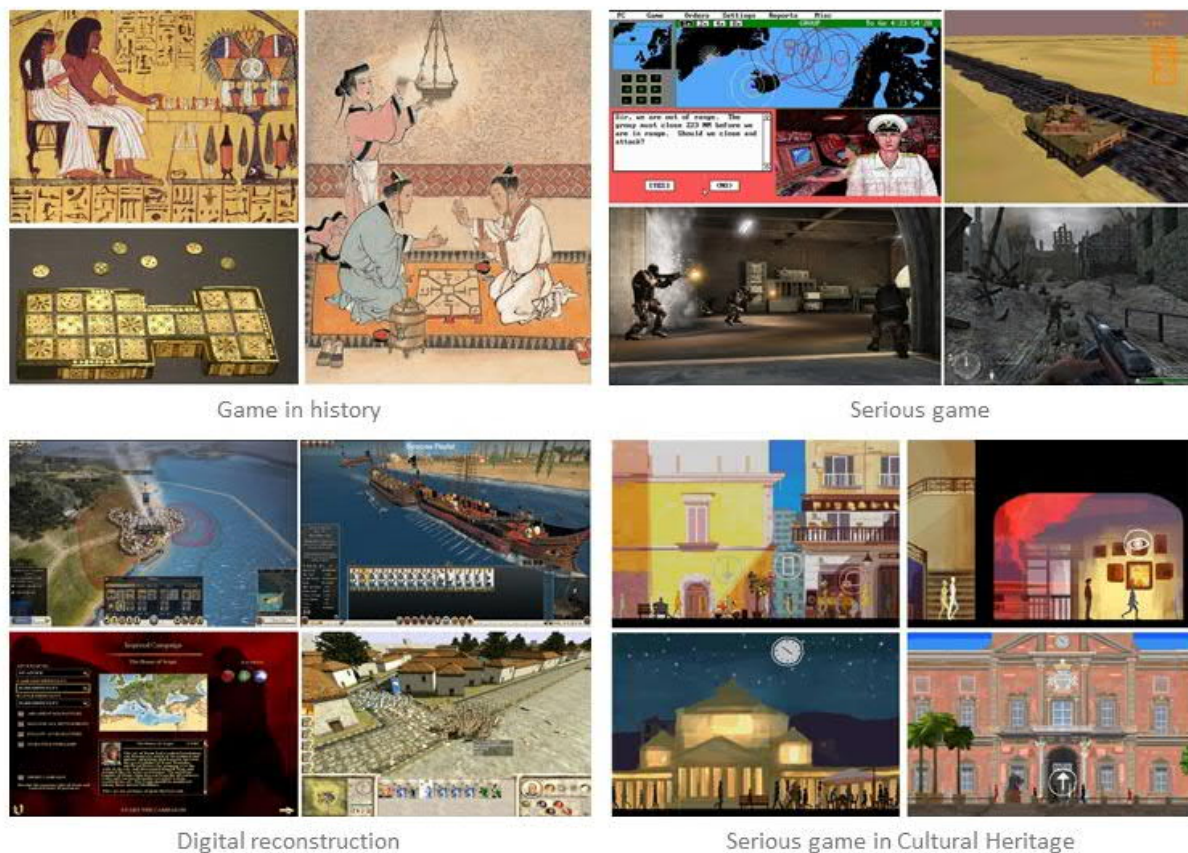


Fig. 1. Representations of ancient games (top left), examples of serious games in the military and cultural fields, and examples of digital reconstruction of historical scenarios

MASADA: THE CASE STUDY

The research project is about the digital documentation of the archeological site of Masada² in Israel, which was conducted in accordance with the heritage sites management rules of UNESCO, with the agreement of Israel “Nature and Parks Authority” (NPA). The research³ took place during four years of international missions in which professors and researchers from the Italian Universities of Florence and Pavia participated, in collaboration with the Shenkar college of Ramat Gan (Tel Aviv), and the results were made available to the NPA in the form of a digital document to support the development of the site’s ‘management plan’.

The work represents the first complete digital documentation of the current state of the site and demonstrates the possibility of using advanced digital technologies in conditions of extreme environmental difficulty, as the orographic and morphological nature of the site presents terrain unevenness of over three hundred meters and inaccessible mountains sides. Thus, the use of Laser Scanners with 300 m range and “Structure from Motion” (SfM) terrestrial and middle-range photogrammetry methods has permitted the realization of the photogrammetric survey of the inaccessible slopes. Each participating university developed research guidelines; specifically the Florence department has aimed at creating interactive multimedia functional to the tourism promotion of the archaeological park.

² For further information please refer to [Netzer 1991; Yadin 1968].

³ In 2013, 2014 and 2015 survey campaigns were directed by a team of professors from Italy, Stefano Bertocci (University of Florence) and Sandro Parrinello (University of Pavia), and from Israel, Rebecka Vital (Shenkar College of Tel Aviv). In 2016 the campaign was directed by Stefano Bertocci and was coordinated by Monica Bercigli. (University of Florence). For further information please refer to [Bertocci et al. 2013; 2014].

The technological progress in the field of archaeological survey – where the use of digital techniques is now strengthened (from organization and acquisition of data to post-production) – involves a series of consequences, the most significant of which appears to be the increase in the amount of data and of acquired information. This consequence leads to the ability to develop new documentation and dissemination strategies in order to obtain the best results from the digital potential (Fig.2).

For system consistency but also for convenience in terms of space and time costs all these results must be organized in a tidy system, which needs to comply with the digital tools in order to organize open systems for conserving and disclosing information and, above all, to contribute to the preservation of an archaeological site that is truly a part of the human heritage.

Since 2007 the Masada Visitor Center, located at the foot of the cliff on the east side, holds a museum that exhibits the findings found during the excavations executed by Yigael Yadin between 1963 and 1965. The museum (Fig. 3), in addition to the traditional display cases and information panels, reproduces scenes through representations and real-scale reconstructions of places and people, accompanied by evocative sounds and illuminating from time to time what illustrates the narrating voice.

This theatrical approach aimed at recreating the atmospheres of the different 'occupations' of the Masada site, makes the museum visit 'immersive' so as to entertain the visitor through both visual and auditory sensations. In the museum are reproduced nine scenes concerning the period of Herod, the period of the Zealots and the Romans one. The archaeological finds exhibited are portions of original frescoes and columns of the Palazzo Nord and parts of the floor of the Palazzo West etc.

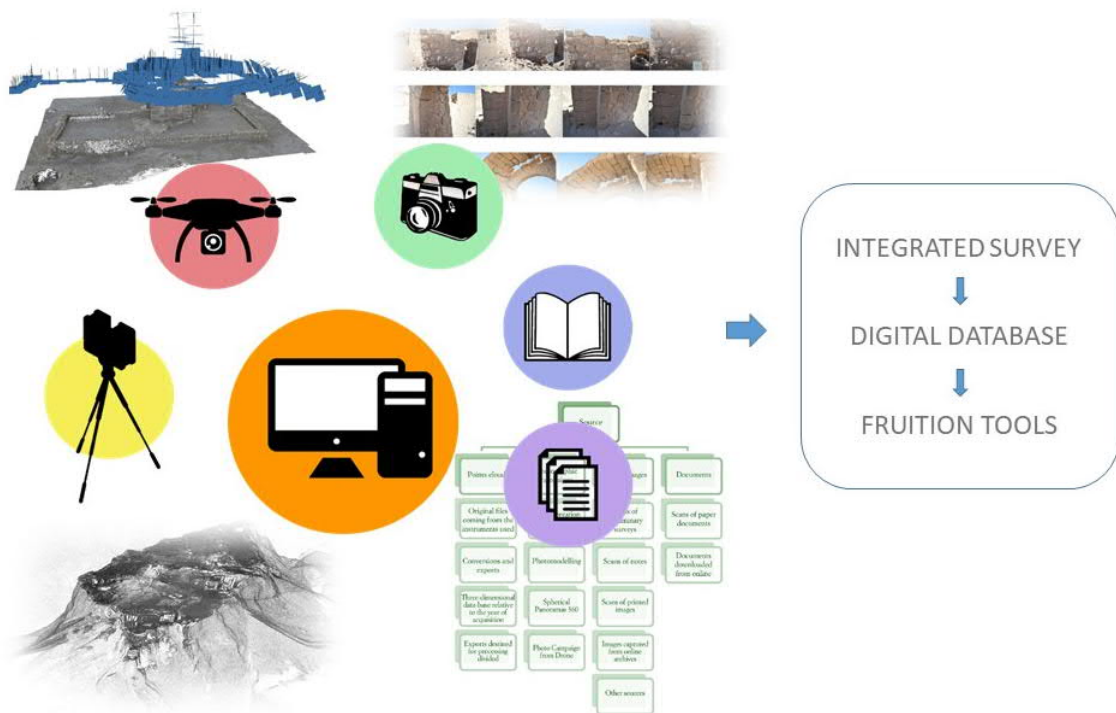


Fig. 2. The scheme summarizes the different types of tools used in digital surveying and the types of output that are generally produced. The challenge is to define a workflow and a useful tool for sharing this digital database



Fig. 3. The Visitor Centre at the foot of the mountain and two rooms of the Masada Museum

A useful tool for the museum both for on-site and remote viewing can certainly be the videogame for all the reasons previously described, starting from the greater involvement of visitors up to the possibilities of cognitive development of children. The museum experience is made more pleasant and the use of the heritage in general is made more accessible through the use of games, able to 'attract' visitors and introduce them in unfamiliar subjects.

MASADA MUSEUM VIDEOGAME

The video game designed and still under development is a single-player type and is only playable by one person. It is possible to share the results in a general ranking with other users, but there is no interaction during the game. The character during the game is related only to some characters in the video game, with which they interact through predefined dialogues that help the player to understand the game plot (Fig.4).

The game is based on a prize-reward progress system where through mini-games and the resolution of the puzzle successive levels are unlocked and are awarded with prizes and points. The 'challenge' factor thus becomes fundamental to make the game attractive and to keep running the interest in exploration and knowledge. The game consists in impersonating the figure of the 'curator' of the museum of Masada who has to set up the permanent exhibition about the history of the site. The game takes place mainly in two places, i.e. the virtual environment of the museum and the plateau of the site, where the character has to go to find the objects. The exhibition rooms of the museum correspond to the four main stages of the history of Masada: Herod's stage, Zealots stage, Romans stage and Byzantine stage.



Fig. 4. The first interaction scene between the Director of the Masada Museum and the curator character

The visualization of the museum rooms takes place by 2D top-down views and by 3D views with the possibility of exploring the virtual museum with an avatar. In this case the course of the game is linear because it is not possible to place freely the objects found in the rooms, but it is necessary to follow the correct historical progress of the different stages.

It is possible to define the part of the game set at the plateau as open-ended (or sandbox) so that the course of the game is not linear and the player is free to perform his preferred actions without following a mandatory plot. The narrative structure of the game is nonbinding for the development of the plot and a player in this way can 'build' his knowledge without constraints.

The player has a map that shows the constructive situation of the phase related to the research objects and can interact with it by choosing to explore different representative buildings. After choosing a building general information is provided and the player can start the exploration with the avatar in 3D models.

The research of the objects is supported by another small map that shows the playing area and the position of the avatar, and a radar that provides an indication of the objects position, thus encouraging the exploration of the places (Fig. 5). When the player is in the immediate vicinity of these objects and interacts with them, the interface of the respective mini-games is activated.



Fig. 5. Videogame scene with an interactive object within the 3D model

There are three types of mini-games: puzzle, memory, and quiz, which can be found within the game several times, performed for different objects and at a different difficulty levels. The structure of the mini-games is well defined and applies the 'always win' approach where the player wins and collects the object located. On completion of the collection of objects and after their placement in the various rooms, a video illustrates the main events and describes the historical and architectural features, thus adding an additional component for the knowledge of information. The aim of the game is to collect all the objects and complete the museums exhibition, thus assuming the role of 'curator' of the Masada Museum.

DIGITAL DATABASE AND GAME CONTENTS

An important step in the creation of the videogame is the visual design phase, the choice of video game graphics, the definition of the interface, etc., but also the content. In this regard there are several specialists who work within the 'chain' of the creation of video games, such as 3D builder, 2D artist, 3D character builder, 3D character animator etc., and that deals with the creation of all the virtual content.

In order to realize a serious game, however, it is necessary to take into account the communication aspects of the information and how to gain effective and captivating content from the digital database. It is essential to study the historical sources and to have a clear understanding of the structure of the storyboard and of the plot for a correct exposition of the peculiar contents.

The greatest difficulties are the 'simplification' of the amount of data collected during the survey and post-production phases together with the complexity of the archaeological site's history and the interpretation issues concerning some buildings that have not yet been completely solved. The procedures used to 'transform' information and data from the digital survey and documentation into game content are here summarized (Fig.6).

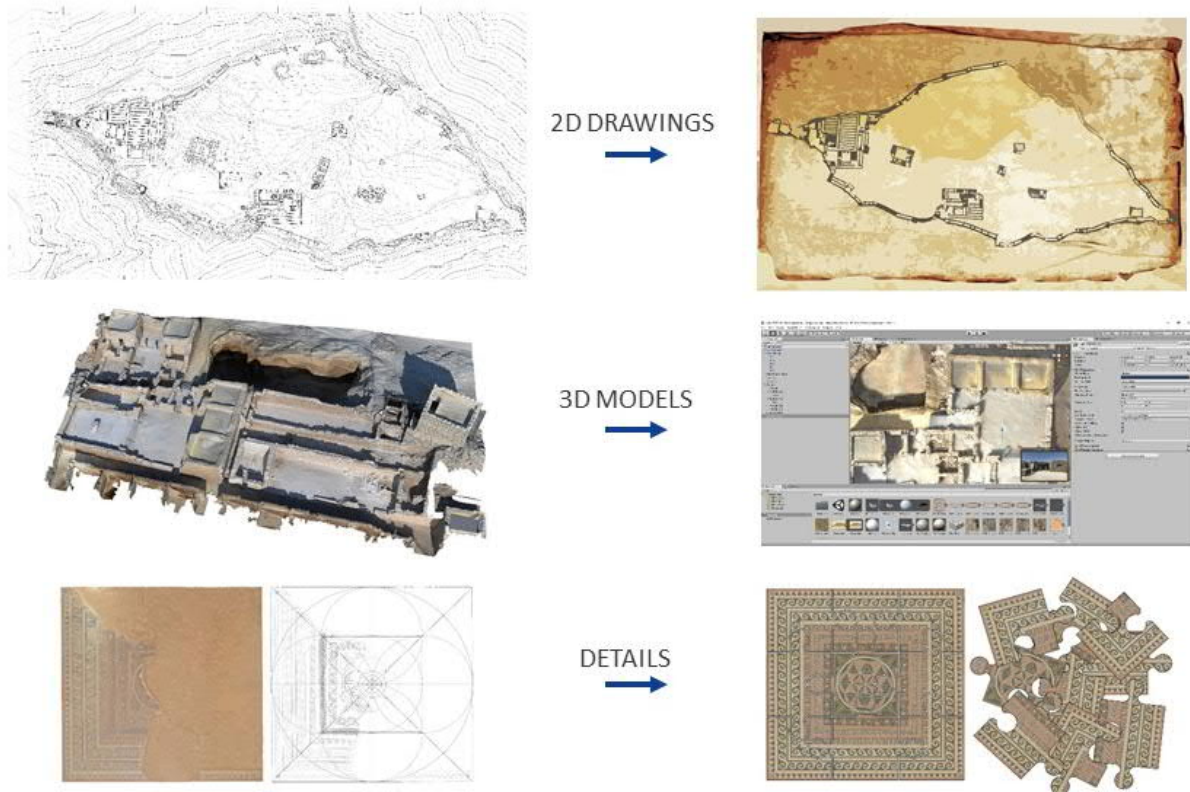


Fig. 6. From digital database to game content. Examples of how to use 2D drawings as map, 3D model as scenarios and detailed element for mini-game

The 2D planimetry obtained from the digital survey has been used as a basis to realize the maps of the game, and it can be useful for the realization of a location-based game. Modern cartography allows the placement of objects to be searched in precise and exact positions and the localization of the user and the objects through satellite positioning via GPS. The 2D drawings of the buildings were used as a basis for the 3D model reconstructions (Fig. 7), for the study of the elevations in their original size, and for the study of architectural typologies.

For the environment of the game, in order to reconstruct the area around Masada plateau, *contourline maps* were used, and then the various other models were placed. A multiscale and multi-resolution model has been created, that is a model made up of different parts with a different level of detail of the polygonal meshes.

3D models of the game's main environments have been realized, using the integration of data coming from laser scanners and SfM techniques so as to obtain a complete model in every part and equipped with photorealistic textures. Further detailed models have been realized and concern all the parts the player is interacting with at a close range and therefore require greater accuracy and at the same time an optimal graphic quality.



Fig. 7. Example of virtual reconstruction of the Large Bath House

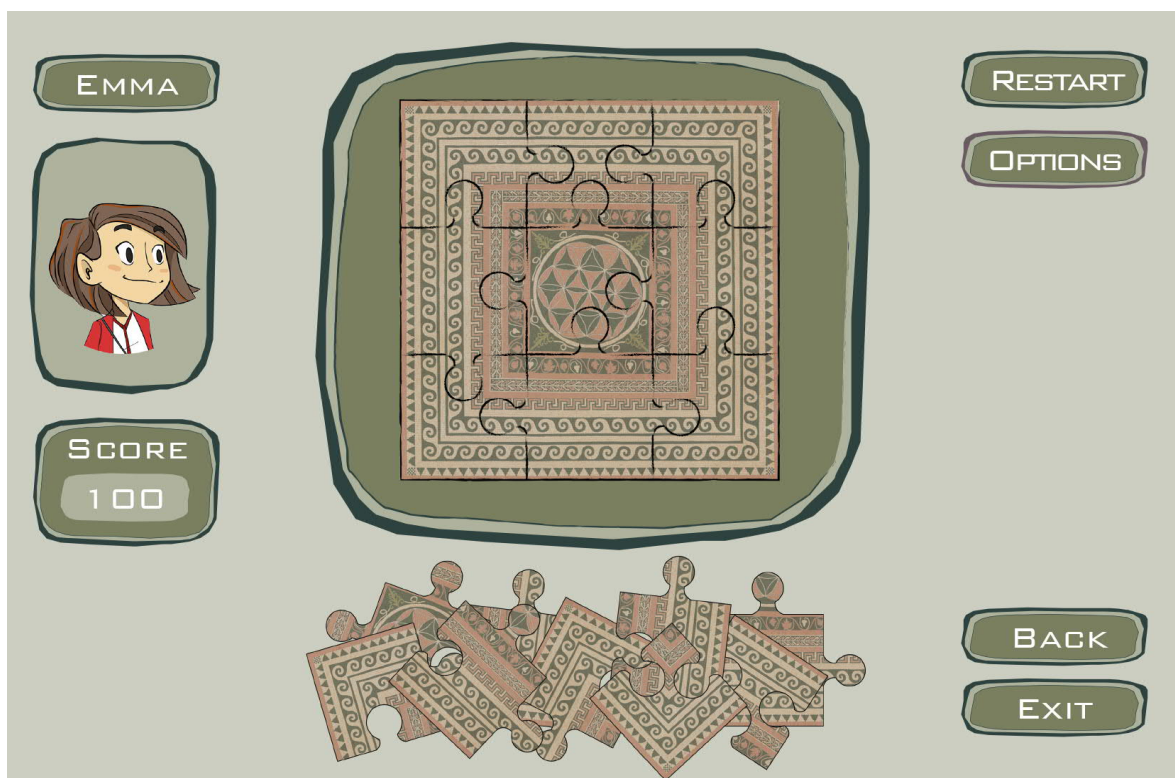


Fig. 8 Example of a puzzle mini-game

At the end the contents of the mini-games were realized taking into account the objects presented in the Masada Museum and representing each of the construction stages of the site in different eras. An important example of using the digital database for mini-game content is about a mosaic in a room in Western Palace; in this case the mosaic in its entirety was rebuilt and used as a puzzle game (Fig. 8).

CONCLUSION

Ludic activity has played an important role in the history of humanity and accompanies every human being during the period of growth. Starting from birth and childhood, when playing is manifested as a spontaneous activity and allows cognitive development thanks to processes of imitation and emulation, until adulthood, when the playing turns into a leisure activity voluntarily carried out and often becomes manifest in sports activities.

Today video games represent a medium of great importance, able to fill the gap and the widespread disinterest that contemporary has opened between cultural heritage and users; the 'Millennial Generation' and all the 'Digital Natives' prefer what is equipped with an interactive screen, ignoring the importance of direct contact with the places, with the works and social relationships in general. It is therefore necessary to exploit this growth in favor of the re-appropriation of museum spaces by users, using videogames as the 'driving force' of innovation and 'cultural promotion'.

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