A VIRTUAL REALITY ETRUSCAN MUSEUM EXHIBITION – PRELIMINARY RESULTS OF THE PARTICIPANTS' EXPERIENCE

Antonella Poce, Alessio Caccamo, Francesca Amenduni, Maria Rosaria Re,
Carlo De Medio, Mara Valente, Roma TRE University, Italy

Abstract

The current global health emergency has posed the need to reflect upon how to guarantee high standard of quality in 100% virtual exhibition. In this case study, we present one of the possible solutions to design a VR museum exhibition for educational purposes. The Centre for Museum Studies designed "The E-Trouria App", a VR exhibition which is aimed at providing participants with personalised learning path based on an Etruscan museum collection in Rome. The App was designed by combining different pedagogical methods such as Digital Storytelling and Reflective Questioning. The goals of the research were to understand visitors' evaluation of their experience. 20 postgraduate students (F = 17; M = 3; Average age = 36 years) in Museum Education took part in the pre-pilot experimentation. Participants expressed very positive evaluation on the visit and their features (narratives, soundtrack and multimodality). Participants were emotionally engaged during the visit and the most reported emotions were "pleasure" and "wondering". Future research steps are illustrated.

Keywords: Virtual Reality; Museum Education; Assessment; Visitor experience

Introduction

The Covid-19 pandemic, that has spread over the entire world since the beginning of 2020, despite purely health issues, has highlighted the role of digital technologies in the life of every single person inevitably (Ting et al., 2020). The cultural sector – museums, theatres, cultural centres – had to face the question of remote fruition both for economic reasons and mainly because of the role of Culture as an integral and fundamental part of people's lives; never as before, Culture had to convert and adapt its way to communicate and mediate information to a new reality (Shaker, 2020). Clearly, the digitization of museum collections and the design of cultural digital experiences are not something new. In fact, there are numerous cases in the literature that highlight the efforts that museums are making together with multidisciplinary development teams. Bringing the museum and its

contents closer to the audience (Grau, Coones, & Rühse, 2017), digital projects offer both solutions within the museum structure – interactive exhibition, AR / VR experience – and remote solutions such as digital catalogues or Virtual Museum (Barbieri, Bruno, & Muzzupappa, 2017).

The potential of Virtual Reality technologies is manifold. If in the early 2000s these could seem only futuristic experiences and prerogative only of large research centres, starting from 2016, the year of the consecration of VR to the general public (Cellan-Johns, 2016), the number of applications and contexts of use of this technology has increased exponentially. The result of this escalation is clearly the release on the market of low-cost devices for the use of VR, first of all the economic and eco-sustainable Cardboard (https://arvr.google.com/intl/en_uk/cardboard/), produced by Google. Because of that, a series of apps – also produced by Google – such as Expeditions (https://edu.google.com/expeditions/) created in order to use VR technologies to engage students in learning, offer numerous virtual tours of various museums around the world.

Virtual reality can therefore be used to design for example museum tours or make exhibitions interactive. Currently, in fact, we can divide museum VR products into two types: on-site itineraries-exhibitions, and remote digital experiences. The former, such as the VR Zone of the Leonardo da Vinci National Science and Technology Museum (https://www.museoscienza.org/en/offer/vr-zone) in collaboration with Sony Entertainment, offers specific educational paths on site starting from the contents of the museum collection. The latter, the digital experiences such as The Grand Museum VR (https://store.playstation.com/it-it/product/EP3645-CUSA13682_00THEGRANDMUSEUMEU) produced by Sony for the PlayStation platform, take the form of Virtual Museums (VM), in order to complete and implement the museum experience (Barbieri et al., 2017) by offering personalized experiences based on user preferences.

These experiences, being able to be accomplished and enjoyed regardless of place or time (Kersten, Tschirschwitz, & Deggim, 2017), offer a totally accessible and inclusive service; cultural services that – in a condition of restriction of movement such as those caused by the Covid-19 pandemic – have proved to be vital for the maintenance of museums around the world (Network of European Museum Organisations, 2020).

All these experiences teach us that imagining a simple transposition of the museum object from physical to digital environment, without designing any form of active involvement of the user is methodologically wrong and counterproductive (Vaz, Fernandes, & Veiga, 2018). Thus, innovative digital technologies require a reflection on which teaching and learning practices could be adopted and developed within museum contexts.

Pedagogical methods in cultural heritage education

During the last decades, different pedagogical approaches that combine technology and cultural heritage education have been developed, such as Digital Object Based Learning (Chatterjee & Hannan, 2015), Visual Thinking (Housen, 2002), and Digital Story-Telling (Rappaport & Liguori, 2019). All these approaches are characterised by an active involvement and participation of the museum visitor.

It is necessary, and it is possible, to bridge the gap between physical and virtual fruition, leveraging the elements of storytelling, involvement, interaction and experience, in order to develop fundamental skills in museum visitors, such as Critical Thinking (Poce & Re, 2019). Nevertheless, the previously elements do not find correspondence in the digitization of museum objects or that suffer from gaps in terms of user experience (Barbieri et al., 2017).

In fact, offering a digital catalogue of the items present in a given museum collection is not enough to ensure a higher or at least equal fruition respect of the physical one. To achieve a high degree of involvement and educational effectiveness, it is necessary to build digital storytelling and environments that place the user in an active condition with respect to the interaction with the cultural object. One possible strategy is to make a transposition from the video-gaming world to the museum and cultural heritage ones through the application of gamification principles (Tayara & Yilmaz, 2020). These principles – leveraging the conceptual aspects of the game – allow to generate involvement and interest in a given theme, through narratives, the use of achievements: rewards and immersed environments. At the same time, they stimulate the so-called skills of the 21st century: Critical Thinking, Creativity, Communication and Collaboration (Qian & Clark, 2016).

From all the previous suggestions, E-Trouria App was developed. As will be explained in the following paragraphs, the app intends to present itself as a Virtual Museum Exhibition with a strong educational and experiential impact, seeking – through a data-driven design process (King & Churchill, 2014) – to offer a customized product based on the features and training needs of the user, easy to use, accessible and inclusive.

The E-Trouria App

The E-Trouria app – whose name refers to the virtual journey through an assonance between the terms Etruria and electronic tour – is a stand-alone VR application both for MacOS and WindowsOS environment. In this first experimental phase, the application allows the fruition of one of the six thematic-educational paths that were previously described: the Etruscan woman. From a technical point of view, the application has two fundamental characteristics: on the one hand the virtualization of the museum space and its artworks, on the other the interaction and movement within it.

As regards the first point, it was decided to make the virtual environment of the museum as abstract and neutral in terms of visual language. The motivation traces back its origin from the aim to create a counterweight environment with respect to the decorative richness of the objects it contains. Nevertheless – in conceptual terms – the sequential structure of the rooms has been maintained; a typical element of contemporary architecture to those of the Villa Giulia Museum. The route includes the exploration of the female figure in the Etruscan age, through the use of five iconic archaeological objects from the Etruscan Museum of Villa Giulia collection. Through Olpi and Bucchero, Jewels and the well-known Sarcophagus of the Spouses, ad hoc storytelling have been created – analysed in their history and contents, in terms of decorations and stories – which, starting from the work itself through knowledge of the contents and stimulation in terms of critical capacity (Poce & Re, 2017). In addition to a main narrative, a series of in-depth analyses have also been provided - at the user's discretion - in order to broaden the specific knowledge of some themes emerging from the central narrative of the artwork.

Technical features of the E-trouria App

The artworks contained within the application and the virtual environment were designed using the 3D modelling software Rhinoceros (https://www.rhino3d.com/en/), together with photo editing software Adobe Photoshop (https://www.adobe.com) for the definition of the covering textures of the decorations and objects. Subsequently – for the interaction part – the designed elements were incorporated with the intent of the Unity software (https://www.unity.com). The user can move within the virtual space through an interface – developed on Adobe XD (https://www.adobe.com) – designed to obtain the highest level of usability and readability.

For this reason, even the font used in the app – Biancoenero (http://www.biancoeneroedizioni.it/font/) – designed by graphic designer Umberto Mischi, with the advice of Alessandra Finzi (cognitive psychologist), Daniele Zanoni (expert in study methods in learning disabilities) and Luciano Perondi (designer and teacher of typography at the ISIA in Urbino), has the aim of allowing an agile reading even towards subjects with SLD disorders, without lacking to elegance and general usability. The font, in fact, compared to many others similar in purpose, is characterized by a great visual satisfaction even for those who do not suffer from these diseases, thus offering an inclusive and non-niche experience.

From the point of view of the virtual experience, the user – once the product installation phase is complete – starts the application and completes phase 1 of profiling (necessary for the subsequent data interpolation phase). A short tutorial on the movements is provided to simplify the experience. Subsequently, the virtual experience begins.

The user can move around the virtual space in total freedom. Inside each thematic room – made up of 6 display cases – the main object of the narration is placed. To facilitate the interaction with the object, and start the narration, a user experience trick has been chosen, i.e. the use of an indicator / coin that the user will have to collect (by clicking on it), which will start the narration of the specific artwork. After the reading phase of the narration and of the related comprehension questions, the user will be rewarded with the relative coin. Once the path is completed and all the coins have been obtained, the user will be able to access the last room of the experience. Finally, an outgoing questionnaire allows you to collect data on the experience and be able to understand, as we will see in the following paragraphs, the relationship between use and personalization choices.

Research questions, data collection and data analysis

Before testing the application with a large group, we decided to carry out a pre-pilot activity with a group of 20 postgraduate students (F = 17; M = 3; Average age = 36 years) in Museum Education from Roma Tre University. Working with this group allowed us to achieve two purposes: firstly, we collected data from experts in the field of cultural heritage and museum education; secondly, we provided those students concrete applications of the contents presented during the post-graduate course. The pre-pilot activity was aimed at answering the following research question:

How do visitors evaluate the experience in the VR exhibition?

The E-Trouria app was equipped with two kinds of questionnaires designed to collect information on visitors' profiles. The first questionnaire was designed to be filled by the participants before the visit and the second one after the visit. In the first questionnaire, items were built starting from a tool developed for a similar purpose in a museum context, the Acropolis Museum in Athens (Antoniou et al., 2016). The two questionnaires together were thought to retrieve information on the following dimensions: (a) personal data, such as gender, nationality and prior visits, (b) general artistic preferences, (c) favourite activities and mood in museums, (d) extraversion/introversion dimensions, (e) preferences for the museum objects and their related contents, (f) preferences for the fruition modality such as 100% virtual, 100% physical or blended. The questionnaire includes both closed questions and short open-ended questions. Further data were collected regarding (g) participants' engagement (h) and critical thinking with intermediate questions related to each object's narrative during the visit. We calculated descriptive statistics to understand how participants assessed the experience in the VR museum.

Results

Results show that participants had some kind of familiarity with the contents of the virtual exhibition. Indeed, the majority of participants had already visited an Etruscan museum (N = 17), although most of them never visited a virtual museum before the experimentation (N = 13). Almost all the participants would suggest to other people the E-trouria App experience (N = 18).

Participants expressed positive evaluation regarding the main E-Trouria app features (Figure 1). 19 students appreciated *a lot* or *totally* the virtual exhibition in general. Narratives were appreciated *a lot* by 14 students and *totally* by the remaining six students. Multimodality was appreciated *a lot* or *totally* by 17 participants while the remaining 3 students did not express any opinion on that. Regarding the Soundtrack the students' opinion was less uniform. Although most of them (N = 12) appreciate the Soundtrack *a lot* or *totally*, 4 participants did not appreciate the music much. Having said that, when participants were asked to express a preference among different fruition modalities, none of them expressed a preference for 100% virtual visit. 18 participants would prefer a mixed reality solution and 2 participants would prefer the traditional physical visit.
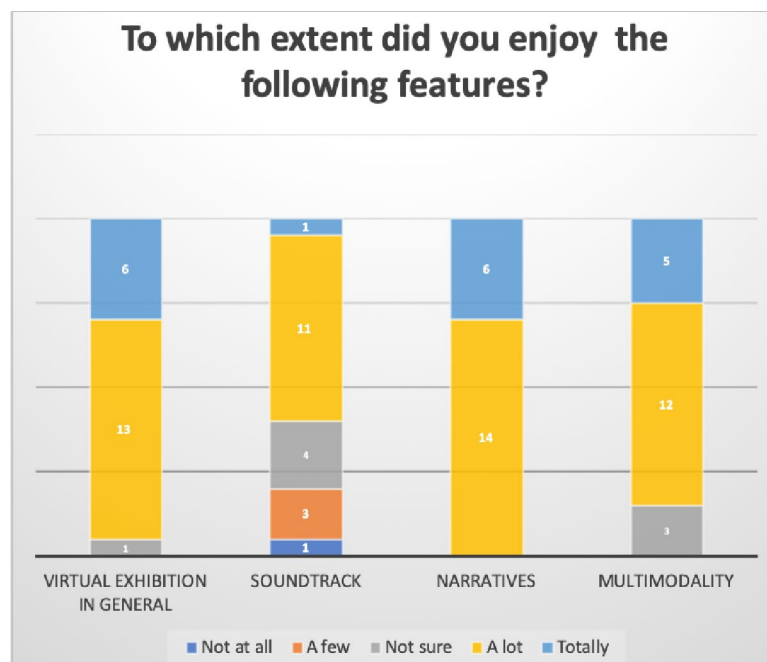

Figure 1. Participants evaluation of the main E-Trouria app features

In Figure 2 we can see the association between the different archaeological objects and emotions expressed by participants. We can see that each archaeological object engages participants in some way. The most reported emotions are *wondering* and *pleasure*. The Sarcophagus is the object most associated with the *pleasure* emotion (N = 16) whilst the Bucchero Olpe is the most associated with the *wondering* emotion (N = 12).

The Sarcophagus of the Spouses was considered the favourite object by 10 participants. The story related to the Bucchero Olpe was the favourite one for 8 participants, although the "Olpe" was the favourite object only for two participants. The association between the favourite narrative and the favourite object is low. The Bucchero Olpe, for example, is considered only by two participants the favourite object, but it was the most popular narrative among participants.
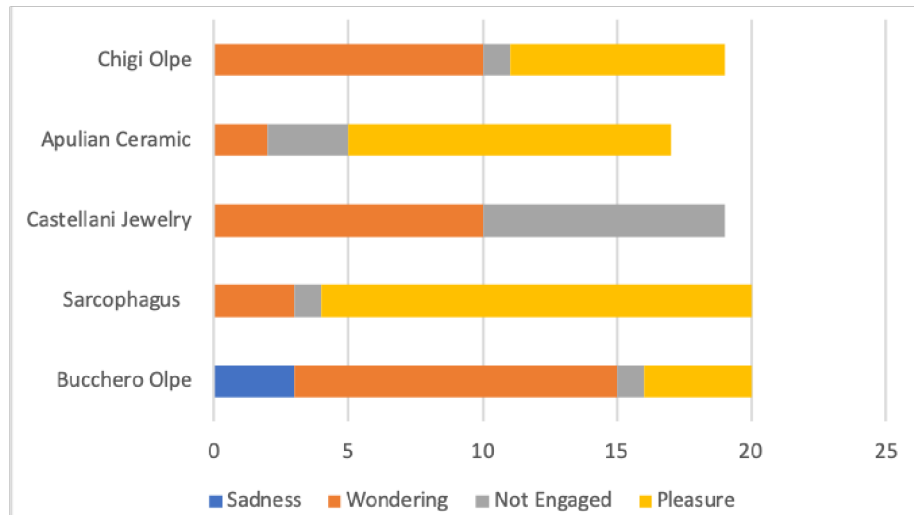

Figure 2. Emotions expressed in relation to the 5 archaeological objects' contents

Conclusion and final remarks

The current global health emergency has posed critical challenges for the cultural and the museum sectors. Trends related to the use of digital technologies, such as VR and AR, have started to become popular in the museum field even before the beginning of the health emergency. In the last months, we saw that some museums were more prepared than others to face the challenges of digitalization and to provide visitors' alternative opportunities to access their collections. In this case study, we present one of the possible solutions to design a VR museum collection for pedagogical purposes, by maintaining the focus on the promotion of inclusiveness, personalization and visitors' critical reflection. A learning path was designed by combining the Digital Storytelling with Reflective Questions methodologies, devoted to the solicitation of visitors' critical thinking. Participants reported to be emotionally engaged during the visit. The most reported emotions were *wondering* and *pleasure.* Both these emotions were correlated with the choice for the participants' favourite narratives. Regarding the soundtrack, we found that participants did not express a homogenous opinion on that feature. This contrasting opinion could be possible mediated by personal visitors' features, such as extraversion/introversion level. These results are preliminary in nature, but they provide initial methodological and pedagogical insights regarding the design of VR museum exhibition for educational purposes. Compared to the current state of progress, the project clearly has margins for

implementation. After this first experimental phase, the collected data will be used to improve the general UX of the product in terms of use / movements, general readability and educational contents. A greater degree of customization can be offered during the start-up phase on the app (type of reading use – light or dark mode – choice of soundtrack or voice controls) while – through the necessary changes – it will be possible to convert the app firstly into a stand-alone product available online without the need for installation, and subsequently make the transition from a VR use to AR one, thus being able to offer an on-site product for the museum and its users. We tested the application with a target of cultural heritage experts and we do not know which kind of response we would have received from other kinds of targets. For this reason, in the near future we are going to test the application also with high-school students from disadvantaged cultural contexts.

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