

A Work Project, presented as part of the requirements for the Award of a Master's degree in International Development and Public Policy, from the Nova School of Business and Economics.

ENHANCING VISITOR EXPERIENCE IN MUSEUMS AND MONUMENTS THROUGH  
TECHNOLOGY: PROFESSIONALS' PERCEPTION AND CASES IN OTHER COUNTRIES

LAURA FERNANDES DO AMARAL

Work project carried out under the supervision of:

(Sergio Guerreiro)

03-10-2022

# Table of contents

<b>ABSTRACT .....</b>	<b>3</b>
<b>KEYWORDS .....</b>	<b>3</b>
<b>FUNDING .....</b>	<b>3</b>
<b>ACKNOWLEDGMENT.....</b>	<b>3</b>
<b>INTRODUCTION.....</b>	<b>4</b>
<b>LITERATURE REVIEW.....</b>	<b>7</b>
<b>I.PROFESSIONALS’ PERCEPTION ABOUT THE USE OF TECHNOLOGY IN THEIR SITE..</b>	<b>14</b>
<b>I.A. AIM AND RESEARCH QUESTIONS.....</b>	<b>14</b>
<b>I.B. RESEARCH DESIGN .....</b>	<b>15</b>
<b>I.C. SELECTION OF RESEARCH PARTICIPANTS .....</b>	<b>16</b>
<b>I.D. DATA COLLECTION AND ANALYSIS .....</b>	<b>17</b>
<b>I.E. RESULTS .....</b>	<b>17</b>
<b>1. THE USE OF TECHNOLOGY IN MUSEUMS AND MONUMENTS .....</b>	<b>18</b>
<b>2. THE MANAGEMENT AND FINANCING OF TECHNOLOGIES .....</b>	<b>19</b>
<b>3. OPINION OF DISCUSSED TECHNOLOGIES .....</b>	<b>21</b>
<b>4. PROFESSIONALS’ EXPERIENCE WITH TECHNOLOGY IN THEIR MUSEUM AND MONUMENT .....</b>	<b>21</b>
<b>II. CASES OF MUSEUMS IN OTHER COUNTRIES .....</b>	<b>24</b>
<b>CONCLUSION AND RECOMMENDATIONS .....</b>	<b>26</b>
<b>REFERENCES .....</b>	<b>30</b>
<b>APPENDIX.....</b>	<b>35</b>
<b>APPENDIX 1: INTERVIEW GUIDE WITH GENERAL AND SPECIFIC QUESTIONS FOR EACH PARTICIPANT TO CONDUCT THE INTERVIEWS. ....</b>	<b>35</b>

## **Abstract**

This thesis intends to analyze the use of technology in museums and monuments to strengthen the tourism experience, with emphasis on Portugal. Previous literature tackles this subject on a broad basis, an issue this thesis addresses. Hence, how can Turismo de Portugal enhance visitor experience in museums and monuments through technology? This paper advocates for Portugal's museums and monuments to explore the value of technology in today's world. By interviewing museum related professionals, this paper demonstrates there is demand for technological enhancements within cultural spaces from providers. The significance of this study is that it informs the theoretical understanding that professionals want to execute technology in cultural sites.

## **Keywords**

Tourism; Technology; Experience; Museums; Monuments; Professionals

## **Funding**

This study has received no funding.

## **Acknowledgment**

Words cannot express my gratitude to my professor and advisor Sergio Guerreiro for his guidance, advice, and patience. I am extremely grateful to Roberto Antunes, Victoria Decocq, Emília Ferreira, Teresa Ferreira, Nadzeya Kalbaska, and Pedro Trocado for taking the time to share their knowledge and expertise with me.

## Introduction

Megatrends tend to last two decades, if not more, and have the power to transform people's habits globally. Technology is a great example since digital evolution significantly changes the way people live, work and travel. In 2022, technology is present everywhere even in simple and unexpected objects like toilets. This presence creates an expectation on the part of consumers in terms of technological advances in each industry as many professionals have attested during this research. Technology as a supporting tool for museums and monuments has a positive impact on visitor experience due to its interactive nature and knowledge sharing capabilities.

Many managers have introduced new technological tools to revitalize the experience within their museum or monument to attract the newer generations. Numerous studies have been conducted to determine the impact of the use of technology in museums and monuments and the evidence indicates that it does in fact enhance the visitor's experience.

Interactivity is one of the main reasons for this enhancement as well as one of the aspects that drives cultural sites to adopt technology. Technology such as Augmented Reality or tablets offering quizzes allow visitors to interact with the artwork while simultaneously being educated.

Nonetheless, interactivity is not the only benefit of technology in cultural sites. Nowadays, to avoid queuing for hours to enter a museum or monument, it is possible to buy tickets online which allows the website to manage attendance and entrance times simultaneously. This measure may seem trivial but is highly important because it is from this moment that a visitors' experience and satisfaction begin.

Technology also helps to popularize access to culture and knowledge. The Mona Lisa is a famous unfinished portrait of its time which regained popularity following its theft by an Italian,

suspected of being Picasso or Apollinaire, who wanted to restore the painting to its country of origin. This work of art is one of more than 480,000 owned by the Louvre, of which many were stolen by Napoleon during his military conquests and are exposed today to the public. Another fact is that he once called this art gallery his home before it became the largest and most visited museum in the world. These facts show how essential museums and monuments are for collecting, preserving, and conveying years of history and cultural heritage. With the help of technology, cultural sites like the Louvre can readily deliver these facts to people through an audio guide where people can learn more based on their preferences. This information is also made available online for everyone's knowledge and to increase viewership. Sometimes people cannot visit museums due to financial concerns, medical reasons, or many other issues. Hence, technology enables museums and monuments to democratize cultural and historical knowledge to counteract the inequality in access to culture still present today.

The aim of this research is to highlight the important role of technology in enhancing visitors' experience in museums and monuments by exploring professionals' perception and experience with technology as well as the potential advantages and limitations of different technologies in this environment. In order to illustrate its importance, advantages and make recommendations to Turismo de Portugal, this paper focuses on the following research questions:

1. How can Turismo de Portugal enhance visitor experience in museums and monuments through technology?
2. What is the perception of museum and monument owners on technology in their sites?
3. What kind of technology do other countries use?

The scope of this study consists of professionals with cultural site experience, sometimes including technology, who were contacted by email or phone. Since a qualitative analysis was conducted, there were no limits on participants. The selection of the participants shall not exceed 3 months to allow time for data analysis. Each participant was asked to answer a list of general and specific questions according to their position, experience, and background.

This paper contributes to previous literature by specifically analyzing professionals' perceptions, addressing what is being done in different countries, and specifically providing recommendations for Portugal.

In a museum or monument, personnel are just as vital as the artwork. Thus, their opinion is essential for the improvement of visitors' experience. Many papers studied the contribution and impact of technology in museums and monuments, but few have studied professionals' opinion and experience. With the technological advances in every sector of life, it is now difficult to authentically exhibit art. From the launch of the first audio guide to augmented reality reviving lost history, technology is making its way to ensure a more enjoyable and interactive visit. Hence, it is important for museums to be up to date but more importantly, on the same level.

The main objectives are to study professionals' perception of the use of technology in museums and monuments to better understand its role, advantages, and challenges to effectively study what other countries are doing to better enhance their visitors' experience.

## **Literature Review**

Museums and monuments are essential as they promote the creation and transmission of knowledge and information about cultural heritage (Antón et al. 2018; Capriotti & Kuklinski, 2012 and Freedman, 2000). For museums, they should “serve society by helping provide the knowledge its members need to survive and progress” (MacDonald & Alford, 1991:305). Some technology this paper finds important to address are audio guides, Multimedia Guides, apps and beacon technology, Augmented Reality, Mixed Reality, Virtual Reality, and Binaural/3D Audio.

In early 1998, Pine and Gilmore emphasized the prominence of the “stage experience” as the centerpiece of the tourism industry. In 1999, they developed the Experience Economy Theory arguing that experience economy is constructed of four areas: Entertainment (wish to enjoy), Education (increase knowledge), Escapist (jump to 600 years ago in Versailles' Castle) and

Aesthetic (attractiveness) (Pine & Gilmore 1999). This theory is constructed along two domains of participation (passive and active) and connection (incorporation and integration). However, Chung, et al. (2016) recently argued that other elements like demographics, technology, and perception should be considered.

Hence, many of them have adopted technology to support both interaction and communication and to empower information and knowledge management (Antón et al. 2018; Capriotti & Kuklinski, 2012 and Freedman, 2000). According to Weibel (2018), museums should foster innovation and enhance visitors' experience. Prebensen (2013) believes that in order to offer this, visitors must be included in the process of evolving value creation. Due to the disparity of targets' enthusiasm, museums and monuments invest in new technologies, often critical for tourist involvement.

In 1952 in Amsterdam, the first audio guide was launched to deliver an enjoyable experience which can be individually monitored by visitors at their own pace and according to their interest (Bastiaansen et al. 2019). Through technological evolution, audio guides advanced, and multimedia guides (MMG) were introduced as a new way to enhance visitors' experience. Othman et al. (2011) have designed two scales to measure in-museum experiences: The Museum Experience Scale and the Multimedia Guide Scale. Their results suggest that the adoption of MMG strengthens engagement and is not an impediment to an emotionally satisfying experience of attachment to exhibits. Further, this technology is more attractive to audiences than more standard and classic methods of delivering information. Therefore, the majority of museums began proposing MMG. However, since the Covid-19 crisis, museum owners reviewed their utilization of MMG due to sanitary concerns. In fact, 21% of survey respondents stopped using Audio Guides



and 35% replaced them with a “use your own device” offer through mobile apps (MuseumMate 2020).

Apps to download are becoming more popular among museums and monuments mostly due to sanitization concerns. Tablets and other tools need to be sanitized after each use requiring museums to hire more employees while apps enable visitors to select their favorite topics, exhibits, find their location, and more on their own device using beacon technology. This technology uses Bluetooth and mobile apps to track guests in a fixed area and perform an assigned action. For example, the American Museum of Natural History developed the app Explorer, allowing visitors to choose their favorite theme like dinosaurs generating a personalized tour based on their interests. It also proposes interactive games, quizzes, the opportunity to purchase tickets and avoid queuing for special exhibits (American Museum of Natural History, n.d.).

Some of these apps even display Augmented Reality. Augmented Reality (AR) is a mobile tool for discover-based knowledge that can improve the information accessible to visitors as they visit gallery rooms, engage with real-world items, give life to paintings and rooms, or explore off-site facilities using a smartphone, tablet, or AR glasses possible through superimposed digital information (Bastiaansen et al. 2019; Ding 2017; Elder and Vakaloudis, 2015, Kounavis et al. 2012 and Jung et al. 2015). For some authors, AR is seen as an approach to improving the accessibility of historical and cultural monuments and increase visitors’ knowledge without harming the monument (Han et al. 2013 and Leue et al. 2015). In a study, Contero (2013) discovered that AR reinforces aesthetic and visual attractiveness, enjoyment, and interactivity. Tourism professionals adopted this technology as a means to convey information to visitors and develop an entertaining and engaging experience (Chung et al. 2016).

Ding (2017) discussed how beneficial AR has been for both museums and visitors. First, it allows visitors to have access to endless information on their smartphone by scanning a QR code. Second, engagement is a formal advantage as it permits better observation of the artwork if a rope or protective case creates a barrier between the painting and the spectator, such as the Mona Lisa. Third, this technology provides visitors with a kinesthetic experience while gaining insight into the artwork in an engaging and educational manner.

Nevertheless, this new trend has its limits. Some museums and monuments cannot afford to develop their own app and should instead use existing apps developed by tech firms. However, when choosing to create their own or use an available app, cultural monuments must first carefully evaluate their budget constraints. One important feature to consider is whether the app needs free internet across the gallery space (Ding, 2017). In January 2015 the Smithsonian's National Museum of Natural History presented the Skins & Bones app permitting visitors to observe the transformation of specimen skeletons. However, the app did not have the expected success for several reasons such as lack of advertisement, app size, and Wi-Fi being inaccessible across the entire museum. Despite all this, user feedback was predominantly positive (Ding, 2017).

While AR combines real-world environments with computer-generated content, Mixed Reality (MR) provides the opportunity for users to engage with the content (Debandi et al. 2018). Since the release of MR headsets, this technology has been able to provide experiences based on spatial awareness. Computer-generated objects are accurately positioned in the surroundings to authentically merge and mask real world elements. It also offers authentic interactivity to ensure that the equipment and the technology is noticeable to the greatest extent possible. Through this technology, visitors do not need to carry their smartphones as natural engagement techniques take the place of point-and-touch screen interplay (Kontopanagou et al. 2021).

Compared to other methods, AR and MR do not disconnect visitors as it offers created content combined with their surroundings and are, therefore, favored over Virtual Reality (Kontopanagou et al. 2021). However, MR has its limitations. Debandi et al. (2018) highlighted the unstable tracking, reduced visibility, and a narrow range of view in various lighting situations. Nonetheless, it is important to point out that technology keeps evolving, encouraging the adjustment of these inconveniences.

In this context, Virtual Reality (VR) is defined as total-immersion in a digitally produced setting (Bastiaansen, 2019 and Guttentag, 2010). VR provides travelers with the chance to see endangered areas in lieu of in-person visits to preserve historical landmarks and travel destinations for future generations. Similarly, hard-to-reach sites can also be made accessible to visitors through VR (Chung, et al. 2016). The tool was introduced in several cultural sites for experience improvement, involvement, interactivity, and learning to virtually recreate historical sites (Bruno et al. 2010; Ghazali, Fathihin, and Shah, 2018 and Frasca et al. 2016). Its capacity to deliver an individual and unique visit is one of its many advantages as well as its capacity to plunge visitors into history and places that are impossible to enjoy today, essentially enabling them to time travel. This immersion is seen as a capability that may have multiple drawbacks in the museum environment. Buonincontri et al. (2018) examined the opportunity of utilizing VR to enhance destination competitiveness. Their results show a significant and positive relationship between visual appeal and emotional involvement of VR on visitors' behavior when exploring a museum or monument.

In the context of museums, inclusion and accessibility are highlighted as one of the principal benefits of VR (Mac Devitt, 2018). In fact, this technology may allow disabled people to visit cultural sites that would ordinarily be unattainable (Shehade and Stylianou-Lambert, 2020).

However, the technology is known to be difficult or inaccessible for users with certain disabilities, such as the blind or deaf, which may lead to an undesirable experience, especially if the formal display of information is substituted with VR.

Due to the age limit, many children are not old enough to use VR tools and may end up disappointed or frustrated. Indeed, several manufacturers advise that headsets should not be used by children under the age of 12. Hence, the family's experience may be negatively impacted. If a museum is targeting families, VR may not be appropriate as they would be omitting a sizeable portion of their visitors. Consequently, it is important for cultural sites to find an equilibrium between the requirements of their diverse visitors (Shehade and Stylianou-Lambert, 2020). Some authors recommend that instead of using VR as a substitute for gallery experiences, museums should instead use it to provide visitors access to experiences they would not otherwise be able to enjoy. For example, they could use VR to immerse visitors in the world surrounding the artwork since the essence cannot be substituted by technology.

Shehade and Stylianou-Lambert (2020) discuss the drawbacks that VR can have on museums and monuments. First, the immersion that many people find amusing is highlighted to be unsocial and isolating for the user through its individual use. As a result, certain museums have experimented with alternate methods of utilizing VR to render it more social. Second, competent staffing and costs are an issue. As VR is a new technology, many consumers are not sufficiently comfortable with it and may not know how to use a headset leading to necessary help. This signifies that cultural sites should employ a team to solely supervise the VR headsets which calls into question both the financial and organizational departments. Third, sometimes the volume of information necessary to develop digitally created content is extremely dense and unavailable. In addition, there are technical and visual presentation concerns, exhibition processes, disturbances,

and, most importantly, whether visitors accept the technology in this environment. Virtual Reality is not necessarily the answer to all challenges and may sometimes be unsuitable.

This last type of technology is new to the museum scene and uses spatial information like depth and distance to create an immersive audio experience. This invention is called Binaural Audio, also known as 3D Audio, but is by no means new. This audio has been around since the 1930's and has only improved with time. It uses dynamic binaural sound to imitate the vibrations of your body - such as the head, neck, and chest - to create sound waves which replicate the exact location of the source of a sound in relation to your body. This means BA is able to breathe life into those who once lived or visited the site before to build a deeper connection with the history presented before you (Argenti, F et al. 2018).

Argenti, F. et al. (2018) set out to address how to enrich visitors' fulfillment of museums and art shows which led to considering an immersive audio environment like 3D Audio. Artworks can become virtual sources by using real time binaural audio which users perceive as personally speaking to the audio guided voice. Typically, museums and monuments focus on users' visual experiences but neglect that humans are influenced by sound as well. How this technique works is, consider a museum visitor approaches an art piece. They were provided with an audio guide and a set of headphones with the following capabilities: a monaural audio track that describes the artwork with real time processing, the replication of a stereo signal through the headphones, and a positioning and head-orienting system. The visitor would select the audio related to the desired artwork, thus starting the system which allows them to freely walk around while the audio moves with them appropriately controlling the sound.

If costs are an issue for museums and monuments, then 3D Audio might be a top contender. Preliminary results have found this system has adequate audio quality at an estimated cost that is

affordable for consumer devices (Argenti, F. et al. 2018). The implementation depends on basic audio and signal processing techniques, which means inexpensive and non-personalized equipment for visitors. The audio most often used are pre-recorded tracks or real time speeches.

The implementation of these technologies should not encumber people or disconnect them from the experience of visiting cultural sites in person, raising the importance of a trade-off between utilization and overutilization.

## **I. Professionals' perception about the use of technology in their site**

### **I.A. Aim and Research Questions**

The main goal of this paper is to support Turismo de Portugal's tourism policy agenda to enhance visitor experience in Portugal's cultural sites through technology. One important aspect of policy implementation is to understand and manage stakeholders' perspectives on the use of technology to improve customer experience. In this sense, the purpose of this study is to understand museum and monument owners and other relevant tourism stakeholders' perceptions and opinions regarding technology in cultural sites.

The main goal of this study is to address the challenges of Turismo de Portugal and how to enhance visitor experience through technology in its cultural sites, highlight which can be used but also study the professional viewpoints of this subject. Indeed, this paper consider that museum and monument owners' opinions about technology in their venues are important to study as they oversee all operations. Hence, this study focused on the following research questions:

1. What is the perception of museum and monument owners on technology in their sites?

2. What kind of technology do other countries use?

### **I.B. Research Design**

To know more about the perception of professionals on technologies in museums and monuments, a qualitative methodology was deemed more appropriate.

An interview guide with general and specific questions for each participant was developed to conduct the interviews (see Appendix 1).

A qualitative analysis was employed for the evaluation of the interviews based on a theoretical sampling process selected with respect to the degree of understanding that each interviewee is intended to contribute. This design was chosen because it is adaptable and allows for a thorough examination of respondents' views and experiences. It also generates a variety of perspectives that people have regarding the topic (Berg, 2009).

Therefore, the sample was designed according to their experience with the cultural and tourism sector and knowledge of technology. Two managers of museums, one manager of educational and cultural actions, one Development Director of a Tourism Board, one Expert in technology and one Expert in Tourism Innovation were selected to participate in the research through online interviews and by email, asking them about the use, gestion and financing of technology in cultural sites, their experience and the advantages or disadvantages they see in its use. These actors either have experience or are experts in this topic.

Since a qualitative analysis is being conducted, the number of interviewees is acceptable as the objective is not to have statistical portrayals of the whole museum community. Through these interviews, this paper intends to paint a portrait of viewpoints from museum managers,

tourism boards and experts in Technology and Tourism Innovation in order to develop a list of recommendations.

These interviews were complemented with an analysis of relevant case studies about the smart use of technology in museums and monuments. For this study, descriptive research was considered the most adequate. A number of research and case studies were used as well as visits to Portuguese, French, Italian, and American museums and monuments to gain insight into what is being done in other countries. Some museums and monuments considered here are Palacio da Pena, L'Hôtel de la Marine, Le Louvre, le Musée d'Histoire Naturelle, Pompeii, and Palazzo Vernazza.

### **I.C. Selection of research participants**

To find participants, museums were contacted by phone and email to get in touch with the museum manager, a department manager or someone who has been involved in a technology project for a cultural site.

The participants were Roberto Antunes, Executive Director of Nest – Tourism Innovation Center Portugal; Victoria Decocq, in charge of educational and cultural actions at l'Hôtel de la Marine, Paris; Emília Ferreira, Director of Museu Nacional de Arte Contemporânea do Chiado, Lisbon; Teresa Ferreira, Development Director at Turismo de Portugal; Nadzeya Kalbaska, Researcher and Lecturer and Team Leader of Digital Fashion Communication Research at University of Svizzera Italiana; and Pedro Trocado, IT Director at Parques Sintra Monte da Lua, a museum and monuments managing company.

Despite the variety of participants' background and domains of expertise, from art to technology to digital fashion and communication as well as their geographical position:



Switzerland, France, and Portugal all oversee the management of projects for cultural sites, media and educational content and technologies. This diversity of experience and knowledge allows this research to paint different perspectives about technology in cultural sites and provides relevant insights in terms of the potential and barriers to use technology in this business development.

### **I.D. Data Collection and Analysis**

Interviews were conducted online via Teams. Due to conflicting schedules, some situations called for professionals providing written insights via email. All meetings were recorded with the authorization of the participants and transcribed to ensure that no information was lost.

After collecting the data, the first step was to organize and categorize it into a single spreadsheet. When organized, a coding procedure was utilized for easier observation of the diverse data categories. Coding enables the identification of themes within the data and the relationships among them (Flick 2018). The coding undertaken involved a comparative opinion study on the importance of technologies to enhance visitors' experience. Ultimately, the focus was on pinpointing the recurring themes in the data by capturing their perspective permitted to further the understanding of ongoing projects, why they believe technology has a role to play or not along with its benefits and limitations, and the participants' opinion on the upcoming landscape of technologies in cultural sites. Coding permitted the facilitation of the data analysis (Corbin and Strauss, 2014).

### **I.E. Results**

The expert interviews allowed to identify several relevant domains in relation to technology and cultural sites and, despite their dissimilar profiles, there is some convergence of opinions from

those interviewed in many subjects like the use of technology in cultural sites, its management and financing, as well as their opinion on discussed technologies and their own experience.

### **1. The use of technology in museums and monuments**

When mentioning the role of technology in museums and monuments the answers were unanimous: in today's society, it is an indispensable tool. From educational purposes, value creation, experience enhancement and promotion, the adoption of technologies is beneficial for cultural sites.

The interactivity and enhancement aspect of technology are the most frequent aspects mentioned when the question of the role of technology was discussed. Some professionals believe it brings new layers, an interpretation that visitors would probably never have before or see things that no longer exist. As well as helping to select the information that is important for each person and make the information and visit more accessible for all or solely make it more interactive to different visitors, such as children and young people that are difficult to attract. Others, through their experience, noticed it promotes activities and experiences but also helped them to reach new audiences and generations, one of the main objectives of cultural sites today, and create new products and business models.

Over the years, people's demand has changed as they expect the same degree of technological use from all industries. As other industries have raised expectations on the experience, they expect museums and monuments to innovate and improve their offer as well. For example, buying a ticket for a museum should be as simple and fast as buying a ticket for a plane or using Uber for a car ride in the city, reducing wait time and giving the customer the tools to

search, plan and experience. This is the reason why some professionals believe cultural sites should invest more in both technologies and people who work onsite.

Nonetheless, the majority emphasized that even if it can be attractive, managers must deeply search for which technology is appropriate for their needs and visitors' expectations as well as the content. Others, even if they believe technology's role is beneficial and enhances visitors' experience, fear that one day some museums will be considered antiquated unless they replace or fully complement their collections with technological tools. This requires openness to new developments in terms of technology but a clear strategy regarding the use of those technologies in the cultural site's experience. The Director of Museu Nacional de Arte Contemporânea do Chiado, Emilia Ferreira is clear on this stating "We need to be open, yet critical. Not just believers, not just blind followers."

## **2. The management and financing of technologies**

Management and financing are important matters for an efficient use of technology.

Firstly, it is important to know who will oversee the project and, on this subject, respondents had different perspectives. On one hand, some believe it should be supervised by a multidisciplinary team including a Board of Directors, General Secretary, an IT team, or a partner company for this project. On the other hand, some museums like Museu Nacional de Arte Contemporânea do Chiado do not have a specific department that oversee it. Instead, the artists use the technology they want, and the museum organizes the exhibitions according to their own requirements for showing their work. Basically, these perspectives differ between being the museum or cultural site, the one driving its digital agenda, or being a provider to a business partner that delivers the experience. This might also be related to the museum team skills, to implementation costs or simply because of the need to focus on the museum's core activities.

During the research, it was found that some museums mentioned the financial costs as a barrier to adopt some technologies. Hence, it was important to discuss the financing of these digital tools where the question of partnership with startups was introduced. A part of them believes these partnerships allow cultural sites to improve the experience, to respond to the expectations of visitors with other services and to create new content. In the case of Parques de Sintra, they recognize that they are a cultural heritage management institution and not a technology company, hence their purpose is to preserve this heritage. Therefore, they look at both national and international programs or innovation programs for the tourism sector to establish strategic partnerships or to search and obtain solutions from startups to improve their business.

However, one participant highlighted that these partnerships depend on what they have to offer and would rather, if the site has the required budget, work with a big company or one that has experience and worked on other cases. The latest revolutionary technology may seem attractive but may not be in line with the museum's objectives. In this context, developing partnerships with IT companies or even with other sectors' businesses seems to be an interesting way of following technology developments, of transferring experiences from other sectors or to fund some investments in this field.

The Confident was mentioned as a best practice of implementation of this partnership's strategy. This tool, a headset, was designed by the company RSF, specialists in audiovisual museography, based in Toulouse, for l'Hôtel de la Marine, in partnership with Centre des Monuments Nationaux, national museum center, and Studio Radio France. For Victoria Decocq, in charge of educational and cultural actions, this partnership has made it possible to achieve realism through a technology that until now, on the scale of a visit to a cultural institution, had not been achieved.

### **3. Opinion of discussed technologies**

In order to advise and recommend technologies that could be used in Turismo de Portugal's programs, the opinion of professionals on the type of technologies varies according to their usage. For example, AR is defined as an excellent tool to incorporate into gameplay solutions, and discovery of historical realities that are no longer possible using existing objects or references while VR is considered to be a great tool for cultural promotion and marketing as well as for disabled visitors as well as a visual immersive and immersive tool. The experts also mentioned that MMG is a pleasant and intelligent tool combining good storytelling and effective among almost all age groups. Mixed reality is seen as optimal when used judiciously for the transmission of knowledge of past realities. Concerning 3D and binaural audio, the technology is described as perfect for pre-prepared rooms, but its development and maintenance can be expensive. Finally, apps are believed to be efficient, but managers should bear in mind that they require equipment resources from the visitor such as a phone, memory, processor, and data as well as access to the internet to download it.

But again, managers should understand first what the cultural heritage's goals behind the integration of these technologies are and if the visitors would accept them. The appropriate technology for a project or cultural site depends on its goals, the public, the message, and contents they want to share and the means both financial and the expertise for maintenance.

### **4. Professionals' experience with technology in their museum and monument**

Following the discussion on different technologies that could be incorporated in a cultural environment, it was the perfect occasion to discuss professionals' own experience, the reason why they use technology, and the potential feedbacks they gathered from visitors. Museum Nacional

de Arte Contemporânea do Chiado for example, uses technology either as part of an artist's approach, as a pedagogical tool or to communicate with the public like online courses, online visits, social and digital media platforms and apps. Parques de Sintra uses different technologies depending on each sites' goals and visitors' needs. Due to sanitary safety since Covid-19, they decided to move from MMG to "CloudGuide" and "Equestrian App" consisting in a 100% mobile audio tour app supporting the visit of monuments that visitors must install. At the same time, PenaQuest is an online/offline web-app supporting the visit of Parque da Pena offering the creation of visiting routes with an interactive game concept using geo-location and augmented reality components. "ZoomGuide" is another web-app using an artificial intelligence algorithm allowing visitors to learn the story behind objects of the museological collection of the Palacio Nacional de Sintra. Additionally, the park allows visitors to experience a 360° visit on a web platform by using VR. The following contributes to the promotion of visitor routes to engage visitation and facilitates access to knowledge for people with disabilities.

Turismo de Portugal is supporting two projects involving AR and VR in several municipalities to explain the history behind their sites, part of the Napoleonic itineraries and the Templar Route.

L'Hôtel de la Marine restoration mission was to immerse visitors without compromising the authenticity of the museum. The project and production management teams thought that mediation should be part of this same bias towards something very authentic while today, the known mediation tools are mainly with screens. The monument had thought of a technology that resembled that of the histopad in augmented reality to be able to re-furnish the apartments, but in the end, the screen was considered anachronistic if they wanted to be in the 18th century and its presence is very imposable. Same thing with the labels in the rooms that describe the room, they

were going to impose themselves in an atmosphere that they wanted to be 18th century. Hence, they had the idea of using sound but not too much of an audio guide, where a person enters a room, presses the button, and hears a description of the room. Indeed, the project team wanted something that accompanies, plunges the visitors in the 18th century and therefore something immersive such as 3D audio and binaural audio.

When addressing the question of the factors that pushed them to adopt technology in the daily experience of visitors, experience and visitor engagement enhancement, immersive experience, memorable moments, new ways of interpretation and reaching new audiences are the main drivers mentioned. Others have cited the fact that it helps them to share information to visitors with cognitive deficiencies, to immerse visitors without compromising the authenticity of the museum for 3D and binaural audio while some participants highlighted that it allows them to create a new business model.

According to the feedback some professionals received from visitors, the experience has been positive. Indeed, Parque da Pena reported that 80% of the comments of PenaQuest emphasize the appreciation of the visit for having used this seamless solution. The feedback helped them to both understand the positive aspects of offering the different tools and the negative ones which mostly concern temporary issues regarding internet access. Hence, reviews not only play a role in the improvement of the tools, but also in strengthening the necessary infrastructure and placing it in the right places.

Furthermore, professionals recognized some benefits and drawbacks of using technology. On the one hand, it enhances visitation through the diffusion of content to all generations, to communicate, teach or even connect online around the world during lockdown. One manager even said that currently, no cultural promoter can survive without its use. On the other hand, they

highlighted that there is still a misconception that these tools will replace the actual living experience of an artwork and that the maintenance can sometimes be expensive.

## **II. Cases of museums in other countries**

As mentioned, these perceptions of cultural sites stakeholders were complemented with some case studies, to support tourism policy for Portuguese museums and monuments. Indeed, it is essential to widen knowledge and mention examples by looking at what other countries do. To do so, research was conducted but, when possible, a visit of museums and monuments using technology was preferred to live the experience as a visitor.

During a visit at the Palazzo Vernazza, visitors have the opportunity to learn more about the city of Lecce, Italy, and the site through a VR experience by using an Oculus headset. The technology allows them to visualize the city and its evolution over the centuries by a 3D reconstruction as a main character. This Palace proposes a “Phygital Experience” ticket for ten euros, offering an immersive digital visit through VR, AR, and multimedia guides (Palazzo Vernazza n.d.).

Then, during a visit to Pompeii, it was proposed to download the application of the archeological site, MyPompeii by scanning the QR code at the entrance. It enables access to a map of this World Heritage site, itineraries, displays every landmark, supplemented with complementary information, and all the facilities such as first aid, toilets, and refill stations. More surprisingly, this app permits real-time monitoring of the number of people present along the route (Pompeii n.d.).

The French Museum Le Louvre, partnered in 2012 with the video game and console company to develop a unique audio guide available on the New Nintendo 3DS system. This



service, available in 9 languages, allows visitors to learn more about the places, the works, and the history behind them but also information about temporary exhibitions. The consoles are available for adults and families for €5. They are also available in LSF and audio description but only in French (Louvre n.d.).

Since the 16<sup>th</sup> of June 2021, the Musée National d'Histoire Naturelle in Paris, proposes a mixed reality experience to its visitors called “Revivre” meaning “Revive”. This name was carefully chosen because it gives life to eleven species of animals that are now extinct or in danger of extinction. Through augmented reality glasses, visitors can observe these species entirely modeled in 3D and animated in their real size but also learn more about the causes of their disappearance (Jardins des Plantes de Paris n.d.).

The time of a temporary exhibition named Visitors to Versailles, the Department of European Sculpture and Decorative Arts of the Metropolitan Museum of Art known as MET, decided to use binaural 3-D audio in order to design an immersive audio experience with the help of the Digital Department. Like the Hôtel de la Marine Confident headset, the audio experience is entertained by Royalty, writers and more of the seventeenth and eighteenth century in their own words through months of research to be the most accurate (Nina Diamond 2018a). For instance, visitors could experience Marie Antoinette’s fabled party while moving around and visiting the exhibition (Nina Diamond 2018b). This audio experience is available on the MET’s website.

The Confident, main tool of the permanent tour of L’Hôtel de la Marine, was one of the key motivations when choosing this topic for the thesis. Indeed, this first experience combining 3D audio and binaural audio is highly intriguing and pleasing as it offers sound immersion. During the visit, in the first tiled antechamber for instance, there is a chimney on the left and a window facing the road on the right. In the case where the headset only used binaural audio, if the visitor

would be oriented in the same way that things were recorded, the person have in front of him/her the sounds of the street to his right. However, when moving, the street sort of moves with the visitor as the sound of the street is still coming from the right. Plus, the fact that the headset is semi-open allows people to interact with each other in the middle of the experience since they are not isolated. This technology deeply enhanced the experience and thus, it was recommended to friends and relatives.

Lastly, during the pandemic museums and monuments showed that visiting an exhibition, a gallery or a cultural monument could be possible from the comfort of the visitor's sofa. Indeed, in 2021, as people were not able to visit museums due to lockdown, the English Museum National Gallery decided to bring the collections of the National Gallery, National Portrait Gallery and of the Royal Academy of Arts outside the museum. Through AR, people could activate via an app on their smartphones the twenty main artworks that are displayed in central London by scanning the QR code (National Portrait Gallery 2021).

## **Conclusion and Recommendations**

Due to its interactive nature and educational capabilities, technology used as a supporting tool for cultural sites has a significantly positive effect on visitor experience. From augmented reality, to tablets with interactive quizzes, sight, and hearing but also emotions and reflection are stimulated by technologies thus enhancing visitors' experience.

In today's modern world, technology is part of our daily lives driving consumers' expectations in terms of technological development and homogeneity across industries.

To respond to consumer demand and stray from being outdated, which could change people's perceptions of museums and monuments, investing in new experiences could be a wise

decision from cultural sites, especially for younger generations. The results of this study demonstrate that for professionals, technology is essential and drives interactivity, knowledge, and curiosity. It also promotes activity and new experiences, as well as new business models which allow sites to reach new audiences. Since the introduction of technological tools has established a positive experience, many professionals are developing new projects involving new expansions or tools. Like any project, it is essential that museums, monuments, or Turismo de Portugal keep in mind their agenda, objectives, and challenges to further implement an appropriate technology that will share their content while holding the capacity to finance and maintain it.

Following the analysis, a list of recommendations to consider is addressed to Turismo de Portugal for their tourism policy agenda.

This first recommendation may seem trivial, however during discussions with related professionals in the industry, it has been noticed that many museums overlook this crucial aspect. Before choosing a specific type of technology, it is important for the museum to know what message they want to transmit, what their values are, why they want to use technology, who their visitors are and what their expectations are. Conducting a visitor survey could be a potential solution.

Partnering with tech companies, start-ups or even universities specialized in technology could be a possible way to reduce costs. For instance, tech start-ups may appreciate the opportunity to test their products in museums and monuments in order to adjust certain settings and identify potential improvements provided the technology is well accepted by visitors. Thus, this allows the cultural site to test the tool before purchasing and implementing it into their exhibitions.

Finally, this study recommends to Turismo de Portugal to develop a web-app which collects all the relevant information from museums and monuments in Portugal a tourist could need. This idea has many advantages, the first being visitor access to all necessary information, such as location hours and ticket prices. Another advantage enables guided tours on a single application without the need to download an app for each site, especially when users have limited mobile device storage. A web-app allows cultural sites that do not have the means to finance their own application a technological tool resulting in not being left behind. However, with the use of a web-app, Wi-Fi should be made readily available with quality service to handle the number of users at a given time.

This study contributes to previous literature by giving a voice to professionals to express their opinions and experiences of using technology in a cultural environment. The interviews specifically ask professionals from different areas of expertise and countries, their opinion on the use of technology in cultural sites, if they see it as an opportunity or not and their experience.

Nonetheless, the paper has limitations. Interviews have some drawbacks since they can cause bias and respondents' answers may be influenced by the interviewers himself or its questions. Indeed, as this study focuses on enhancing visitors' experience in cultural sites through technology, some participants' responses may have been biased. Second, all respondents work in an environment that implemented technology, and it would have been great to get the opinions of professionals who do not use technology to see why. Additionally, more opinions are always beneficial even though the number of participants is irrelevant since the quantitative research method was used.

For future research, it would be worthwhile to conduct an open-ended questionnaire in Portugal in order to better understand the opinion of each of the actors in the country's tourism and cultural sector.

When mentioning art and museums, Portugal is not the first country most people think about. Despite Portugal having centuries of history, the country is not usually a main reference to art and history that people cite. However, this affirmation could become inaccurate with the implementation of technology. By investing in this venture, Turismo de Portugal could change the course of history and attract more tourists, one of their main objectives.

## References

American Museum of Natural History. n.d. “Plan Your Visit: (n.d.) Explorer App.” Accessed July 8, 2022.

Antón, Ccarmen., Camarero Carmen, and Garrido María-José. et al., 2018. “Exploring the experience value of museum visitors as a co-creation process.” In *Current Issues in Tourism*, edited by 21(12), 1406–1425.

Bruno, Fabio, Stefano Bruno, Giovanna De Sensi, Maria-Laura Luchi, Stefania Mancuso, and Maurizio Muzzupappa. 2010. “From 3D reconstruction to virtual reality: A complete methodology for digital archaeological exhibition.” In *Journal of Cultural Heritage*, edited by Elsevier Masson, 11, 42–49. <https://doi.org/10.1016/j.culher.2009.02.006>

Bastiaansen, Marcel, Dai-In Danny Han, Ondrej Mitas, and Xander Lub, Jessica Weber. 2019. “Virtual and Augmented Reality Technologies to Enhance the Visitor Experience in Cultural Tourism.” *Augmented Reality and Virtual Reality*, 113–28. [https://doi.org/10.1007/978-3-030-06246-0\\_9](https://doi.org/10.1007/978-3-030-06246-0_9).

Capriotti, Paul, and Hugo Pardo Kuklinski. 2012. “Assessing Dialogic Communication through the Internet in Spanish Museums.” *Public Relations Review* 38 (4): 619–26. <https://doi.org/10.1016/j.pubrev.2012.05.005>.

Contero Manuel, José Luís Higón, Lola Merino, and Marina Puyuelo., 2013. “Experiencing Augmented Reality as an Accessibility Resource in the UNESCO Heritage Site Called ‘La Lonja’, Valencia.” *Procedia Computer Science* 25: 171–78. <https://doi.org/10.1016/j.procs.2013.11.021>.

Corbin, J., and A. Strauss. 2014. *Basics of Qualitative Research. Techniques and Procedures for Developing Grounded Theory*.

Chung Nambo, Timothy Jung, M. Claudia tom Dieck, and Hyunae Lee. 2016. "Effects of Virtual Reality and Augmented Reality on Visitor Experiences in Museum." *Information and Communication Technologies in Tourism 2016*, 621.

Ding, Mandy. 2017. "Augmented Reality in Museums." *Arts Management & Technology Laboratory*.

Debandi, Federico, Roberto Iacoviello, Alberto Messina, Maurizio Montagnuolo, Federico Manuri, Andrea Sanna, and Davide Zappia. 2018. "Enhancing Cultural Tourism by a Mixed Reality Application for Outdoor Navigation and Information Browsing Using Immersive Devices." *IOP Conference Series: Materials Science and Engineering* 364 (June): 012048. <https://doi.org/10.1088/1757-899x/364/1/012048>.

Devitt, Aedín Mac. 2018. "Editorial." *Museum International* 70 (1-2): 3–4. <https://doi.org/10.1111/muse.12187>.

Elder, Stuart, and Alex Vakaloudis. 2015. "Towards Uniformity for Smart Glasses Devices: An Assessment of Function as the Driver for Standardisation." *IEEE Xplore*. November 1, 2015. <https://doi.org/10.1109/ISTAS.2015.7439424>.

Freedman, Gordon. 2000. "The changing nature of museums." *Curator: The Museum Journal* 43 (4): 295–306. <https://doi.org/10.1111/j.2151-6952.2000.tb00013.x>.

Flick, Uwe. 2018. *An Introduction to Qualitative Research*. Los Angeles: SAGE, 2018.

Guttentag, Daniel A. 2010. "Virtual Reality: Applications and Implications for Tourism." *Tourism Management* 31 (5): 637–51. <https://doi.org/10.1016/j.tourman.2009.07.003>.

Han, Dai-In, Timothy Jung, and Alex Gibson. 2013. Dublin AR: Implementing Augmented Reality (AR) in Tourism, In Z. Xiang, & I. Tussyadiah (Eds), *Information and Communication Technologies in Tourism* (pp. 511-523). *Springer Computer Science*: New York,

Jung, Timothy, Namho Chung, and M. Claudia Leue. 2015. "The Determinants of Recommendations to Use Augmented Reality Technologies: The Case of a Korean Theme Park." *Tourism Management* 49 (August): 75–86. DOI:[10.1016/j.tourman.2015.02.013](https://doi.org/10.1016/j.tourman.2015.02.013).

Jardin Des Plantes. n.d. "Revivre, Les Animaux Disparus En Réalité Augmentée." Galleries, Jardins, Zoo. Accessed July 11, 2022. <https://www.jardindesplantesdeparis.fr/fr/programme/galleries-jardins-zoo-bibliotheques/revivre-animaux-disparus-realite-augmentee-4077>.

Kounavis, Chris D., Anna E. Kasimati, and Efpraxia D. Zamani. 2012. "Enhancing the Tourism Experience through Mobile Augmented Reality: Challenges and Prospects." *International Journal of Engineering Business Management* 4 (January): 10. <https://doi.org/10.5772/51644>.

Leue, M. Claudia, Timothy Jung, and Dario tom Dieck. 2014. "Google Glass Augmented Reality: Generic Learning Outcomes for Art Galleries." *Information and Communication Technologies in Tourism 2015*, December, 463–76. [https://doi.org/10.1007/978-3-319-14343-9\\_34](https://doi.org/10.1007/978-3-319-14343-9_34).



MacDonald, George F., and Stephen Alsford. 1991. "The Museum as Information Utility." *Museum Management and Curatorship* 10 (3): 305–11. <https://doi.org/10.1080/09647779109515282>.

Le Louvre. n.d. "Services Sur Place." Accessed July 11, 2022. <https://www.louvre.fr/visiter/services-sur-place>.

Mohd Noor Shah, Nurul Fathihin, and Masitah Ghazali. 2018. "A Systematic Review on Digital Technology for Enhancing User Experience in Museums." *Communications in Computer and Information Science*, 35–46. [https://doi.org/10.1007/978-981-13-1628-9\\_4](https://doi.org/10.1007/978-981-13-1628-9_4).

MuseumMate. 2020. Review of *What's next for Museum Audio Guides*. Accessed: July 15,

National Portrait Gallery. n.d. "Art of London Augmented Gallery." Accessed July 12, 2022. [www.npg.org.uk](https://www.npg.org.uk). <https://www.npg.org.uk/visit/art-of-london-augmented-gallery>.

Othman, Mohd Kamal, Helen Petrie, and Christopher Power. 2011. "Engaging Visitors in Museums with Technology: Scales for the Measurement of Visitor and Multimedia Guide Experience." *Human-Computer Interaction – INTERACT 2011*, 92–99. [https://doi.org/10.1007/978-3-642-23768-3\\_8](https://doi.org/10.1007/978-3-642-23768-3_8).

Pine, Joseph, and James Gilmore. 1998. "Welcome to the Experience Economy." *Harvard Business Review*. August 1998. <https://hbr.org/1998/07/welcome-to-the-experience-economy>.

Pine, B. and Gilmore, J. 1999. "The Experience Economy: Work Is Theatre and Every Business a Stage." Harvard Business Press, Boston.

Prebensen, Nina K., Joar Vittersø, and Tove I. Dahl. 2013. "Value co-creation significance of tourist resources." *Annals of Tourism Research* 42 (July): 240–61. <https://doi.org/10.1016/j.annals.2013.01.012>.

Pompeii. n.d. "MyPompeii, the Application Which Allows One to Visit the Archaeological Site in Safety." Pompeii Sites. Accessed July 12, 2022. <http://pompeiiisites.org/en/visiting-info/mypompeii-the-application-which-allows-one-to-visit-the-archaeological-site-in-safety/>.

Shehade, Maria, and Theopisti Stylianou-Lambert. 2020. "Virtual Reality in Museums: Exploring the Experiences of Museum Professionals." *Applied Sciences* 10 (11): 4031. <https://doi.org/10.3390/app10114031>.

Weibel, P. (2018). Manifesto for a new museum. In G. Bast, E. G., Carayannis, & D. F. J., Campbell (Eds.), *The future of museums* (pp. 49–52). Cham: Springer.

## Appendix

Appendix 1: Interview guide with general and specific questions for each participant to conduct the interviews.

- How do you perceive technology's role and uses in museums and monuments?
- Do you use any kind of technology in your museum? Which types are you using?
- If you do not use technology? Why?
  - Would you consider using it in your museum?
  - If for financial reasons, would you consider partnering with a tech startup for a lower cost?
- Have you witnessed any benefits or drawbacks from using the technology?
- Do you think they are important and beneficial or not?
- Which factors pushed you to adopt technology?
- Is your department responsible for handling the technology and do you have a digital strategy/vision in place that includes emerging technologies? Why or why not?
- Many people, mostly ages 50+, are reluctant to technology while some believe it has negative impacts? Do you believe technology is harmful to cultural sites and may decrease the experience in any way?
- Many studies highlight that technology enhances visitors' experience to cultural sites. Do you agree or disagree and why? Have you witnessed it in any form in your museum?
- If you believe technology enhances culture, which types do you find more suitable for museums and why?
  - Augmented Reality
  - Virtual Reality

- Apps
  - Mixed reality
  - 3D audio
- Do you agree that technology infrastructure should be applied to museums and monuments?
- Do you think partnering with tech startups beneficial for tourism? Why or why not?
- What are your thoughts on the following technologies in museums and monuments?
  - Augmented Reality
  - Virtual Reality
  - Apps
  - Mixed reality
  - 3D audio
- Are they easy to finance?
- Do you think your technology enhances visitor's experience?
- Have you received feedback from visitors about their experience after the implementation of the technology?
  - If yes, according to the feedback, does it reveal their experience have been easier?
  - Has it been positive or negative feedback?
- Do you think your technology enhances visitor's experience?