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# DIGITALISATION PROCESSES AND TECHNOLOGICAL APPLICATIONS IN ART MUSEUMS IN TURKEY

**Karya DİRİK**
**119677012**
**Doç. Dr. Avşar GÜRPINAR**

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**DIGITALISATION PROCESSES AND TECHNOLOGICAL APPLICATIONS IN ART MUSEUMS IN TURKEY**

**TÜRKİYE'DEKİ SANAT MÜZELERİNDE DİJİTALLEŞME SÜREÇLERİ VE TEKNOLOJİK UYGULAMALAR**

Karya DİRİK
119677012

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| **Tez Danışmanı:** | Doç. Dr. Avşar GÜRPINAR<br>Loughborough University | (imza): ..... |
| **Jüri Üyesi:** | Doç. Dr. Esra YILDIZ<br>İstanbul Bilgi Üniversitesi | (imza): ..... |
| | Doç. Dr. Selçuk ARTUT<br>Sabancı Üniversitesi | (imza): ..... |

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## ABSTRACT

This thesis investigates the digitalisation processes of art museums worldwide and in Turkey. The aim is to compare these processes with digital technology applications. The study consists of a literature review based mostly on secondary resources.

The thesis presents an overview of the historical evolution of art museums initially. Moreover, the constitution of the museum concept, the adoption of the visitor-centric approach of museums, and the entry of digitalisation into museums are included.

In the first chapter, the digitalisation processes of art museums is handled under three main parts and analysed with examples. The first part discusses the reproduction of art. While artwork can be reproduced through photography, the concept of going to the museum has begun to change its meaning. The second part covers the entry of digital technologies into museums, initial examples, and their effects on museums. The last part deals with the increasing accessibility and global circulation of art and art museums as a result of the reproduction of art and the digitalisation of museums.

The second chapter analysed prominent examples of digital applications in art museums worldwide. This analysis points out why museums use these technologies and how. This part categorised according to the type of technology; each has related examples with images.

The last chapter has three parts: the digitalisation processes of art museums in Turkey, prominent applications from Turkey, and the digitalisation of Pera Museum as an example.

As a result, this research highlights significant points in the process and cause-effect relationships between them. At the same time, while a literature review is done with existing examples, it aims to compare worldwide practices with those in Turkey and create research areas for further researches.

# ÖZET

Bu tezin amacı Türkiye'deki ve dünyadaki sanat müzelerinde dijitalleşme süreçlerini, dijital teknoloji uygulamalarını incelemek ve bir karşılaştırma yapmaktır. Çalışma, çoğunlukla ikincil kaynaklara dayalı bir literatür taramasından oluşmaktadır.

Tez, başlangıçta sanat müzelerinin tarihsel evrimine genel bir bakış sunmaktadır. Ayrıca müze kavramının oluşumu, müzelerin ziyaretçi merkezli yaklaşımı benimsemesi ve dijitalleşmenin müzelere girişi yer almaktadır.

Birinci bölümde, sanat müzelerinde dijitalleşme süreçleri üç ana başlıkta işlenmiştir. İlk başlıkta sanatın yeniden üretimi ele alınmıştır. Sanat eseri fotoğraf sayesinde yeniden üretilebilirken, müzeye gitme kavramı anlam değiştirmeye başlamıştır. İkinci başlıkta, dijital teknolojilerin müzelere girişi, ilk örnekleri ve müzeler üzerindeki etkileri ele alınmaktadır. İlk bölümün son başlığında da sanatın yeniden üretimi ve dijitalleşen müzelerin bir sonucu olarak sanatın ve müzelerin artan ulaşılabilirliği ve global dolaşımı konu alınmaktadır.

İkinci bölümde dünya çapında sanat müzelerinde kullanılan dijital uygulamaların örneklerle analizi yapılmıştır. Bu analizler, müzelerin bu teknolojileri nasıl ve neden kullandıklarını da içermektedir. Bu bölüm, teknolojinin türüne göre sınıflandırılmıştır ve her bir alt başlık görselleriyle birlikte ilgili örnekleri içermektedir.

Son bölümde de Türkiye'de sanat müzelerinde dijitalleşme süreçleri, öne çıkan uygulamalar ve Pera Müze'sinin dijitalleşmesi örnek olarak ele alınmıştır.

Sonuç olarak, bu araştırma süreçteki önemli noktaları ve bunlar arasındaki neden-sonuç ilişkilerini öne çıkarmaktadır. Aynı zamanda mevcut örneklerle literatür taraması yapılırken, dünyadaki uygulamaları Türkiye'deki uygulamalarla karşılaştırmayı ve daha sonraki araştırmalar için araştırma alanları oluşturmayı amaçlamaktadır.

# INTRODUCTION

> "Museums are wonderful, frustrating, stimulating, irritating, hideous things, patronising, serendipitous, dull as dishwater, and curiously exciting, tunnel-visioned yet potentially visionary. The real magic is that any of them can be all these simultaneously . . . What is a museum and what is it not?"
>
> (Boniface, Fowler, 1993)

A museum is defined as "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, research communicates, and exhibits the tangible and intangible heritage of humanity and its environment for education, study, and enjoyment." by ICOM Statutes, adopted by the 22nd General Assembly in Vienna, Austria, on 24 August 2007. Additionally, by the official definition, museums are viewed as leading actors of cultural values and norms, as places that combine elements from high and popular culture that foster discussions and debates about current issues; and blend various periods, artists, art genres, and people interested in. Museums can maintain such extraordinary socio-cultural power because of their trusted and revered organisation structure (AMM, 2001, as cited in Bautista, 2013).

Various purposes may be observed for the foundation of museums: to contribute to the quality of life and education of the public; to attract visitors and revive tourism; to offer services as an entertainment venue, scientific site, and scholarly sources; to raise citizenship consciousness and to carry the nationalistic and ideological concepts across generations (Lewis, 2020). These purposes may affect the museum's form, concept, content, design, and operation. Nevertheless, these various purposes do not change the main intention: the preservation and exhibition of some culturally, artistically, or scientifically valuable objects.

Initially, the word *museum* comes from the Greek word "mouseion", which first appeared in 1732. It means "seat of the Muses" and refers to a philosophical

organisation or a place of meditation for the nine goddesses of the arts in Greek mythology (Bowry, 2015). Then the meaning started to change, and in Roman times, museums became places for philosophical meetings and discussions. The Great Museum at Alexandria, founded in Egypt in the 3rd century BCE, consisted of a college for scholars and a famous library (Alexandrian Museum, 2020). It was a pilot university rather than a place to conserve and demonstrate heritage materials and artefacts. During 15th-century Europe, the *museum* word got closer to its current meaning as it was used to describe Lorenzo de Medici's collection in Italy. However, it was just a term indicating a concept rather than a building or an organisation.

Around the 16th century, the most similar concept to the museum was the *Wunderkammern*, or Cabinets of Curiosities, created first by nobles, wealthy individuals, and merchant clusters (Rodini, 2019). Cabinets of Curiosities were modest collections of rare artefacts that aimed to classify and convey stories about the natural world's wonders and oddities (Cabinet of Curiosities, n.d.). These, often thought outmoded cultural activities by museum historians, have significantly impacted contemporary museum practice in the late 20th and early 21st centuries (Bowry, 2015). Wunderkammers, essentially, were places to display wealth to the other elite clusters. Wunderkammers were not open to the public; only the other collectors, people from the owner's social circle, or unique visitors with permits could visit them (Huber, n.d.). Then, various concepts emerged, primarily introduced by noble families, such as Tradescant's collection of *naturalia and artificialia* in England in 1649. The owners of these collections were ready to welcome people who wanted to see the exhibited objects. Thus, this practice is considered a pre-concept for museums (Macdonald, 2011). In 1675, a private collection that belonged to Elias Ashmole was transferred to a building at the University of Oxford. Eight years later, it was renamed as Ashmolean Museum. The Ashmolean Museum was the first public museum to receive the title "museum" (Britannica, 2022). The British Museum, as a public institution for the preservation and exhibition of a collection, was created in England in 1973.

As a space for public participation and education through exhibited artefacts and artworks, the modern museum concept emerged around Europe's 18th and 19th centuries, in an era of increasing colonisation, nationalism, and the Enlightenment. During these centuries, the museum concept was a name given to a building that reserved some particular objects. Nevertheless, the "physical building" aspect of museums began to lose its significance over time due to the changes in the exhibited artefacts. For example, open-air museums containing buildings as displayed objects and old city remnants emerged towards the end of the 19th century (Shafernich, 1993), such as the Göreme Open Air Museum in Turkey (Lewis, 2020).

The object-centred museum idea has turned into a visitor-centred attitude at the beginning of the 21st century (Macdonald, and Hooper-Greenhill, 2006). The museum concept emerged from the rooms that noble families used to store and display their possessions, evolving into places where nations exhibited their treasures and achievements. In the same way, art museums are institutions that undertake the tasks of exhibiting artworks, bringing them together with the visitor while storing, protecting, and archiving the artworks or artefacts. In time, education inside museums and visitor-centred practices have increased to make museums more sustainable and interactive in the long term.

The concept of museums has maintained its existence in various forms until today. Santagata states that cultural heritage is essential for generating creative economic and technological innovation, enhancement for a sustainable future, and art-historical exploration (Santagata, 2009 as cited in Pietro, Mugion, Renzi and Toni, 2014). Also, the number of museums has seen a dramatic increase.[1] Thus, museums need to maintain their resilience, keep up with the times and achieve sustainability (Pescarin, 2014). Also, to maintain this sustainability, museums must be responsive to diverse visitors' needs. They should attract attention to stand out from other

[1] According to UNESCO 2020 data, there were about 22,000 museums in 1975 and 95,000 today worldwide.

museums and entertainment options. Thus, it is essential to correctly determine potential visitors' expectations (Pietro, Mugion, Renzi and Toni, 2014). Museums are institutions to maintain the sustainability of cultural heritage and its transfer to upcoming generations. There are two main ways to maintain this sustainability. The first is to adapt to changing economic, environmental, social, and political circumstances, while the second is to build solid connections and relationships with the visitors. In order to increase the visitor flow and develop relationships, a visitor-centric approach has been formed (Pietro, Mugion, Renzi and Toni, 2014). One of the biggest reasons for the spread of the visitor-centric attitude is that museums have become more than just exhibition spaces over time; they have become a complete experience for visitors.

On the other hand, a visitor-centric vision must work not for the visitors but with the visitors. Provided online and onsite workshops based on the area in which the visitors are interested, user-friendly websites and services, personalised online collections, and membership programs are ways for museums to create a sustainable relationship with their visitors even after the physical museum visit (Bautista, 2013). Morris (2020) states that visitors cannot be received as guests or spectators anymore. They have been active members and delegates in creating the whole experience in the museum (Morris, 2020). That is a visitor-centred museum attitude. With this attitude, the visitors become an active element in designing a museum.

As a part of this visitor-centric perspective, an additional need has emerged to collect the visitors' feedback and learn about them, especially their needs and requests (Pietro, Mugion, Renzi, and Toni, 2014). As explained before, the museums shifted their focus from object to visitor over time. With this focus change, museums have become not only the places that show the history of a country, cultural belongings, and artefacts but also take the responsibility of teaching. Accordingly, new needs have arisen in line with museums' new meanings and responsibilities. Many specialists and writers from cultural industries agreed

that museums have evolved into visitor-centred places from collection-driven institutions (Anderson, 2004).

Experience is affected by the physical context of the exhibition as well as the personal-sociocultural context of the visitor. Collecting various data from a potential visitor is essential because every museum experience is unique to the visitor. Moreover, while the socio-cultural context affects the visitors' level of knowledge, the visitor evaluates the museum according to this level of knowledge. Falk and Stroksdieck state that the museum visit experience is "a complex phenomenon situated within a series of contexts" (Falk and Stroksdieck, 2005, as cited in Sundar et al., 2015). A museum visit could be for entertainment, education, research, or other reasons; this could change depending on the visitor's motivation, expectations, knowledge, memories, and experiences. Being a museum visitor provides a cultural vantage for people. In short, nevertheless, the paths are similar; experiences for each visitor are different and unique. The visit experience change depending on what the visitors prefer to engage in and the meaning they assign to these actions (Falk and Dierking, 2012). It is essential to make this visit experience memorable for visitors.

Moreover, works of art began to be reproduced digitally. The artwork, which was first reproduced with photography, was later reproduced through digital technologies and started to become accessible worldwide around the end of the 20th century. While the meaning and accessibility of the artwork have changed, this has also been reflected in the definition of the museum and the concepts of accessibility. In addition, museums started to use digital technologies for enhancing sustainability, accessibility, and audience communication. For example, digital applications were developed in which visitors could ask questions about the artworks and play games. Augmented reality experiences in museums and virtual reality exhibitions have increased over time.

In addition, digital data collection from visitors is easier and faster than physical assessment tools like traditional questionnaires. Museums can have more data in less time, and this data may then be used for museum websites and physical equipment customised for visitors. Technology is not only affecting the physical museum experience but also changing the before and after processes of a museum visit. For example, visitors can use websites to buy tickets, check exhibitions and events in a museum, or share their opinions and memories on social media after their visit. Museums may send emails about new exhibitions or about a new video they put on YouTube to create a sustainable digital community. In addition, digital applications got into the museums, and virtual museums increased over time.

In the late 20th century, digital communication methods became inevitable for visitor-centric approaches and created better learning and experience. In the 1990s, the information age, the Digital Age or New Media Age, emerged by utilising the world wide web (Tucci, 2014). In the following years, the transmission of information accelerated, especially with the increase of personal computers. First, digital platforms were created with the Web 1.0 concept, which implies the earliest internet version and gives information in a read-only version. Then, this situation became more interactive with Web 2.0, which the Internet turned into a system that actively engaged with users. Thus, public awareness of digital technologies increased. Accordingly, museums also aim to reach that availability level and provide the information needed by their visitors. One of the earliest examples is the Metropolitan Museum of Art, which created its website to provide immediate updated information about the museum to people worldwide in 1995 (Kuo, Lee and Wang, 2016).

In recent years, museums have started digitalised their collections to be a part of the information community. For instance, The British Museum has started using a software system created by System Simulation Ltd. and has already digitalised its collection of pieces dating after 1970. Around 2004, the British Museum began to include digital images in its database, and most of the museum's database was put

on the museum's website by 2007 (Kuo, Lee and Wang, 2016). The European Union created *Europeana* in 2008, an online platform that makes many cultural heritage materials accessible in text, image, sound, and video formats (Huber, n.d.). There were more than 50 million items on the portal by 2016. Then, the Google Art Project and The Google Art Institute were created in 2011 (Hylland, 2017).

Moreover, digitalisation has permeated art practices, giving rise to new art fields such as video art, electronic art, and new media art. Furthermore, with the advent of virtual universes and virtual currencies, virtual art markets have resurfaced, and the number of works in this field has increased. For example, the Non-Fungible Token (NFT) market makes it possible for digital artworks of pixels to increase in value and be traded with customised features (Wang et al., 2021). Examination of these artistic fields is beyond the scope of this thesis, but it is essential to mention these issues are among the topics that can be studied in future research.

Although digital technologies are mostly used in science and cultural museums, it is possible to come across very different digital examples in art museums. Museums use these technologies to provide visitors with a more interactive experience, to be more accessible, to be known more, to provide more information, and to offer a more enjoyable experience. Modern art museums' technologies are virtual reality, augmented reality, artificial intelligence, kiosks, sensors, sound systems, screens, and mixed technologies. Compared to the examples in the world, there are fewer examples of digitalisation in art museums in Turkey. Some art museums that are active in the field of digitalisation in Turkey are Pera Museum, Sakıp Sabancı Museum, and Istanbul Modern.

## AIM AND IMPORTANCE

In this thesis, I first examine the digitalisation process of art museums and the highlights of this process while providing prominent examples from around the

world. Then I would like to examine the examples of art museums in Turkey and compare the world and Turkey. Pera Museum was chosen as a prominent example for a more in-depth examination of the digitalisation process. I will discuss how this digitalisation process affects these museums and their practices. The main aim of this study is to provide a literature review to compare digital practices in museums in Turkey and worldwide.

It is essential to see that museums are digitalised, especially when extraordinary situations arise, such as the COVID pandemic. I also aim to deepen this study by including significant topics that have emerged from the digitalisation of museums, such as legality issues surrounding the digitalisation of artworks and the need for external digital consultancy and design firms in this field. This thesis can be a resource for those conducting research on the digitalisation process of museums and the applications used in museums.

## THEORY AND METHOD

This thesis was written using the explanatory research method. This research method analyses why something occurs when resources are narrow about the topic. This research method also aims to create cause-and-effect relationships and find patterns in existing data (George, Merkus, 2022). Firstly, I present a brief overview of the museum concept and a summary of the history of museums as an introduction. Then I mention why digital technologies came into use in art museums and how this process was carried out. In particular, in line with the increasing technological developments, digitalisation in museums has also increased at the same momentum. With the advent of Web 2.0, an interactive version of the internet, the use of digital technologies in museums has increased, and with the changing understanding of museology, it has become a visitor-centred tool.

This explanatory research aims to exemplify the consequences and the initial causes of the digitalisation process of museums. I use secondary data and conduct both

qualitative and quantitative research. I use quantitative data about art museums in Turkey and worldwide to highlight the digital technologies that museums use through examples. Also, the digitalisation methods most used by museums are presented in a chart at the end of the thesis. This chart has nine categories containing the most used digital applications, contents, and social media accounts of the world's top 20 and Turkey's top 5 art museums. These selections were made according to the museums that use the determined applications most actively.

According to the research, I create the thesis into three chapters. I identify three highlights in the first chapter. I argue that these are the significant points of digitalisation in art museums. In the first chapter, subtitles have cause-and-effect relationships. In the first part of the first chapter, the starting point for the reproduction of the artwork through photography and the first steps towards its digitalisation are mentioned. The second part of the first chapter, the entry of digital concepts into museums, and the last part of the first chapter, the increase in the accessibility of art and museums globally due to the contents of these first two parts of the first chapter are discussed. The second chapter comprises digital application and technology examples in art museums worldwide. I examine the examples in this section in two main categories. I divide these categories into applications in which audiences interact passively and those that interact as a result of their active participation. In the last chapter, I examine the effects of digitalisation on art museums in Turkey. In addition to the processes and examples in museums in Turkey, I also specifically analyse the Pera Museum because it is one of the most prominent museums in Turkey in terms of technology.

In the chosen examples, the most prominent examples in social media, articles, and search engines in the world and Turkey are examined. All digital technologies used by art museums have been presented under separate headings with explanations, and relevant examples are added to their visuals. The attempts made in the field of technology in museums in Turkey are few compared to the world. Pera Museum was chosen as an prominent example to deeply analyse, because it is among the

museums that practised the most applications in the name of digitalisation in Turkey. Although they are presented in different news sources and social media channels, analysis of these examples is not available in many academic sources. Moreover, additional and less related resources are included in the appendix for further research.

There are some near-synonymous terms in the general literature on the topic. For example, it is possible to come across "visitor" and "audience" words in various resources to mention the people who visit museums.[2] While the term "visitor" is mostly used for general and daily definitions, the "audience" term is mainly used for digital observers of the displayed object, not just those physically visiting the museum but also similar digital followers. I use the words "visitor" and "audience" depending on the particular example. Also similarly, the terms "artefact", "object," and "artwork" are used to refer to "the things" which are displayed in museums. These words also differ according to the type of museum. While the term "object" is mostly used to refer to objects from ancient civilisations exhibited in historical museums, the words "artefact" and "artwork" are used to describe handmade objects. I prefer to use the word "artwork" mostly because most of the examples I examined throughout my thesis were examples of art museums. There are also couple of examples that I prefer to use "artefact" because of the usage of original sources.[3] In some parts of the thesis, different terms are used because they convey the meaning of the original quotations better. In addition, in the thesis, the term "virtual" and the concept of the "virtual museum" are examined under two headings, virtual museums, and virtual reality.[4] With the concept of a virtual museum, virtual tours that are transferred to the computer environment through 3D laser photography and accessed through a website are signified. Moreover, virtual environments created in the computer environment that can be accessed with VR sets are mentioned with virtual reality.

[2] For example in the source "Museums in the Digital Age" by Susana Smith Bautista
[3] See page 57
[4] For more information, see sections 2.2.1 and 2.2.2

## FRAMING OF RESEARCH QUESTION

This study follows the main research question of "how has digitalisation affected the museum experience?" To examine these further, certain sub-questions have been employed: How did digitalisation begin in art and art museums, and how have these museums been affected by this process? What are the most prominent examples of digital applications in art museums worldwide and Turkey? How has digitalisation progressed in art museums in Turkey compared to examples in the world, and which examples stand out?

# 1. HIGHLIGHTS OF THE DIGITALISATION PROCESSES IN ART MUSEUMS

## 1.1 REPRODUCTION OF ART

The first digital highlight for museums may be the reproduction of the artworks. The reproduction of artwork, which starts with photography and other copying methods, causes the artwork to break away from the environment it is in, and from the texture of the material, it is produced and loses the touch of the artist who produced it (Benjamin, 1936). This new reproduction is now a hyperreality of the artwork. This act of reproduction alters the cultural, emotional, and material value of the artworks. These reproductions spread first through printed sources, and then through technological devices such as television and computers. Websites and digital platforms are the first digital places for displaying reproductions of artworks and digital presences for museums. Thus, the concepts of "seeing artworks" and "going to a museum" have gained new perspectives.

The concept of mechanical reproduction of art, first suggested by Walter Benjamin, has been performed in various ways in different historical periods (Benjamin, 2008, initially published in 1936). In his essay titled "The Work of Art in the Age of Mechanical Reproduction", Benjamin elaborates on the effect of mass production on art and its traditional and individual uniqueness (Mehdi, 2017). The main point of his article is that mechanical reproduction brought about a completely new and revolutionary change in how people experience artwork (Larsen, n.d.). Benjamin (1936) explains, "In even the most perfect reproduction, one thing is lacking: the here and now of the work of art and its unique existence in a particular place." The method of reproducing the artwork creates a possibility of being manipulative. This reproduction concept is mainly problematic when recording performance art. Some scholars state that performance art cannot be recorded, saved, or documented because nobody can catch every angle of a lively four-dimensional event that

consists of multi-sensors. Recorded performance art gets out of its context and grows apart from its original meaning (Phelan, 1993, as cited in Watkins, Manzella, 2011). Benjamin explains his thesis that technological reproduction takes the aura and authenticity of the artwork away.

One of the most influential philosophers of the postmodern era, Jean Baudrillard, brought his interpretation of this technological process with the Simulation Theory and stated that the virtual world supplanted cognitive and physical reality (Okuyan and Taslaman, 2018). In Baudrillard's explanation, the simulation creates hyperreal reality, which models generate without origin or reality. Although these models are from the real world, the created new things have lost their identity and realness. In the hyperreality case, despite all the increase in data production, meaning is getting lost, the essence loses its value, while the real and hyperreal become inseparable (Baudrillard and Glaser, 1994). In this case, digital artwork, a copy of an artwork, loses its aura, the artist's touch, and the material texture. When digital artworks become hyper-realistic versions of physical objects, virtual museums can be considered the hyperreal state of real museums.

Before the invention of photography, the only way to copy an artwork was to make it again. With the invention of photography, some painters, such as Courbet, considered this new invention suitable and welcomed it to their work as they were already against the classical academic style of art. On the other hand, others despised this machine available to everyone without an artist's trained eye (McCouat, n.d.). Photography was the starting point of artwork reproduction. Baudelaire defined *photography* as "… art's most mortal enemy..." (Baudelaire et al., 1859). While photography can capture the moment, it also destroys artwork's "human hand" factor. Previously, hand skills were the only way to create artwork, but with the invention of photography, rendered eyes and lenses became enough to reproduce an artwork.

The invention of photography also transformed the value of artwork. To illustrate, the angle of the photo or any other thing that comes into the frame can affect the photo. Even just the lens can even affect reproduction. Benjamin (1936) states that this alteration can take the cultural and emotional value of the artwork away. This cultural and emotional value emerges with the artist's touch and is affected by the production atmosphere and duration of the artwork. Thus, the meaning of "seeing" is also altered. While "seeing" required the action of "going to the museum" in the past, with the invention of photography around the 1890s, many works can be "seen" without going to the museum. However, as John Berger (2008) claimed, the camera has changed our perspective and manipulated our way of "seeing art". Being in a museum allows visitors to feel the stillness and silence of the artwork and see its purest form.

Nevertheless, seeing the artwork on a computer or a smartphone screen is different. The viewer can move, manipulate it, and this act ruins the stillness of the artwork (Berger, 1972). In other words, the difference between the representation and "the real thing" emerged. The artworks were reproduced with photography and spread worldwide through printed sources at the beginning. Then other copying methods were also used to reproduce artworks, such as video recording and 3D modeling. People have started reaching artworks digitally through technological networks such as the internet and television. In addition to allowing the audience to access the artworks through search engines such as Google, museums have established their websites and started exhibiting the artworks digitally. One of the first representatives of museums in the digital environment is their websites. Other than the official museum websites, there are also art-related websites that exhibit various artworks and art-related content online. WebMuseum, one of the first virtual museums, was founded in 1994 by Nicolas Pioch, a 23-year-old student. It was not an official museum website, but this project received the "Best Use of Multiple Media Award" at the CERN World Wide Web conference in 1994 (White, 1997). Various exhibitions on WebMuseum consist of works from the Baroque, Impressionism, and Abstract Art periods. The website includes biographical

information of some artists and many works by known artists; Monet, Van Gogh, and Manet. There are also explanations and photos of some of the touristic points of Paris to create a better and more holistic cultural experience (Neufang, 1994).

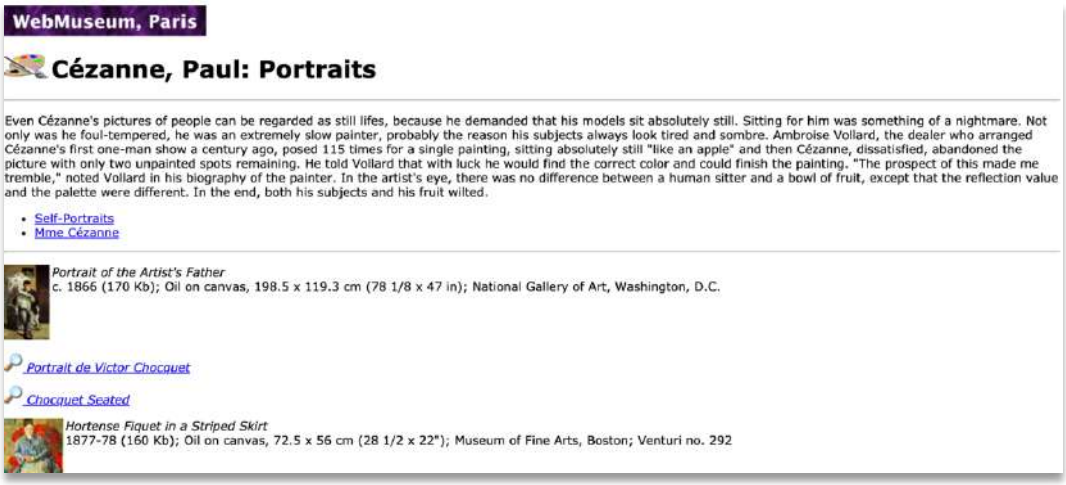



**Figure 1.1.1** Website of WebMuseum. **Source:** Pioch, 2002

Websites are more than only online platforms to reach the existing visitor of the museum; these are the places to reach more people from other countries and cultures. A website helps museums expand their visitor diversity in terms of age, culture, and educational level (Bautista, 2013). Almost every museum has a website recently. One of the oldest art museum websites is the Metropolitan Museum of Art website, established in 1995. The museum's website, which has been gaining popularity since its establishment, has gradually improved its content and started to offer users online membership, educational content, and customisable areas, for example, areas where they can add their favourite works of art and program their calendars (MET Museum, 2000). When museums started to create their online presence, some art-related websites were also created. One of the first "so-called" virtual museum websites, WebExhibit, launched in 1999 as an interactive, online museum of science, humanities, and culture (Anonymous, n.d.). It consists of an educational web page collection formed mainly by images and documents. The

creators identified them as exhibits, yet this kind of display is considered more of an archive (Bianchini, 2019).

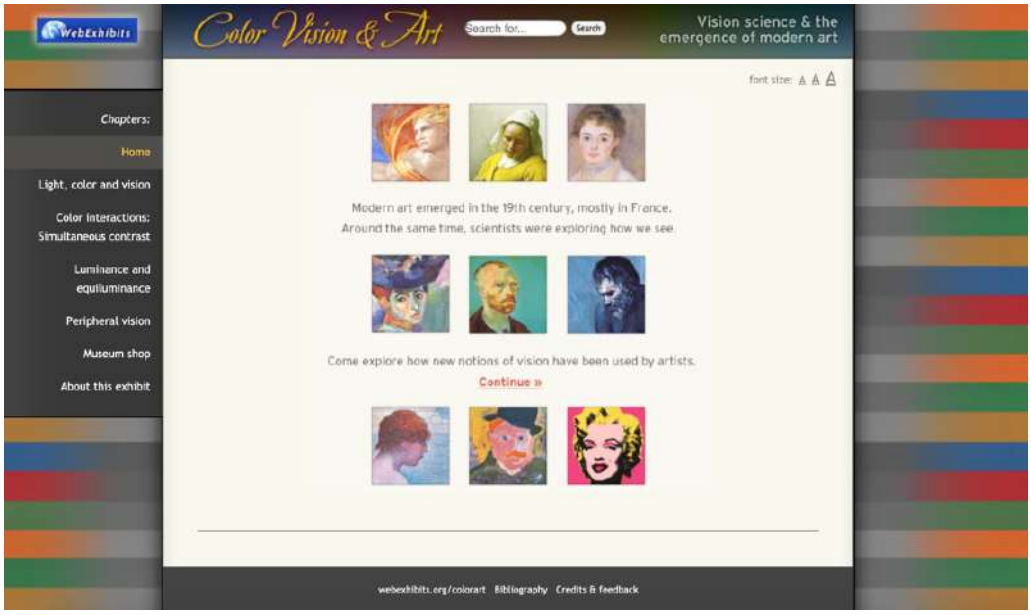



**Figure 1.1.2** Website of WebExhibit. **Source:** Douma, 1999

Artworks began to be reproduced, first through photography, then with other copying technologies, and with the emergence of these representations, their spatial constraints were reduced. Thus, copies of these artworks have begun reaching visitors who could not even reach the original pieces through TV, the internet, art platforms, and websites. “Seeing artwork” and “going to a museum” changed their meanings. Museums have also entered the digitalisation process at the forefront of art institutions. Not only are they involved in the reproduction of these artworks, but their digital storage and display efforts are carried on.

## 1.2 DIGITALISATION IN THE CONTEXT OF MUSEUMS

With the artwork reproduction, the perspectives on the artwork have been reshaped. Artworks are no longer something that can only be seen when visiting a museum.

With the emergence of websites and digital platforms, reproduced artwork reaches more people, and digitalisation enters museums. Museums digitally reproduce their exhibitions by making digital catalogues and archives to reach more people. Developing technology have affected many institutions and organisations as well as affecting daily life. When the objects we use are digitalised, the services we receive are also digitalised. Like many institutions, museums are affected by digitalisation and trying to adapt to it. Eventually, this digitalisation process entered the museum departments in order, and the purpose of use was shaped according to the department's needs. First of all, digitalisation steps were taken within the management departments of the museums. Then, when object-centred museology started to evolve into visitor-centred museology, digital tools began to be used to give the visitor a better experience. Museum administrations have started to design interactions between the museum and its visitors through digital technologies. At the same time, digital technologies began to be used to create platforms and a more interactive experience within the museum.

Parry (2013) has examined the technical details very broadly in his book, Museums in a Digital Age, beginning with the computerisation of museums. The first attempt at computerisation in museums was in the United States in the 1960s. The integration of computers into museums started with the managerial and financial aspects, such as collection management, as the technology was insufficient for advanced applications such as supplementary educational services. Despite these unsatisfactory conditions, the computerisation rate was very rapid. After a while, in the 1970s, minicomputers came into use, and a new era started for museums with electronic data management (Parry, 2013). Gradual digitalisation in some museums has caused noticeable improvements in artefact conservation, research sharing, curation, marketing, education, and public relations. Although the idea of the museum arose from the need of noble families to exhibit their possessions, museums were transformed into institutions established by communities and countries to take on more responsibilities, such as educating the people. Thus, museum management departments have started to lean towards digitalisation to

spread knowledge and attract more attention from visitors (Kuo, Lee, and Wang, 2016). After the managerial part, as administrations began to adopt a visitor-centred attitude and become more comfortable with technology, digital applications began to be used in parts of museums for visitors as well. With this visitor-centred attitude, museums have started to use various technologies to create more interactive experiences for their visitors. Kiosks, screens, QR codes, sensors, voice systems, virtual reality, artificial intelligence, augmented reality, 3D modeling, and printing technologies are what museums use inside their physical space. Museums also use digital platforms and social media channels to maintain visitor relationships.

One of the most used technologies while designing the interactive experiences used in the museum is the screens and kiosks (touchable screens). While these technologies are sometimes used to present more information or content about the artwork to the audience, they can sometimes be turned into devices where users can interact with content such as games. Aside from that, 3D modeling technology is used to digitally store, archive, and display artwork in a digital environment. Due to the reflectability of dimensions and volume, 3D technology has dramatically impacted the preservation and archiving of plastic artworks. The interactive kiosk at the Tribuna del David Statue could be an example of a museum's kiosks and 3D modeling technology. In 2002, after scanning Michelangelo's statues in the Galleria dell'Accademia, a kiosk was placed right near the statue to show the digital renderings of the David Statue to visitors (Levoy, 2002). Even though the kiosk was placed only a few feet away from the statue, visitors accumulated around the device in crowds because they could see the statue in detail via the kiosk. This statue was too tall for visitors to examine in detail, so this digital screen created a new perspective and experience. The kiosk also allowed rotating the statue and adjusting the virtual lighting, which is impossible in the conventional museum setting. Visitors can see David's famous furrowed brow through these artificial lights, which is hard to see from the real statue, because of its height (Figure 1.2.3). Although templates on a kiosk screen are unlikely to replace the experience of walking around a statue, they can improve it. A kiosk is just a device to help the

visitors see the actual statue, standing right in front of them, from a new perspective. This kiosk allows visitors to create their own interactive experience (Levoy, 2003). In this example, digitalisation creates a conceptual "layer" between the artwork and its visitors. Visitors prefer to observe the artwork through the kiosk, which transiently enhances the experience. However, it may also manipulate the direct communication between the people and the artwork.

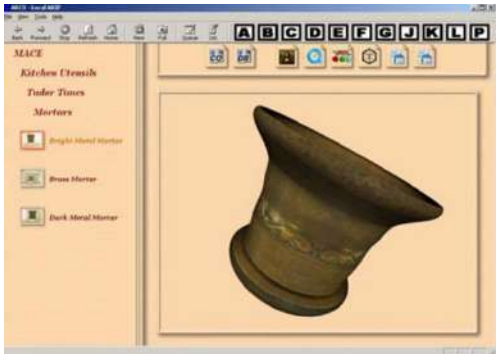
**Figure 1.2.1** 3D Model of the body parts of Tribune del David Statue. (Left) **Source:** Levoy, 2003

**Figure 1.2.2** The Interactive Kiosk That Visitors Can Navigate And Manipulate the Tribune Del David Statue by the Buttons. (Right) **Source:** Levoy, 2003

**Figure 1.2.3** Light changes on 3D model of Tribune del David, The Digital Michelangelo Project. (Dual bust figure below) **Source:** Levoy, 2003

In the early 2000s, museums started to use 3D modeling techniques for creating virtual museums. Along with the efforts to create a virtual museum, virtual reality (VR) and augmented reality (AG) concepts have also become popular. These techniques were used to create more interactive experiences for museum visitors. Museums could also activate these technologies by integrating them into a PC desktop system or a museum kiosk. For example, artwork visualisation by 3D modeling was one of the first steps toward virtual museums (Figure 1.2.4). Users could rotate and discover the details of the artwork by using an input device. This device may be a regular mouse, a keyboard, or another device. Then, by using augmented reality technologies, these 3D models and reality came together. For example, users could hold a plate, and a 3D model would appear above the plate. While viewers observed that through the screen, users could also manipulate the 3D object through these plates (Figure 1.2.5). An augmented reality system benefits from the real world rather than imitating it. In a virtual system, on the other hand, all elements are constructed (White, Petridis, Liarokapis, and Walczak, 2004).

These visualisation methods created more realistic virtual museums where users can walk along the 3D gallery and browse the visualised artefacts (Figure 1.2.6).



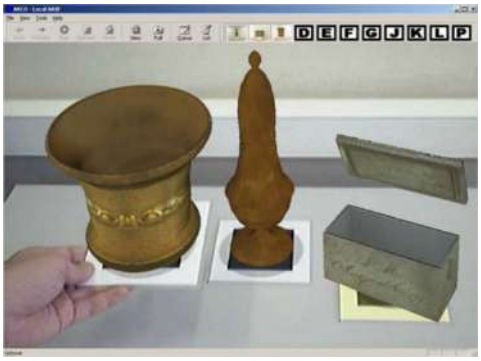




**Figure 1.2.4** Web-based visualisation of the object. (Left) **Source:** White et al., 2004

**Figure 1.2.5** Real scene augmented with superimposed virtual models manipulated through Plates. (Right) **Source:** White et al., 2004

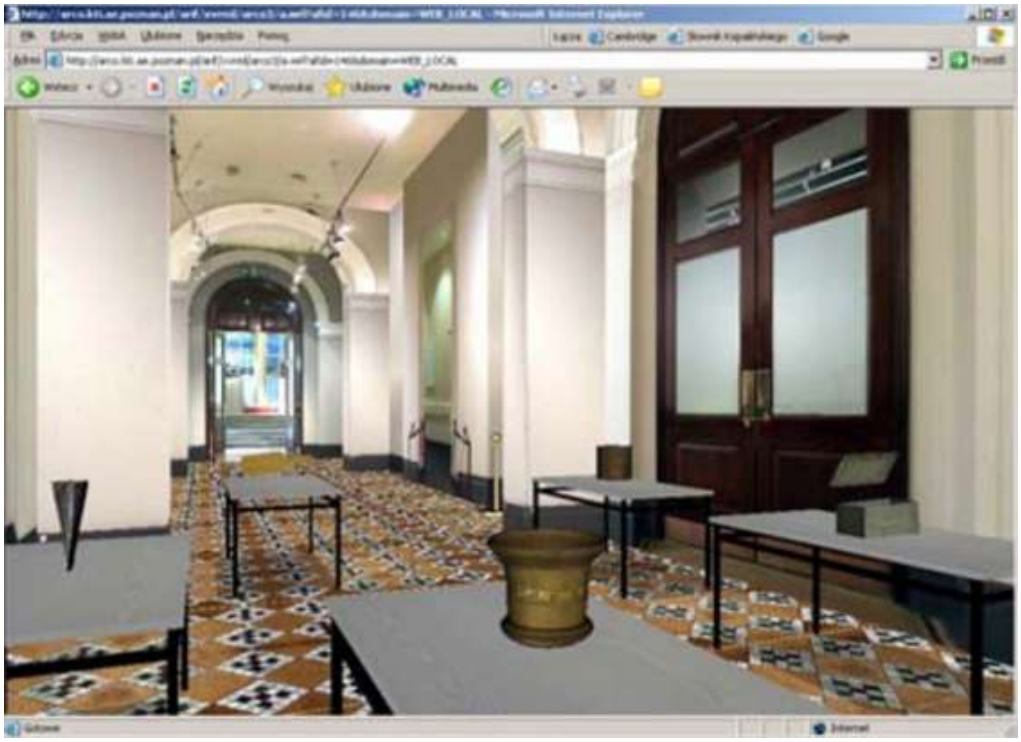


**Figure 1.2.6** Example 3D virtual exhibitions. **Source:** White et al., 2004

In 2004, another Museum in Pure Form project also encouraged visitors to touch and explore the artworks. With this project, visitors can touch the representations of the original ones, which is generally forbidden in conventional physical museums. These representations were 3D virtual models created by scanning. Some artworks taken from the partner museums, such as Centro Gallego de Arte Contemporanea Santiago de Compostela in Spain, were scanned and presented to the visitors at the Museum of Pure Form. In the project, they conducted the first trials with a CAVE-like system. CAVE-like (Cave Automatic Virtual Environment) is a cube-shaped virtual reality room with projection displays on the walls, floors, and ceilings. Also, a haptic device mounted on an exoskeleton was used in the CAVE-like system. A virtual force is created against the hand through the haptic devices, creating the feeling of touching an artwork. The user generally interacts with joysticks, wands, or data gloves and wears a virtual reality (VR) headset or a head-up display (HUD) (Wigmore, 2016). Scanned Artworks are selected according to the artwork's physical convenience, form, and material. To collect all the scanned objects in one place, they also created a virtual museum, the Museum of Pure Form (Loscos et al., 2004).

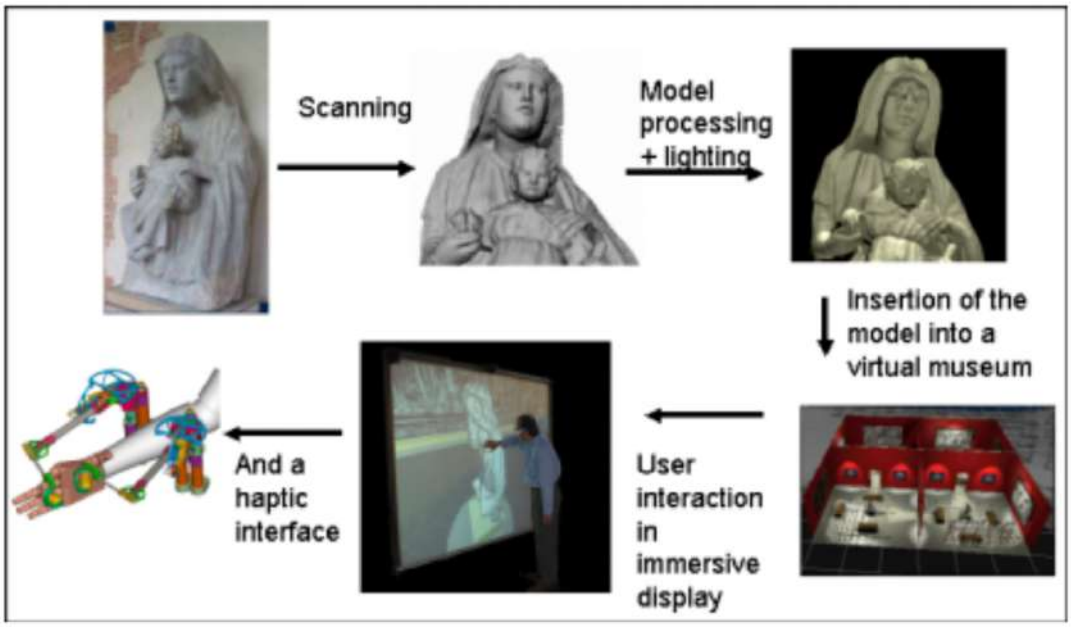



**Figure 1.2.7** Overview of the different steps necessary to build the Museum of Pure Form. **Source:** Loscos. Et al., 2004)

Some design rules were prioritised when designing the Museum of Pure Form, which was also crucial for the visitor experience. First of all, the lighting of the museum should be natural light. The reason is that natural light makes the atmosphere more pleasant for the visitor. The second design principle was that the museum should be created with architectural complexity to provide real-time navigation. Accordingly, demonstrating the project aims to create a digital archive in the long term and improve the interactive experience for visitors (Loscos et al., 2004).

**Figure 1.2.8** Example of a room of the museum with a statue displayed. (Left) **Source:** Loscos. Et al., 2004

**Figure 1.2.9** Model of the Museum of Pure Form. (Right) **Source:** Loscos. Et al., 2004

To sum up, digitalisation started in museum administrations first. However, with the mindset transition to visitor-centred understanding in museums, digital applications began to be used to improve the visitors' experience. Over time, many museums began to provide information about artworks, creating a more interactive experience for visitors and turning the museum into an experience center rather than just displaying artworks. For example, while kiosks help visitors find their way inside the museum or learn about the artworks, sometimes they help them see the artworks down to minor details. Alternatively, through digital archives, visitors can see artworks that do not exist today, artworks that have been stolen, destroyed, or too sensitive to be exhibited, and examine them down to the smallest detail with high-quality visuals. At this point, more interactive technologies have started to be used than those used in management. Some technologies can be combined with each other in different combinations and can also be used for different purposes in various projects. While one of the usage areas of 3D modeling can be interactive kits consisting of VR and AR technologies, it can also be used at a kiosk where the visitor will have a more intense experience.

## 1.3. GLOBAL CIRCULATION AND ACCESSIBILITY OF ART AND ART MUSEUMS

Since museums created their initial digital presence by creating websites in the 90s, their global accessibility has increased. First through photography, then with more advanced technologies. Reproduction possibilities made artwork more accessible, and digital versions of artwork have increased. Accordingly, the percentage of people who could access those artworks has also increased. Compact disks, phones, and fax machines made easy the data circulate. In 1995, with the start of Web 1.0, museums created their first digital presence, which gave information in a read-only version. These platforms were used not only for giving information but also for archiving and documentation. Then, in 2000, the Web 2.0 came along, and an interactive web environment was created, and the audience was now an active participant. The virtual museum concept emerged and was used in various ways. It affected the accessibility of museums. With the advanced technology, entirely virtual museums were generated, which had no physical presence. This increase has led to copyright issues and changes in foundation and curatorial processes. Digitalisation could be the thing that sparks the idea of reproduction, de-territorialisation, and dematerialisation in museums (Hylland, 2017).

Web 1.0, a term used for the earliest version of the internet and a read-only web, has also affected museums. Users were passive entities without interaction (Chakraborty, 2021). These simple platforms help digitalised information be opened to the world. With the Internet, advertisements cannot be published. These web pages are in the form of brochures. Although the first domain name museums in history were generally science and culture museums, the museums that took the first step in the field of art were the London National Gallery (1993), New York Metropolitan Museum (1995), and Paris Louvre Museum (1995). These websites also become digital archives for museums. Information about the artefacts is documented. As a result of the establishment of the Google search engine in 1998 and the increasing links between museums, information began to spread faster

(Vargün, 2022). With the advent of Web 2.0, the Internet turned into a system that actively engaged users. Users started to create accounts on the website, share content, and feedback, and leave comments (Kenton, 2022). Web 2.0 is also called the "social web". In the Web 2.0 period around 2004, museums started to collect information from the audience and produce content for them. Interface designs and the digital experience designs of these platforms have become important.

After creating basic museum websites, the virtual museum concept emerged with various meanings. According to a report created in 2014 on the common language in the virtual museum domain, the "virtual museum" concept has been classified according to various features such as interaction technology, communication, content, and level of immersion in a museum (Reuter et al., 2014). The phenomenon of the virtual museum has been used in many different meanings by different people, institutions, scholars, and resources. For example, in computer science, virtual means interactive simulation, while in human sciences, virtual is used as a synonym for digital. Furthermore, "being virtual" is used commonly as synonymous with being online (Pescarin, 2014). On the other hand, according to a report by V-must, "immersion," one of the categories for virtual museums, was defined as the system creating a highly representational environment that includes many audiovisual effects and blocks impulses coming from the "real world" (Slater and Wilbur, 1997 as cited in V-must, 2014).[5]

Some museums have an online archive available for public access worldwide such as Met Museum Collection (MetMuseum, 2022). As mentioned in the previous section, the reproduction of artwork makes it possible to reach even off-display particular collection objects through the Internet. Ross Parry (2013) claimed that digitalised objects, which are more accessible, could lose their context. Thus, the need for some extra information to create the object's context from the visitors' perspective increases. This extra information should be related to the object's

[5] For more information, see section 2.2.1

origin, artist, physical material, volume, and dimensions (Parry, 2013). Descriptions on the artwork labels are given as extra information in a physical museum. However, in a digital environment, for example, on a website, the artwork and the label are shown on the screen. It can be harder to understand an object whose dimensions cannot be seen physically. Both of them are digital, and out of physical context, these digital labels can detach the viewer from the context. Also, the accessibility of a digital object takes the place of the authenticity of a physical one (Hylland, 2017). For example, while visiting *Museum Island* in Berlin, visitors may find the chance to visit another museum that catches their eye after entering and exiting a museum entirely by chance. Alternatively, visitors can visit a museum in Berlin digitally from their home in another country, but this will likely result in only visiting the museum they want. Visitors can easily reach the museum they prefer, but that museum is breaking away from the context.

Moreover, the combination of the internet and immersive technologies affects how the visitor sees the museum as a place. Berger (1972) states that the timelessness of museums fascinates visitors. According to him, people feel less alone when looking at the things they do not see every day and run away from the rush of their lives. The museum is a place to listen to artwork. Nevertheless, the digital museum experience is quite the opposite of this feeling (Berger, J. 2001, as cited in Smith, D., 2003). With the emergence of these immersive technologies, museums could now be a video, VR experience, or documentary on TV.

On the other hand, intellectual property rights could be another issue with the increasing global circulation and availability of artworks. For example, it could be hard to maintain augmented reality applications for artworks without the collaboration of a company (Freeman, 2016, as cited in Allen, 2016). It is a legality issue able to prevent unauthorised and garbled reproductions. Moreover, it also brings the idea that digitalisation blurs the borders of ownership and knowledge of artworks. They were followed by the interrogations of cultural institutions' authorities. Especially in the case of the Google Art and Culture Project, it is

controversial to determine who holds the right to the artwork. Some museums that let Google display the artworks do not let visitors download or copy the images from there. However, at the same time, visitors can access high-quality images of the same artworks on the museums' official websites. Thus, the artwork can be copied and reproduced (Hylland, 2017). These agreements between museums and digital cultural platforms have also made the case more complicated for visitors looking from an art ethic perspective.

Apple Computer Inc. released the first virtual museum as a CD on CD-ROM in 1992 (ICOM, 2019). Entitled "The Virtual Museum", it consists of a 3D model of the inside environment of an actual museum, and the user can move around the gallery rooms and read the information about the exhibition on display.

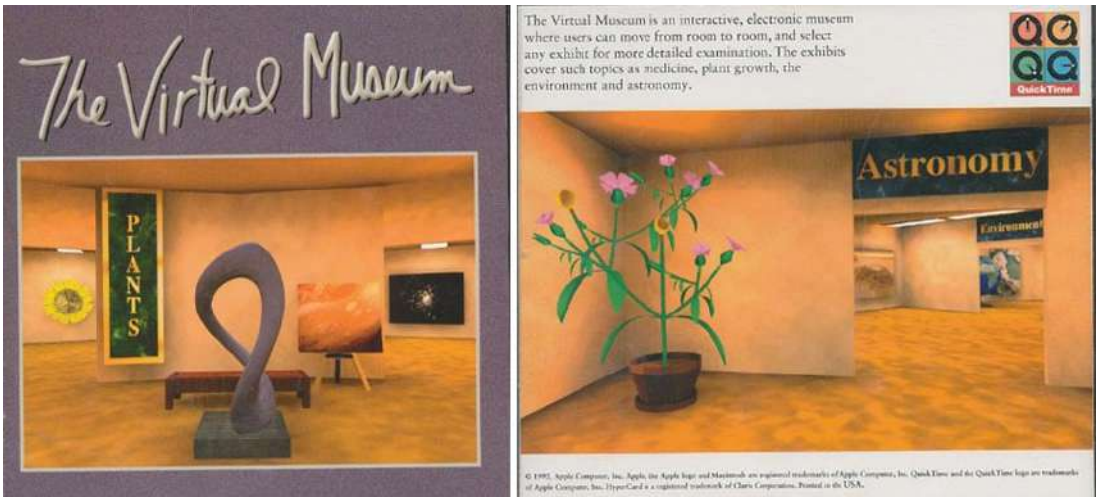



**Figure 1.3.1** "The Virtual Museum" by Apple, the First Digital Virtual Museum, released on CD-ROM in 1992. **Source:** ICOM, 2019

The Museum Inside the Telephone Network was another example of increased accessibility before the Internet as we know it today. It is a "virtual and invisible" exhibition created by NTT, one of the major telecommunications companies in Japan, in 1991. The project was created when the internet was unavailable in Japan, but it still allowed visitors to experience the museum via phone and fax. Visitors could see performances and art pieces through various channels. For example,

through Live Channel, the artists' live performances and the conversations between guest scholars could be followed by phone. Likewise, the Voice and Sound channel was for the discussions and readings of artists. In addition, Fax Channel has assisted visitors in obtaining artworks, comics, and outputs from the comfort of their own homes (Marshall, 2017).

**Figure 1.3.2** The 1991 Tokyo Museum Exhibition. (Marshall, 2017)

Additionally, the digital platforms of real museums, some digital platforms of museums do not have a physical presence. These museums and the artworks inside them are entirely virtual and are called "web-only museums." MUVA Virtual Museums of Art was the first virtual museum created in 1997 in Uruguay (Haber, 2006).



**Figure 1.3.3** Hallway of MUVA and a digital artwork. (Left) **Source:** El Pais, 1997

**Figure 1.3.4** A Digital Artwork in MUVA. (Right) **Source:** El Pais, 1997

In the digital era, museums' curatorial processes have also been changed, and digital consultancy has become necessary. Companies working on digitalising museums, such as Cuseum and MuseVR, increased. On the other hand, some partnerships were created between significant tech companies and museums. For example, the British Museum collaborated with leading technology companies to create the museum's technological infrastructure. Also, the British Museum, one of the UK's leading museums, started to invest in technological projects such as interactive workshops with children or augmented reality mobile apps (The British Museum, n.d.).

Furthermore, some of the most significant museums have created their digital departments. One is the Digital Media Department of the Metropolitan Museum of Art was founded in 2009. Tallon, the former chief digital officer of the MET, states that the whole digitalisation process, which includes building a website and creating a digital archive, is challenging, and collecting all the different digitalisation works in one department. He instead suggests a collective approach to the needs of the museums that all the departments should take part in (Tallon, 2017).

As a result, as works of art began to be copied with the help of different technologies, they began to be exhibited on different platforms and through

different technological tools. The artwork has changed from an only-exhibited item in the museum to something that was accessible by even those who do not go to the museum. In this way, the artworks have become globally accessible. While this accessibility changed the way artworks are displayed, it also caused changes in copywriting issues.

To conclude, the digital reproduction of artworks and the creation of platforms by museums in digital environments have increased the global accessibility of the museum. Platforms that were developed with the concepts of Web 1.0 and Web 2.0 have become tools through which museums can maintain communication with their audiences outside the museum. Art platforms and virtual museums have been created apart from the sites of the museums. Such developments have created some issues in copyright and intellectual property rights. In addition, to keep up with these developments, museums have established their digital departments or received support from some digital consultancy firms.

# 2. DIGITAL TECHNOLOGIES AND APPLICATIONS IN ART MUSEUMS

In this chapter, examples of technology use in art museums are examined under two categories: passive interactive technologies and active interactive technologies. Passive interactive technologies are technologies the user does not actively interact with and are not subject to individual control, such as sensors, sound systems, and non-touch screens. On the other hand, active interactive technologies can be defined as technologies that require the user's participation and gain meaning in line with the active communication of the audience. This part covers virtual museums, augmented reality, mixed reality, artificial intelligence, kiosks, interactive projection mapping, QR codes, 3D modeling, mobile, and web application technologies.

## 2.1 PASSIVE INTERACTIVE DIGITAL TECHNOLOGIES

### 2.1.1 Digital Screens and Sound Systems

Digital screens are flat panel screens consisting of various technologies to provide multimedia content to their viewers. These screens work with the help of the media player hardware and software that render the content, and the most commonly used type is LCD (Light Emitting Diode Technology). The quality of the screen is not related to the size of the screen; it depends on the panel’s resolution (Navori Labs, 2022). It is a technology widely used in different fields because it can display video and visual content such as billboards, festivals, conferences, and concerts. In museums, these screens can be used to deliver digital artefacts to the audience, reflect the relevant videos, and provide in-museum orientation or translation for the

hearing impaired. It is a digital item that the viewer interacts with through perception, without actively interacting. It is generally used with sound systems.

Screens are used in various positions, sizes, and places in museums according to the arrangement of the exhibition. For instance, a digital display with a raised platform was placed on the museum floor in the Human, 7 Questions exhibition at the Leeum Museum of Art in Seoul (Figure 2.1.1)(Yuna, 2021).

**Figure 2.1.1** An installation view of the exhibition "Human, 7 Questions," at Leeum Museum of Art in Seoul **Source:** The Korea Herald, 2021

Sound and music systems in museums can vary according to the exhibition's setting and the usage of sound for a particular artwork. Museums use sensory elements to complete the experience, provide information, and stimulate visitors' attention. In museums, mechanisms can be set up with classical speakers for sound systems, and interactive systems can be specialised for artworks. These specialised systems are

headphones and directional speakers. Unlike conventional speakers and headphones, directional speaker systems are used to transmit sound to a specific area or point. Thus, visitors can easily access the sounds related to the artwork without the need for headphones. Even visually impaired viewers can easily benefit from this system without looking at any extra devices (Akoustic Arts, n.d.).

Different sound systems are used in museums according to the characteristics and requirements of artworks. For example, in the *Resonant Bodies* Exhibition at the V&A Museum, a specialised sound system is placed on the glass. It provides the sound/music to be transmitted to the visitor (Figure 2.1.2). With this method, the museum creates new interaction between objects and viewers by enhancing their sonic dimension (V&A, 2019).

**Figure 2.1.2** The Resonant Bodies Exhibition at V&A Museum. **Source:** The Caroline Devine, 2019

### 2.1.2 Sensors

Sensors are technological devices that can detect pressure, light, heat, sound, and movement and process data to send to the measuring device or computer to which they are connected. Although these systems can receive and process data without the user's active participation, they are also widely used to collect information in technological systems that require active participation. Sensors are commonly used in daily life, for example, for automatic doors and lights or in public bathrooms for hygienic reasons. Aside from doors, lights, and sound systems, museums also have sensor-operated alarm systems, data analysis systems that determine the number of visitors and create a map of their activities, and sensor-driven guidance systems (Karayılanoğlu, 2022).

For example, a concept project from the MIT Media Lab, *The Museum Wearable* (2002), is a real-time sensor-driven storytelling device guided by the visitors' preferences, paths, and lengths between their stops inside the museum space. The Museum Wearable consists of a central processing unit in a tiny shoulder pack and a private eye display; both are small and light (Figure 2.1.3). With the project, the device can collect more data and give more accurate guidance over time as it learns from the visitors' pauses at certain intervals during the museum tour. It offers a customised audiovisual journey to visitors. Moreover, infrared sensors are placed in the museum, and statistical modeling helps to generate this user model. This technology is an alternative to traditional storytelling options such as audio tours, guided tours, and exhibition catalogues. Museums include lots of stories and information. However, most of the time, visitors cannot find time to listen to all the audio content and read all the explanations in a museum. The visitors' personalised journey originated during the visit to *The Museum Wearable* technology allows people to get all the information they desire. The system can be personalised

through simultaneously created and updated paths (Sparacino, 2002). For example, suppose a visitor spends time in front of an artwork by Picasso. In that case, the system detects that the person likes Picasso's art and reorganises the path by considering this data. Moreover, Greenhill (1992) states that visitors just read the academically written texts on the artwork label during the first fifteen minutes of a visit to the museum, then lose their attention. Creating a personalised path visitors will prefer and enjoy more can help keep their attention higher. Research also shows that museum labels[6] are mostly restricted to descriptive academic prose, which has didactic approaches and is far from evocations and emotions (Vagnone and Ryan, 2013, as cited in Perry et al., 2017). However, with this The Museum Wearable application, a better experience can be created by directing people to the parts that will interest them the most and reducing the academic reading part.

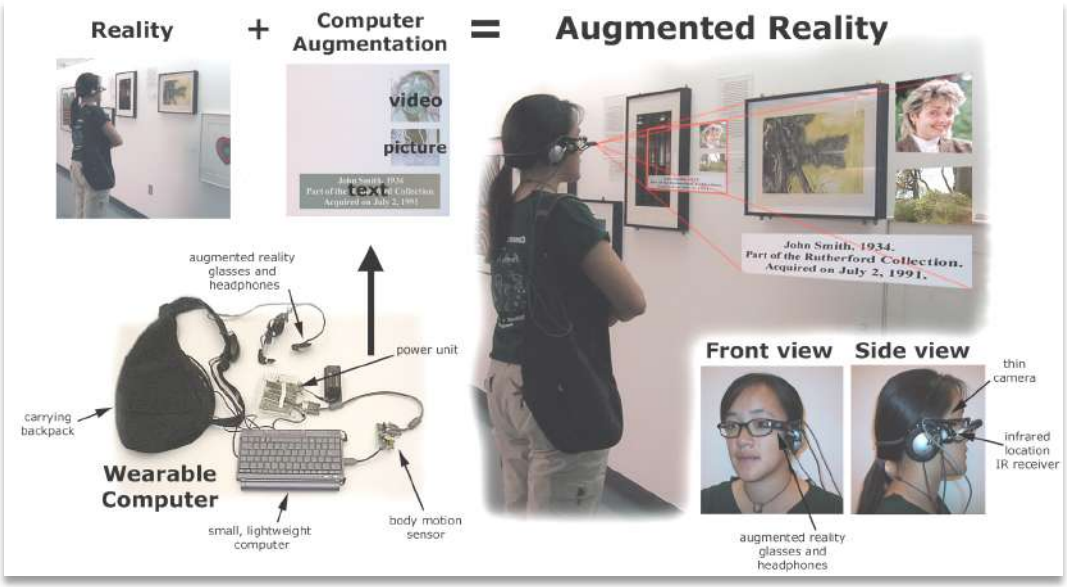



**Figure 2.1.3** The Museum Wearable. **Source:** Archimuse, 2002

RFID (radio frequency identification) technology also digitally identifies and tracks objects and artworks to create a secure environment in museums. Museums can use

[6] Cards with descriptions of artworks

this technology to set up alarm systems and adjust temperature and humidity. In addition, it can be used in interactive activities designed for visitors. For example, in 2015, the Ambrosiana Art Gallery provided RFID-enabled smartphones to visitors. Visitors can learn more by scanning the NFC tags placed near artwork and reaching the corresponding print in the museum shop (Moore, 2020).

### 2.1.3. Projection Mapping

Projection mapping is a video projection method in which a scene is reflected onto a surface, a wall, an object, a building, or even water. It is essential to adjust the light and level of brightness according to the selected canvas. Using suitable software can be turned into an interactive experience.[7] It can be used for events like the Super Bowl and a life-size Noah's Ark in Kentucky to create attractive giant screens. In addition, it can be applied to performance art stages, theme parks, and buildings for touristic events (Cumins, 2022).

For example, in the first digital fine art museum in Paris, L'Atelier des Lumières, the artworks were projected onto the gallery's 10-meter-high walls over the vast 3,300 square meters surface area of the renovated 19th-century building (Figure 2.1.4). 140 laser video projectors were used to create these state-of-the-art visuals. Also, 50 speakers using an innovative "motion design" sound system were programmed to complement the 3D visual experience, and some sounds were spread the area by Wagner, Chopin, Beethoven, and others (Stenson, 2018). The museum is currently displaying the Van Gogh Starry Night exhibition. With the enormous reflections with motions on the wall and musical production, the museum provides its visitors with an immersive experience (Figure 2.1.5).

[7] See section 2.2.7

**Figure 2.1.4** Visitors in the La Halle space at Atelier des Lumières, Paris. **Source:** The Guardian, 2018

**Figure 2.1.5** The Van Gogh Starry Night Exhibition. **Source:** Atelier des Lumières, 2022

### 2.1.4. Holograms

Holograms are virtual 3D images created by the union of light beams to reflect physical objects. It is a specialised photography method, and 3D objects should be recorded with a laser. With this technology, it is possible to reflect the features and movements of an object or a living creature. The visitors can see holograms without wearing any extra devices. This technology is used in education, marketing, and telecommunication, and the most well-known examples are hologram music shows (Respeecher, 2021).

One of the examples of this technology used in art museums is M. F. Husain Hologram Project. In this project, the artist's hologram is supported by artificial intelligence. India's Museum of Art & Photography (MAP) has been working on this project, which is planned to become a reality at the end of 2022. Through the project, the audience will be able to see the artist in 3D and ask questions and get answers from the artist through the support of artificial intelligence (MAP, 2022).

## 2.2 ACTIVE INTERACTIVE DIGITAL TECHNOLOGIES

Ben Schneiderman states that "the old computing was about what computers could do; the new computing is about what users can do… The time is right for the high-tech world to attend more closely to the needs of humanity." (Ubiquity, 2002). Technology has become a limb that users are accustomed to rather than something they use as a tool. Apart from computers and smartphones, which help us handle many things in our daily life, there are many more interfaces that we use to communicate daily, such as kiosks, AR and VR headsets, ATMs, and tablets. Cultural institutions have also started to digitalise and improve the visitors' experiences by incorporating these external technological tools. These interfaces

have been customised for museums through various designs, and specialised studies have been started in this area. These technological devices are mainly used during museum visits and aim to enhance the visitors' experience and create an exciting learning experience, especially for the younger generations. Even if somebody does not visit museums physically, s/he could be exposed to digital content through social media, websites, or mobile applications more likely than before.

Joseph Pine and James Gilmore (1998, as cited in Jung, tom Dieck et al., 2016) developed the "Experience Economy" theory. They argued that museum visits that started as entertainment could become a more educational process with active participation, as seen from the infographic (Figure 2.2.1). They also stated that physically and virtually becoming part of the experience is more immersive than just observing. This research shows that VR and AR technologies enhance the museum visit experience by creating more immersive experiences for visitors. Moreover, these technologies enable the visitors to learn better while promoting entertainment and encouraging another visit to the museum.

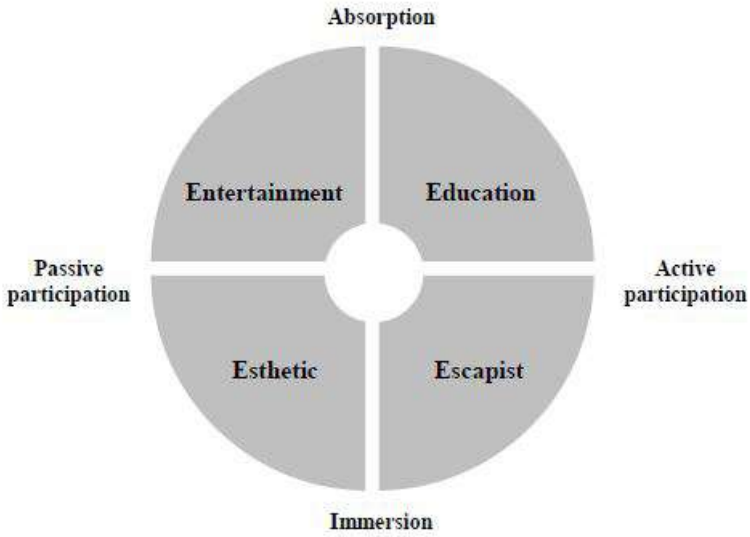



**Figure 2.2.1** Experience Economy Infographic. **Source:** Pine, Gilmore, 1998

Technology-based experiences promoting tactile sense applications aim to make visitors feel rather than learn. Watson states that "more attention needs to be paid

to what visitors feel...It is this that they remember after their visit, rather than any 'learning' they have undertaken" (Watson, 2013, as cited in Perry et al., 2017). However, feeling and learning actions cannot be separated easily, as they are dependent on each other. Similarly, research shows that memory and attention are triggered by emotions and feelings, which are essential aspects of learning (Staus and Falk, 2017, as cited in Perry et al., 2017). Therefore, technologies with which the audiences interact actively are used in museums for education, entertainment, advertising, and increasing the interest of the audiences. These interactive technological applications can be grouped as virtual museums, virtual reality, augmented reality, mixed reality, artificial intelligence, kiosks, projection mapping, QR codes, 3D modeling, mobile apps, and digital platforms.

### 2.2.1 Virtual Museums

Virtual Museums have been used in various meanings due to the different contexts of virtuality. One of the first virtual museum concepts was *Museum without Walls,* created by André Malraux (Figure 2.2.2). He stated that it is possible to create an imaginary museum with a collection of photographic representations of artworks when it would not be possible to create them with originals. Even though this is different from today's idea of virtual web museums, reproducing art and collecting it in one space could be an initial idea for virtual museums (Malraux, 1947 cited in Allan, 2020).

**Figure 2.2.2** Andre Malraux, "Museum without Walls", 1947. **Source:** Neatlyart, 2013

Some "virtual museums" are more like libraries or archives than museums, such as the *WebExhibits* website explained in the first chapter. Sometimes, a virtual museum would be a digital representation of a physical place or a virtualised, imaginary place that does not exist (Perry et al., 2017). The official explanation of virtual museums is collections kept digitally consisting of sound and text documents, artefacts, objects, and artwork images historically, culturally, or scientifically important and inherited (Britannica, 2017). As in the concept of virtuality, the concept of a virtual museum does not have patterns and certain meaning limits. There are various virtual museum technologies, application examples, and purposes of use. The emergence of virtualisation coincides with

digitalisation going beyond museum buildings. Subsequently, virtualisation has started to be used in different meanings. Many other words may be counted as synonyms, such as digital, potential, illusory, theoretical, immaterial, cybernetic, and hypothetical (Bianchini, 2019). Virtual museums have less persistence and institutional impact than physical ones because they do not contain natural objects and are simply digital representations of real museums. According to Pietroni et al. (2018) "virtual museums are designed to complement, enhance, or augment the ordinary museum experience through contextualisation, narration, personalisation, interactivity, and richness of content."

While interactivity is used to improve the visitor experience in museums, sometimes it is not possible in digital museums due to the lack of tangible aspects. The feeling of "being there" is attempted to be conveyed to visitors through features such as viewing artworks from various angles and being able to move around the environment virtually. While visitors are walking along the corridors of a museum, they can even walk around the specific artworks if they want to (Sundar, 2008, as cited in Sundar, 2015). For example, the *Petite Galerie* in the Louvre Museum has a virtual space on its website, and it is possible to walk around the gallery, see the artworks, and read the information about them (The Louvre Museum, n.d.).


**Figure 2.2.3** Petite Galerie by the Louvre Digital Museum **Source:** The Louvre Museum, n.d.

This type of exhibition allows visitors to engage with the artwork more, view the artwork in high resolution by zooming in, and read the information. Both for plastic artworks and paintings, it is possible to see the 3D details, such as the curves of a sculpture or thick layers of paint, which can be lost in 2D images. In addition, in the provided digital information, it is possible to give additional links related to the artist or the artwork, such as videos, webpages, or other relevant artwork. The problem is that the user may lose control of this medium. Environmental perception can be lost in a virtual environment, even in a well-designed one, where the only thing that matters is the artwork (Parry, 2013). Therefore, it may be necessary to use extra guidance to arouse the visitor's interest. Another weakness of this virtual platform is that the visitors can quickly lose interest since it is disconnected from real-time and space. Although increasing computational activities, creating graphics cards, and modelling languages such as VRML (Virtual Reality Modeling Language) have enabled high-quality virtual museums, a thought emerged that a successful virtual museum should look like a real museum. Due to the pleasure of imitating and approaching reality, designers and creators have also started to create virtual museums very similar to physical ones. Additionally, the idea of touching on reality was also essential to create something influential and something like an artwork when designing virtual museums (Bianchini, 2019).

Lastly, other than the websites of official museums and digital platforms that collect artworks, such as Google Arts and Culture, there are entirely digital museums with no physical presence. These museums are virtual and are called "web-only museums," which are essential to global circulation and availability of the museums. For example, VOMA (Virtual Online Museum of Art), created by Stuart Sempre (2021), is an entirely virtual space that displays various exhibitions. The main statement of the museum is that VOMA is nowhere, so it is everywhere, and art can cross geographical borders (Cavaliere, 2020). People can visit this museum worldwide, examine the digital artworks on display and get information.


**Figure 2.2.4** The Entrance of VOMA Virtual Online Museum of Art. **Source:** VOMA, 2021

### 2.2.2 Virtual Reality (VR)

The starting point of this concept is the phrase "virtual" which refers to things created by computer technology and appear to exist but do not exist in the physical world (Cambridge, n.d.). In addition to that, the phrase "virtual reality" was created by Antoine Artaud, a French dramatist. He first used the term for theatre and identified it as "la réalité virtuelle" (Bianchini, 2019). However, as information technology changed, definitions also changed. According to the Cambridge Dictionary, the primary meaning of virtual reality is a set of images and sounds produced by a computer, which create a place or a situation in which a person can participate. In other words, virtual means creating things on a computer that are not real, yet an oxymoron is intrinsically created when it is used as "virtual reality". The concept of "virtual reality," which has its complexities, leads to various experiences and applications combined with the museum concept.

Research by some scholars and cultural tourism organisations has demonstrated the influence of VR and AR technologies on tourists. In 2015, research (Jung, tom

Dieck et al., 2016) was conducted on 163 visitors to the Geevor Tin Mine Museum in Cornwall to see the effects of VR and AR technologies on museum visitors. Consequently, they realised that these technologies have a significant effect on the visitors of the Geevor Tin Mine Museum to revisit the museum.

The transformed visitor experience of the Mona Lisa painting is one example of how these technologies can enhance the museum visit experience. Mona Lisa, the most famous and most visited artwork in the world with 10 million visits per year, is tiny in size, with only dimensions of 77x53cm (Google Arts & Culture, n.d.). Therefore, due to the vast number of people and the painting's dimensions, an average visitor cannot take their time enjoying the painting for so long. Only a limited time of a mere 30-second is given to each visitor to stay in front of the painting (Hillier, 2021). The Louvre Museum collaborated with the Emissive company to enhance the visitor experience with the Mona Lisa painting. Collaborating on developing VR and AR technologies, a 3D virtual reality tour experience of the Louvre Museum was created in October 2019. The project was called *Beyond the Glass*, and it helps people look closely at The Mona Lisa, see its delicate details, and discover the history of the painting. The company created a 3D virtual model of the Mona Lisa as a real person who moves realistically and interacts with the visitors. They also created a real-like background. It took a lot of research and effort to uncover these small details (Manalac, 2020). According to the developing tech company, this VR experience is also a way to create a solid emotional connection with the character of Mona Lisa (Manalac, 2020).

**Figure 2.2.5** The Louvre Re-created the Mona Lisa in 3D. **Source:** Nelson, 2019

### 2.2.3 Augmented Reality (AR)

Augmented reality is the reflection of a digital image, sound, or other sensory stimuli in a physical environment (Hayes, 2020). This technology requires virtual components, real-time interaction, and a physical space (Azuma, 1997). Augmented reality images, which are 3D models of objects, can be created through commonly used devices like smartphones, digital tablets, and headsets. For example, Tate Britain Museum collaborated with Facebook in 2019 and displayed some artworks in motion through augmented reality technology (Figure 2.2.6). The software gets activated when the visitors show the artwork to the Instagram camera. Moreover, following a welcome message, the application directs visitors to the other AR-

enhanced artworks, thus promoting an interest in art. This technology increases the interaction between the artworks and the visitors (Karayilanoğlu and Arabacioğlu, 2020).

**Figure 2.2.6** Spark Augmented Reality Experience at Tate Museum. **Source:** Ochanji, 2019

Latvian National Museum of Art has created an exhibition full of famous paintings in QR codes, and visitors can see these paintings through tablets or their own mobile devices by scanning them. While it could be impossible to hold an exhibition of all these famous works in the physical world, it has become possible to bring all these works together with the visitors in a single hall with a low budget (Klavins, 2022).

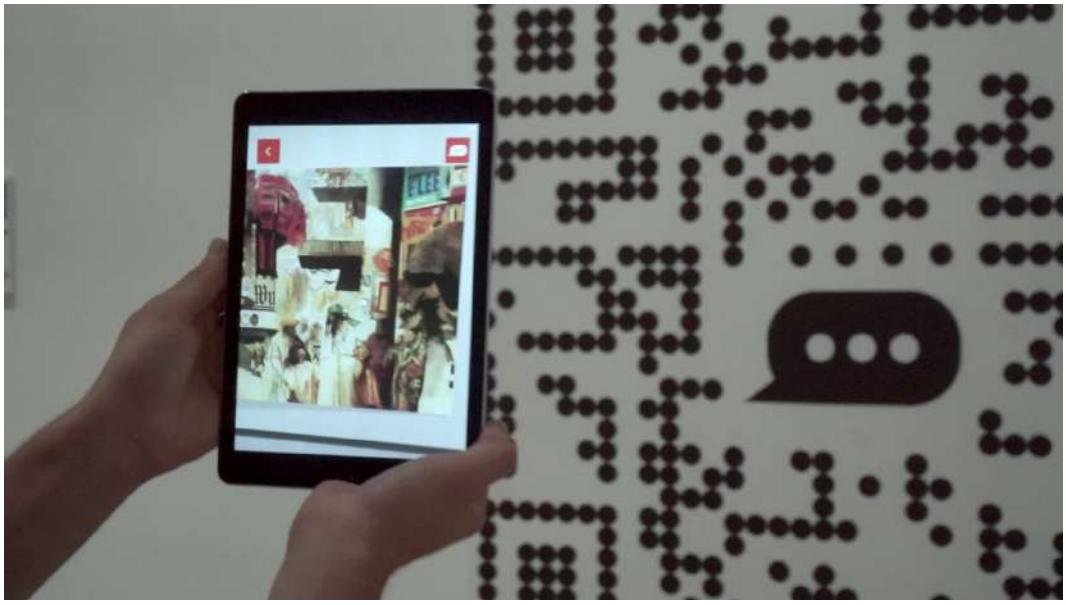


**Figure 2.2.7** Augmented Reality Museum Exhibition in Latvian National Museum of Art.
**Source:** Overlyapp, 2017

### 2.2.4 Mixed Reality (MX)

Mixed reality (MR) technology combines VR and AR technology. The term was first introduced in a study by Paul Milgram and Fumio Kishino in 1994. This technology combines high-fidelity holographic 3D models, people, virtual objects, and real-world environments (Milgram and Kishino, 1994). Mixed technologies are used in many fields today, such as health, entertainment, and engineering. There are some usage examples in museums. For example, Kennin-ji, the oldest Zen temple in Kyoto, used this technology in 2018. This museum was established within the context of the "Hakuhodo-VRAR" project in Japan (Figure 2.2.8). With this technology, visitors can experience traditional Japanese artworks displayed in motion and the guidance of a holographic version of a Kennin-ji monk, Shundo Asano (Karayilanoğlu, and Arabacioğlu, 2020).

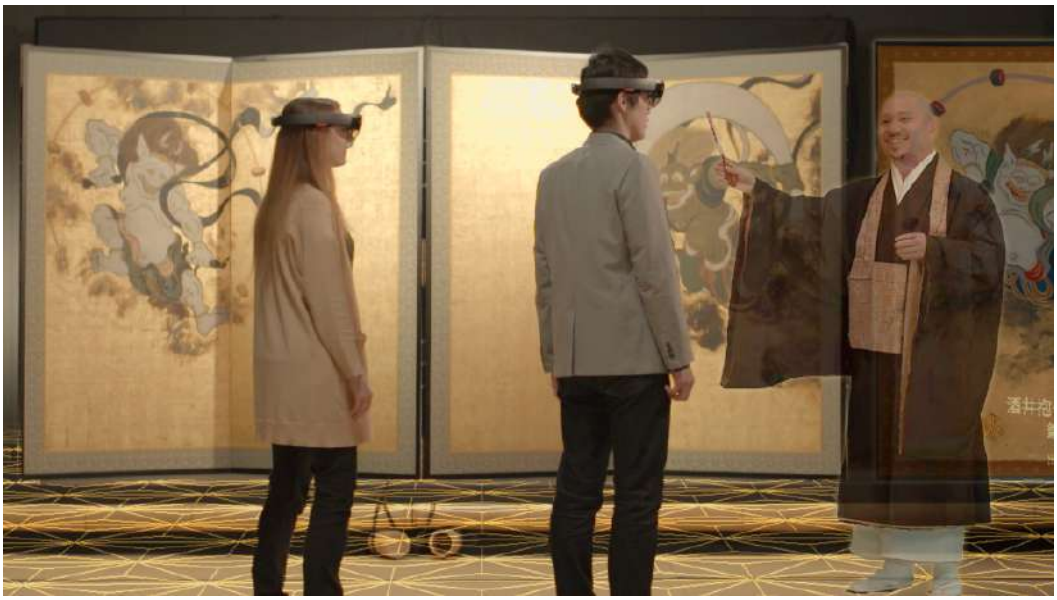


**Figure 2.2.8** A Mixed Reality Experience at Japan's Oldest Zen Temple, Kennin-ji.
**Source:** Hansen, 2018

### 2.2.5 Artificial Intelligence (AI)

Artificial intelligence (AI) is a technology that allows machines to replicate human brains. Intelligent assistants in homes, chatbots in websites or apps, and self-driving cars are created with artificial intelligence technology. There are some subsets of this technology. For example, machine learning means a system can learn without coding programs. The system learns with statistics, data, and trial and error methods (Velazques, 2022). The other subset is deep learning. The technology gives machines the intelligent filtration system of human intelligence, so text, sound, and images can be classified (Bonner, 2019). The term was first used by MIT cognitive scientist Marvin Minsky and other scholars at the Dartmouth Conference in 1956 (Lewis, 2014). Artificial intelligence is used in many fields, such as finance, automotive, and health, and many large companies, such as Amazon and IBM, invest in this field (Calcea, 2021). AI has various practices in museums, such as

answering visitors' questions in chatbots, collecting and analysing visitor data, and increasing interactivity to enhance the visitor experience. For example, the Musee du quai Branly in Paris created a robotic art critic, Berenson, in 2016 (Figure 2.2.9). Berenson is an example of artificial intelligence, walking through the galleries in a hat, a long black jacket, and a scarf. Anthropologists created Berenson to watch visitors, get their reactions, and by recording them to create its art taste. According to the recorded data, it can also give positive or negative reactions in front of artworks (Richardson, 2021). It was a machine learning example. With this system, museums could generate information about the tastes and choices of their visitors while also creating a database about them. Therefore, they can then design future exhibitions accordingly.

**Figure 2.2.9** Robotic Art Critic Berenson in Musee du quai Branly. **Source:** Insider, 2016

### 2.2.6 Touch Screens and Kiosks

Kiosks are interactive, stand-alone machines commonly used in high-traffic areas in various fields and functions, such as healthcare, education, guidance, entertainment, self-ticketing, and accessibility. Similarly, touch screens are display devices containing images, text, and videos that users can interact with using their fingers or a stylus. Museums benefited from these devices to collect data about visitors' manners and create a more interactive experience for them. Touch screens and kiosks also enhance accessibility for disabled people in museums.

For example, the Cleveland Museum of Art created a space blending technology, art, and interaction to attract visitor's attention to the museum's permanent collections. This exhibition area, called Gallery One, had a giant multitouch MicroTile screen in the United States. It displayed over 4,100 images and 23 million pixels (Figure 2.2.10). Users can zoom in and out and manipulate the thumbnails, read the descriptions of the artworks, and play interactive games. While visitors saw the artworks from the museum's collection, including masterpieces by Pablo Picasso, Auguste Rodin, Viktor Schreckengost, they also had the opportunity to see a few fragile artworks which are normally kept in storage (Alexander et al., 2013).


**Figure 2.2.10** Gallery One in Cleveland Museum of Art. **Source:** Smithsonianmag, 2018

In 2019, Dalí Museum in St. Petersburg had an installation called “Dali Lives”, for Dali’s 115th birthday. This installment consists of a screen and an interactive artificial intelligence production video. Visitors could talk with Dalí to learn from him about himself; they could even take a selfie with him. The museum administration has been working with an advertising agency to create this installation. They used many videos, photos, quotes, and interviews with him to realistically capture his motions and gestures (Salvador Dalí Museum, 2020) (Figure 2.2.11). Ethically and legally, people’s or their heirs’ permission should be taken as this type of deepfake video could be easily abused. In this case, permission has been taken from The Dalí Foundation in Spain because Dalí has no family members (Lee, 2019). Although ethical aspects of digitalisation technologies used in museums are beyond the scope of this paper, it is important to note their increasing relevance for the upcoming decades.

**Figure 2.2.11** "Dali Lives" kiosk in the Dalí Museum. **Source:** Lee, 2019

### 2.2.7 Interactive Projection Mapping

As mentioned before, projection mapping is a video projection method in which a scene is reflected onto a surface, such as a wall, an object, a building, or even water. It can be turned into an interactive activity through sensors and receivers. For example, Cayton Children's Museum created a gesture-based exhibition in 2019 (Figure 2.2.12). In a tree-sided room, 2D hand-drawn videos are reflected on the walls through projection mapping. The exhibition consisted of touchless interactions and aimed to teach children about nature. Inside the room, a unique technology, Orbbec Astra motion-sensing devices, was used, which senses fast motions, loud noises, gross movements, and activities rather than full-body gestures (AMT Lab).

**Figure 2.2.12** In Tune with Nature in Cayton Children's Museum. **Source:** Ideum, 2018

### 2.2.8 Qr Codes

QR codes are machine-readable 2D barcodes that carry a URL or extended information or contents. Users can quickly scan the code with their smartphones and access the content. This technology is used in billboards, banners, and advertisements, sometimes even instead of them. Some companies use basic QR codes to attract their customers' attention and direct them to digital content rather than spend money on expensive advertisements. Especially after the COVID-19 pandemic, restaurants started to use QR code menus to provide a more hygienic environment.

Museums also use this technology for mapping, providing information about the artwork or the artists, giving extra information about the objects on view, offering related videos or news, collecting feedback from visitors, making quizzes or surveys, and directing visitors to the social media channels of the museum (Ciecko, 2021). It is easy to give content in many languages; museum administration can

track the scanning statistics; data can be updated and changed; and QR codes are easy to create and cheap (Hegde, 2022).

### 2.2.9 3D Modeling and Printing

3D models are three-dimensional digital products formed by combining and manipulating lines and points drawn in computer environments and can be printed by 3D printers. 3D modeling and printing technology are used in architecture, product design, healthcare, the game sector, and more. Museums use 3D modeling and printing technology for digital archiving, restoration, and educational activities. Developed 3D modeling methods make it easier to create 3D models of objects by special photographing techniques than by drawing them in a digital environment. For example, the 123D Catch program turns pictures taken from all sides of the object into 3D models (Undeen, 2013).

An example of its use in education is the project that the Victoria and Albert Museum designed in collaboration with Great Ormond Street Hospital for Children in 2018. They sent the 3D scans of some of the sculptures with a digital tablet to the children in the hospital waiting for bone marrow transplants. Children could manipulate the 3D models and create their designs. Then, these designs were 3D printed, and children could touch and feel their designs. It stimulated their imaginations while teaching them about cultural objects (Richardson, 2021).

Museum websites also consist of digital archives, restored artworks, and artworks that cannot be physically displayed due to their fragility. Virtual reality or the reproduction of an artwork can be used as an external tool for restoration implementation. Executing restoration in a virtual environment on damaged areas of the artwork ensures seeing the result of the restoration without having an actual effect on the real artefact (Gruen, 2003). It is used to reconstruct historical environments or artefacts destroyed or damaged before, thus protecting and preserving them in a digital environment (Leyoy et al., 1999). This could allow people to recreate an artefact or a historical place that they may not be able to see at all. For example, Morehshin Allahyari has a project aimed at recreating 12 selected statues from Hatra and Assyrian artefacts that ISIS destroyed in 2015. She designed the 3D versions of the artefacts and printed them for an exhibition, *Material Speculation* (Allahyari, 2016). Then, she published a file full of her research, images of the statues in high resolution, and 3D models of the artefacts for printing. Allahyari claims that she was not only reconstructing the artefact but also reviving its history and the lost information about it (Quackenbush, 2016). This project also provided archival documentation and helped spread the data about artefacts.

**Figure 2.2.13** Hatra King Uthal Statue. (Left) **Source:** Jones, 2015

**Figure 2.2.14** Material Speculation Project–- King Uthale. (Right) **Source:** Allahyari, 2015

As in the Allahyari example, 3D modeling techniques help archive artworks. The museums can digitalise their entire collections. These digital archives also have many benefits within the museum. Through digital archives, local and isolated museums have the opportunity to reach and share their collections with more people from all around the world. Many museums, such as the British Museum and the Cleveland Museum of Art, have digitally created 3D (Figure 2.2.15) versions of the artworks from their collections, making them available on sites such as SketchFab (The British Museum 2014). By using these sites, visitors can view the artefact or the artwork closely in 3D and get information about the specific parts.

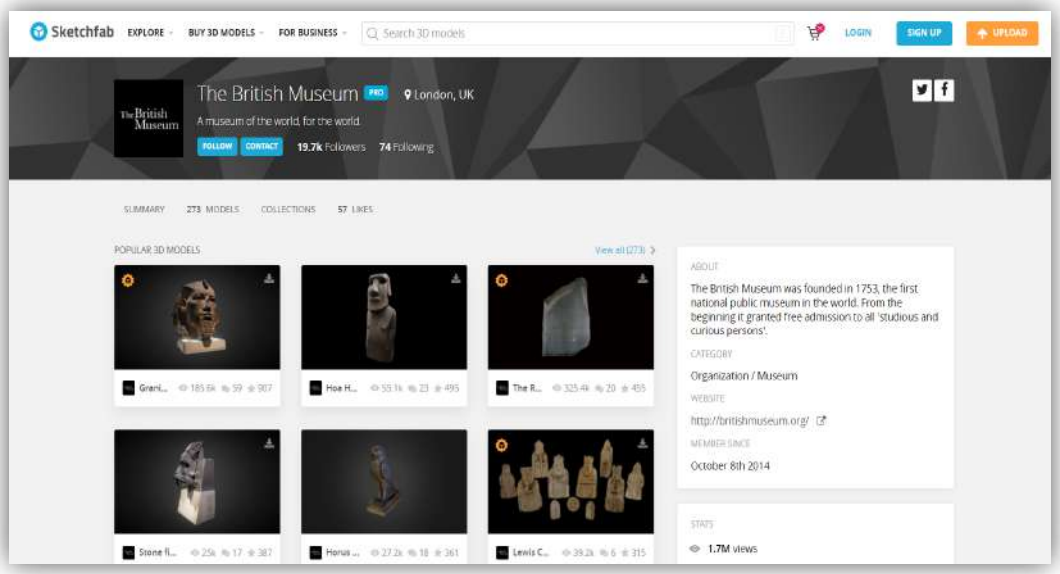



**Figure 2.2.15** The British Museum page. **Source:** SketchFab, 2019

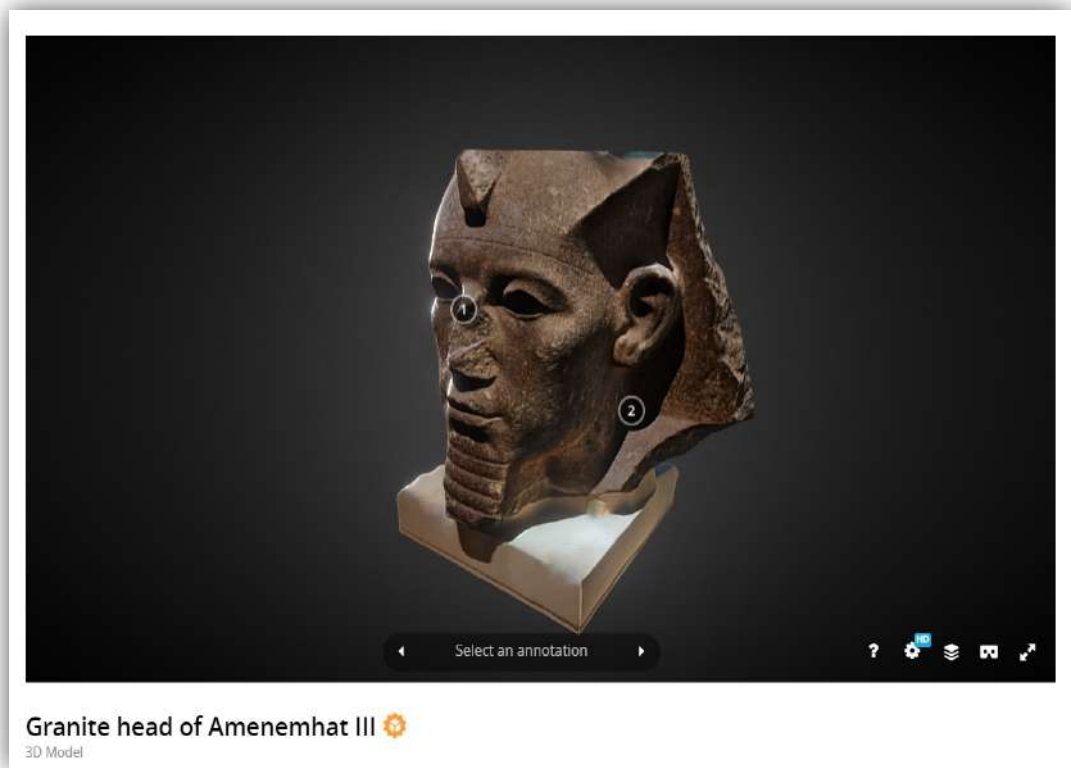



**Figure 2.2.16** 3D model of Granite Head of Amenemhat III. **Source:** SketchFab, 2019

### 2.2.10 Mobile Applications

Mobile phones are the world's most famous technological devices (Tsirulnik, 2017). Through these technological devices, people have started to meet many daily needs, such as communicating, acquiring information, online shopping, and getting directions. Mobile devices have also become more common in museums' visitor communication strategies. For example, many of the leading museums, like The Metropolitan Museum of Art (MetMuseum, n.d.), The Guggenheim Museum (Guggenheim, n.d.), and The J. Paul Getty Museum (J. Paul Getty Museum, n.d.) have their apps. Also, due to the increased availability of mobile phones, visitors can access these applications whenever and wherever they want. They can buy their tickets for an exhibition through the museum's apps or get information about a

special exhibition in a museum. Mobile apps influence the visitor experience and the before and after periods.

According to research conducted in 2011, seventy-one museum mobile apps were identified worldwide, and about sixty of these apps were developed in 2010. The primary function of these applications was to provide guided tours of the museums' permanent exhibitions. The majority of these apps, twenty-seven out of seventy-one, were produced in the USA (Economou, Meintani, 2011).

In addition to getting practical information such as museum addresses or opening and closing times, museum applications are used for different interaction purposes. These purposes can be divided into three categories. The first category is learning apps that provide information and an interactive learning environment. The second category is game apps, which contain interactive elements to enhance the entertainment value of the experience. The last one is guiding apps, which can be alternatives to traditional guided tours.

#### 2.2.10.1 Learning Apps

Museums have a significant role in lifelong learning for children and grown-ups. As mentioned, most digital applications aim to enhance the learning process through interaction (Hawkey, 2007). Therefore, some mobile applications have also been designed for this purpose.

For example, *Ask BKM* app used in The Brooklyn Museum encourages visitors to ask questions. Contrary to popular belief, the questions asked through this app are answered by real scholars. These scholars specialised in relevant fields such as art history, archaeology, anthropology, architecture, or library science and are ready for all kinds of questions in their field of specialisation. Visitors may inquire about the artwork in the museum, discuss other art topics, and share their observations.

The museum staff discovered that this app makes people feel more comfortable asking questions digitally, increases their awareness of the artworks, and improves visitors' experience inside the museum. The best thing about the app is that the conversations have no time limit. Sara Devine, the manager of the visitor engagement department at the Brooklyn Museum, states that she witnessed a five-hour conversation, which was the longest one, yet an average conversation consisting of 13 messages (Rodney, 2016). With this application, visitors can quickly access information about points of interest by asking what they are curious about the unique artwork. Through this interactive experience, the visitors acquire more detailed information about the artwork, remember them better, and simultaneously experience a more enjoyable museum visit.

The digital mobile applications at the museums also provide visitors with the opportunity to see works of art of high quality. For example, the Uffizi Museum App and the Vatican App could provide high-quality images to view artworks in detail (Economou, Meintani, 2011). Through these apps, users can zoom in on little details, such as every brushstroke of the artwork. Similarly, *Smartify App* is another example that contains high-resolution images where visitors can quickly scan an artwork onsite in a museum area through the app to learn more (Hu, 2020). They can read about the artwork and create digital art collections with their favorite pieces. These app services would also benefit visually impaired visitors with audio descriptions to access information about the artworks through their mobile devices (Smartify, n.d.).

#### 2.2.10.2 Game Apps

Gamification is another one of the most used methods in museum applications. This method, used primarily in educational activities for children, can also be used in different ways to improve the museum experience for adults. An interactive game application called *Gallery Tag* at The Brooklyn Museum aims to engage visitors

with artworks more by satisfying their entertainment needs. This app encourages visitors to move around the gallery and find artwork matching the tags to gain points and rewards. There are also some additional motivations to keep the app more attractive. For instance, visitors can get extra points when they visit, find, and tag artwork on different floors. They can access the Brooklyn Museum's website via the app's links, and all of the tags connect to the online collection, creating a link between the physical and virtual worlds (Bernstain, n.d.). While visitors are motivated to see more pieces in the gallery, the application also feeds the visitor's need for appreciation. According to research on rewarding game systems, reward mechanisms promote intrinsically enjoyable experiences, which are as significant as or more critical than distributed extrinsic rewards (Wang and Sun, 2012).

Some apps aim to interact and socialise with other visitors while learning and playing games. While the *Gallery Tag* app allows visitors to play games alone, the *Tate Trumps* (Tate Modern) app allows people to play against each other in the gallery (Figure 2.2.17). This app has three modes: Collector, Mood, and Battles. These modes require visitors to specify the artworks and be active participants in shaping their experience. In the *Battle mode*, they must imagine which artworks may attack each other; in the *Collector mode*, they must locate the artworks and create their collection; and in the *Mood mode*, visitors must decide which artworks best convey their emotions. After making a list of each mode, they can start a competitive card game with other participants based on their decisions, they discover who found the best example from the collection (MoMA, 2010). It encourages people to engage in conversation and increases their social contact and interactions. According to the V-must report (Mohamed, Pescarin, 2013), these kinds of museum applications are in the edutainment group. Gamification helps to convey information, trigger, and foster learning. The actual meaning of "edutainment" comes from engaging learners' emotions through visual stimuli such as brightly coloured animations to attract and maintain their attention (Mohamed, Pescarin, 2013).


**Figure 2.2.17** Tate Modern's Trumps App – A Digital Cards Game. **Source:** Economou, 2011

Another objective of museums and art platforms is to increase the intimacy between the artwork and the visitor. There are some museum apps like *In Still Life* or platforms like Google Arts and Culture that can help to enhance this intimacy. For example, *In Still-Life 2001-2010* Digital Experience that users can reach through the app of the Los Angeles Museum of Country Art users could recreate a painting from the 17th century by selecting the parts of the artwork and positioning the elements on the painting according to their desire (Figure 2.2.18). This experience, designed by contemporary artist John Baldessari facilitated interactivity and heightened their communication with the artwork (Economou, Meintani, 2011). It can be argued that this interactive game makes users feel more intimate with the artwork and promotes an IKEA effect (Norton, Mochon, Ariely, 2011). When people build IKEA products in their homes themselves, the value they give the product goes up. They feel involved in the process, and this phenomenon is called the "IKEA effect" (Norton, Mochon, Ariely, 2011). Similarly, when visitors

recreate the artwork, they can feel more intimate with the artist and become active in the creation process.

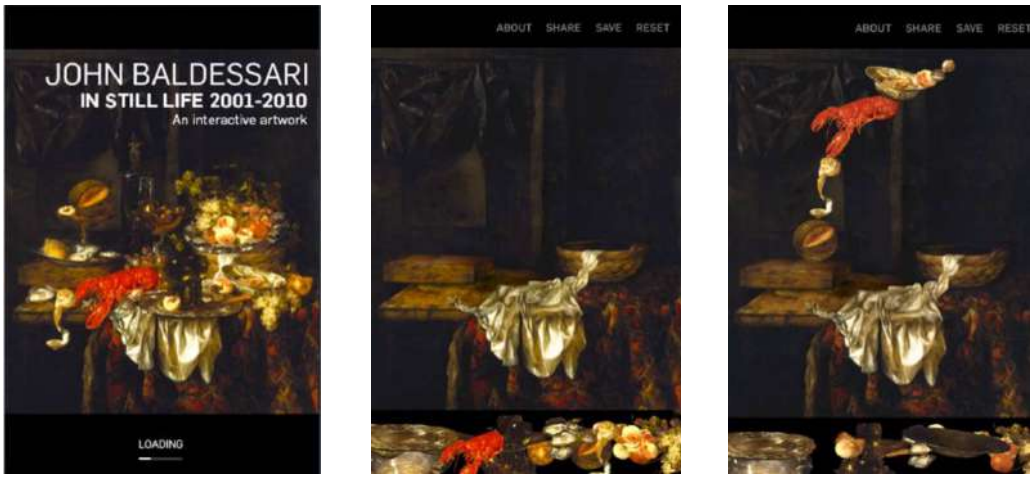



**Figure 2.2.18** LACMA's App John Baldessari: In Still-Life 2001-2010. **Source:** Economou, 2011

### 2.2.10.3 Guiding Apps

As an alternative to the traditional guided tours offered by docents, mobile guides have a significant role in museums for learning. These technologies offer a customisable museum visit and provide an option to select the information the visitor needs or prefers to learn. There are various forms of mobile guides, ranging from traditional guide devices, which only provide audio narration, to digital applications downloaded to smartphones or tablets, which include visuals and videos in addition to the audio content. Most of these technologies have language selections and specialised presentations for disabled people (Proctor, 2011, Tallon and Walker, 2008, as cited in Eghbal-Azar et al., 2016). Several studies show that such practices cause visitors to spend more time in the exhibition using these mobile apps because they can engage with the artwork more thoroughly (Kuflik et al., 2011, Lanir et al., 2013 as cited in Eghbal-Azar et al., 2016).

Especially after the COVID-19 pandemic, since visitors mostly prefer to use their own devices in museums for sanitary reasons, the number of people who use audio devices has decreased. According to a report on museum audio guides by the MuseumMate company that provides audio tours to museums, COVID-19 changed the museums' audio guide offerings. The company is attempting to adapt to the "new normal" (Richardson, 2020). *EasyGuide*, created by MuseumMate, allows museum visitors to access the audio guide content from their mobile devices. Visitors can download the digital application when buying their tickets; then, with the help of the related QR code, they can access the exhibition content. Museums call this BYOD (bring your own device) approach (Charr, 2021). Even before the COVID-19 pandemic, digital tours operating on mobile phones were already getting popular. In 2017, the North Carolina Museum of Art (NCMA) launched an app for visitors to join some themed tours. These tours are self-guided and free. There were three themes from which every visitor could select. These are Curator's Choice, Lunch Break, and Date Night. By selecting Curator's Choice, visitors can listen to audio guidance consisting of NCMA's curators' top picks; with Lunch Break, they can have information about art and food from around the world; or listen to the audio guidance full of romance and love. The museum administration thought this would encourage visitors to look closely at the artworks, spend more time and go around slowly; it would turn the tour into a more intimate and inspirational personal experience (Ciecko, 2018). These applications could be external methods to deepen the whole experience. However, in this era when phones are taking over our lives, phone guidance may be distracting to the visitor. Becoming the protagonists of the museum experience and overshadowing the artworks themselves. Thus, there is still scepticism about using phones instead of museum devices (Economou, Meintani, 2011).

### 2.2.11 Digital Platforms

There are various digital platform types, such as museums' websites, which include virtual museums, digital archives, online stores, blogs, games, and news about the exhibitions in the museum; art platforms that are not directly related to museums but contain various visuals of artwork and information about them; the last ones are social platforms, which are channels where museums can both share content, create a social community, and maintain their digital marketing campaigns.

Schweibenz (2004), on the other hand, categorises digital museums under four headings. The first one is the "brochure museum". These types of digital museums are platforms that contain practical information about the museum, such as contact details, opening and closing times, and types of collections. These types of websites aim to provide information to potential visitors. The second kind of virtual museum is the "content museum". These aim to attract the audience to visit and explore online content. Content museums are object-centred and academically enhanced. These offer more specialised information, not necessarily aimed at ordinary visitors. The third type of digital museum is a "learning museum". These digital museums focus on creating customised content for their online visitors according to their background, age, and education level. However, the aim is to overview the content rather than the object. The primary purpose is to attract online visitors and persuade them to visit the museum. The last type is "virtual museums". These types of museums are beyond learning museums. Instead of containing information about the collections and the artworks in the museum, websites provide external links and data, thus creating a more comprehensive network (Schweibenz, 2004, as cited in Kızılhan, 2017).

#### 2.2.11.1 Museum Websites

Websites are a set of web pages that consist of related content such as images, videos, texts, and related links that share one domain name. Individuals, companies, businesses, and organisations create websites for education, informing, guiding, entertainment, and commercial purposes (Technopedia, 2020). Like many institutions, museums use their websites as education, content sharing, essential information, and news sharing platforms. Visitors can access the most specific information through websites; for example, they can see the opening and closing hours or the exhibition plan. Over time, features such as purchasing tickets in advance and shopping at the museum shores were added.

With the visitor-centred perspective, visitors' experiences started to come to the fore more than ever. Nowadays, it is easy to find information about a museum before the actual visit regarding the museum's history, collection content, or photos of the exhibitions. Thus, in the technology and information era that we live in, it is more challenging than ever to impress a visitor who can access all the details online (Hooper-Greenhill, 2012). Undoubtedly, one of the reasons visitors have so much information about museums without even going there is their ability to access the museums' websites. In time, these websites have turned from platforms that give general information about exhibitions and events into places enhanced virtually to appreciate the artworks (Sundar, Eun, Hyang-Sook and Bo, 2015, as cited in Lee and Lee, 2003). On the other hand, some scholars believe visitors have different reasons when visiting the museum website instead of the physical museum visit. Visitors are mainly motivated to see something they have seen before, learn something new, see the artwork in fine detail, or be surprised (Ciaccheri, 2020). Thus, museum websites, which were there to provide the most basic information initially, changed their functions and became part of the visitors' experiences in their own right. Nowadays, museum websites usually contain virtual museums, blogs about art news and history, museum stores, games, customisable accounts,

digital archives, and digital versions of artworks that have been digitally restored or are too fragile to be displayed.

Websites that are used as informative channels for people contain a blog, news, video, and courses about art, artists, and artefacts. For instance, Museum of Modern Art (MoMA) has a glossary of art techniques, mediums, movements, and other terms (Art Terms, n.d). Museums use gamification on their websites as well as in their mobile applications for active learning and entertainment. Museums tend to have special teams to deal with these works and acquire the required software and design departments to create this additional interactive channel. For example, the Metropolitan Museums of Art in New York is affiliated with Verizon, a communication company, to launch *The Met Unframed Project*. The project was a virtual tour website where visitors could see the digitalised galleries and approximately 50 artworks from the Met's collection, such as five paintings by American artist Jacob Lawrence and artworks created by El Anatsui, Mark Bradford, and Ibrahim El Salahi (Martin, 2021). Visitors could also see the underdrawings of the artworks through the infrared scans to reach the details with a close look and description on this platform. The project also included a game that contains riddles, questions, and a "Zoom and Spot" challenge. It was aimed to create a reconnection between the visitors and the museum, especially in a time of isolation during the pandemic COVID-19.

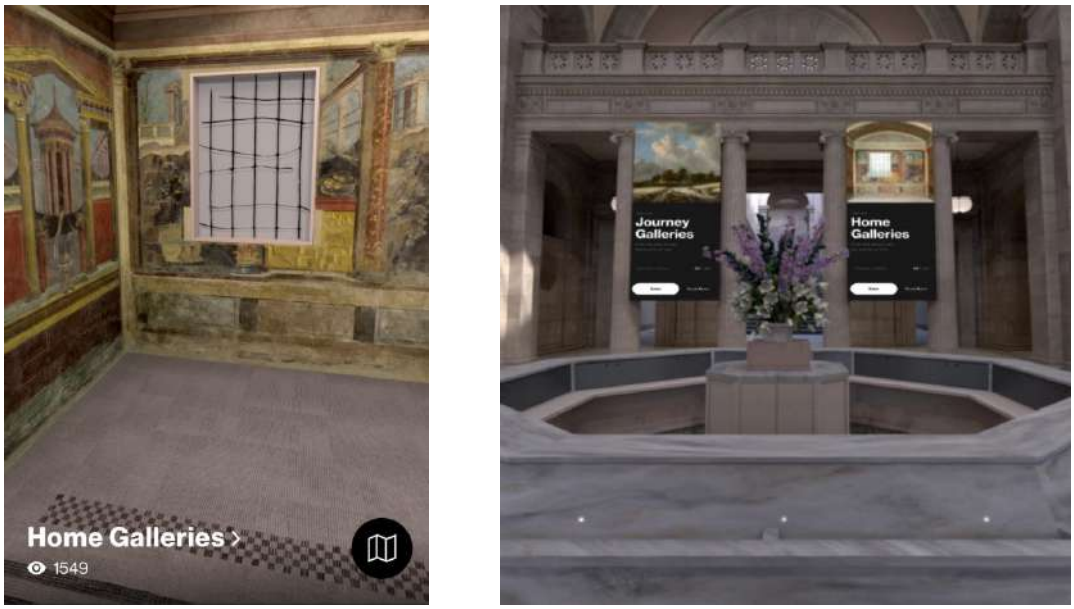



**Figure 2.2.19** Cubiculum from the Villa of P. Fannius Synistor at Boscoreale in "The Met Unframed." (Right) **Source:** Davis, 2021

**Figure 2.2.20** Screenshot of the Metropolitan Museum's Simulated Great Hall in the "Met Unframed." (Left) **Source:** Davis, 2021

Another example of active learning and gamification could be the Museum of the World by the British Museum and Google Cultural Institute (Figure 2.2.21). This website provides the visitor with an interactive digital experience while giving information about the artefacts and artworks from the history between AD 2000 to 2,000,000 BC. In addition, this experience is supported by some sound and color elements in the categorisation part (Museum of the World, n.d.).

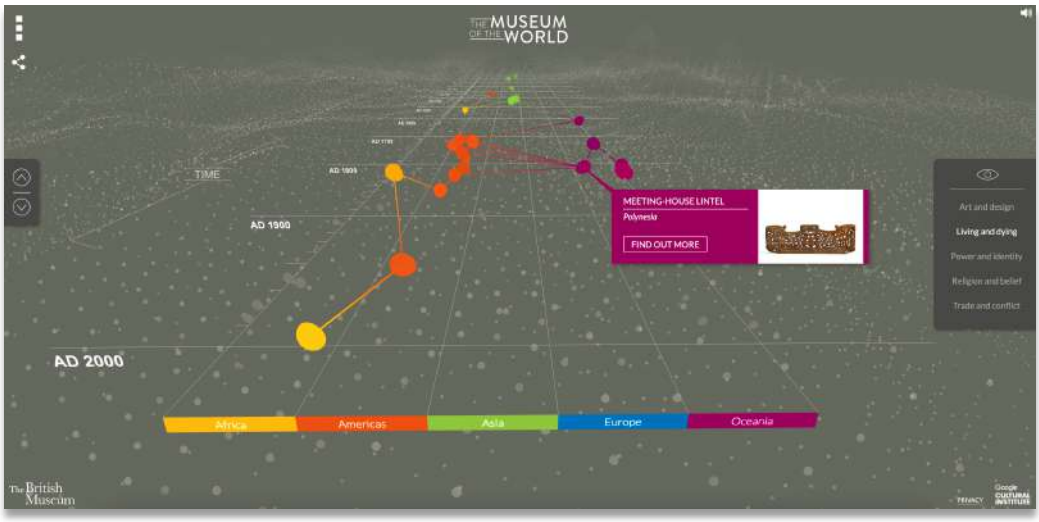



**Figure 2.2.21** The Museum of the World. **Source:** The British Museum & Google Cultural Institute, n.d.

Unlike physical experiences, digital experiences can be presented to the visitor as customised experiences, or visitors can actively shape this experience according to their preferences. Digital environments are much more convenient places to do this quickly and affordably. For this reason, some museums allow visitors to create their accounts on the museum's website. This way, visitors can customise their use of the website according to their interests and have a more satisfying experience. At the same time, museums may collect demographic data about their visitors. For example, the Carrara Marble Museum has grouped its visitors as tourists, art students, and experts. Thus, they can provide the right information and content based on the visitor's expectations per segment. Also, visitors not in one of these groups can create another personalised profile to receive their preferred data (Fantoni, 2003, as cited in Liarokapis, Sylaiou, 2010). As Skov and Ingwersen (2014) emphasised: "understanding online museum visitor behaviour is critical to the development of relevant and useful museum websites." Some museums started to do some research about their online users after adopting a visitor-centred approach. One of the research results is that more than 50% of museum visitors look at only one or two pages before leaving the website; they stay for less than ten seconds. For example, a research team at National Museums Liverpool (NML)

determined the categorisation of website visitors as the general public, non-professionals, students, teachers, academics, and others; while at the same time including the purpose of visit to their analysis, such as museum overview, collection overview, shop visiting, and pre-visit (Walsh, Hall, Clough, Foster, 2018). In addition, another survey mentioned that one of the most common reasons people visit museums' websites is to plan an upcoming visit to the physical museum (Marty, 2007). Similarly, in the discussion part of the survey on National Museums Liverpool, it is mentioned that the findings could be used to shape and design information services and systems. In other words, interfaces can be adapted based on visitors' activities during a website visit. After recognising the visitor's segment, the content key can be arranged according to the convenient preferences for that segment. For more specific characterisation of the users, improved machine learning models can also be used. After the classification, guidelines and user-friendly interfaces may be created by museums for this purpose. This detailed information about the website users can be used to develop a marketing strategy and improve further (Walsh, Hall, Clough, and Foster, 2018).

Some museum websites also consist of digital archives. In addition to archiving, digitalisation of artworks and artefacts enables museums to display some fragile and rare hidden pieces from their collections that are stored in their storehouses. In other words, digital archives also allow visitors to see parts of the museum's collections that will most likely never be displayed. Another important aspect is that, due to the vast number of pieces in their collections, most museums can display fewer than they own. For example, the British Museum collection includes approximately 8 million objects, but just 80,000 objects are on display in the museum. Thus, only 1% of the collection is displayed simultaneously. Moreover, it is not only related to the number of items in museums' collections but also to the museum's conditions and amenities. For example, many objects are unsuitable for display in the museum because of their high light sensibility (British Museum collection (Rep.), 2019). For every little piece, museum staff should carefully pay attention to maintenance and security. Elliot Bostwick Davis, the former director of

Norton Museum of Art, states that most museums only show between 2 to 4 percent of a collection, and an increase in budgets would be required to create extra spaces for all artwork to be put on display (Fabrikant, 2009).

Additionally, archiving, education, games, and virtual tours, websites also create digital marketing advantages for museums. When museum stores can reach a more significant number of visitors from all around the world and continue to sell their products even when the museum is closed, digital ticket sales and reservation systems simultaneously facilitate the activities of visitors and save them from long waiting lines. For example, MOMA has a design store on its website that includes books, furniture, accessories, and technological objects (MoMA, n.d.). Virtual visitors may visit the store online and purchase designed objects with credit cards. It is a massive contribution to museums that earn more income from their stores than ticket sales, such as Bilbao Guggenheim Museum (Bautista, 2013).

#### 2.2.11.2 Art Platforms

Digital art platforms are websites and mobile applications that do not have direct connections with museums. These platforms can be operated indirectly in agreement with the museums or entirely independently from the museums. They create a bridge between artworks and people and also help to create a digital repository for the museums. These platforms can contain information about more than one museum and artwork. The most prominent one of these platforms is Google Arts and Culture (GAC), because it has a significant network of art institutes and contains a large number of artworks.

Google Arts and Culture (GAC) launched in 2011 under the name The Google Art Project and included 17 museums from Europe and the U.S., when it first appeared. At first, it was a digital archiving platform where users could access the rendered artworks with qualified visuals. Then it evolved into a platform that serves multiple

functions, such as displaying various digital exhibitions and artworks or providing interactive art games (Proctor, 2011). Google Arts and Culture platform currently collaborate with more than 2000 cultural institutions from more than 70 countries (Verde and Valero, 2021) (Figure 2.2.22). The platform also includes information about more than 12,000 artists (Google, n.d.). When the platform first came into use, some researchers thought that it could prevent visitors from going to museums. However, the art historian Nicholas Serota claimed that technological development in this field could not prevent the rising tide of museum visitors (Proctor, 2011). Ten years after this claim, museums are still alive despite all technological developments.

**Figure 2.2.22** The Map Shows the Distribution of Collections Owned by Google by Numbers. **Source:** Google, n.d.

One of the biggest platforms in the virtual museum area can be considered GAC by Google, as it allows walking inside the digital museum buildings just like walking around the streets on Google maps (Figure 2.2.23). In addition to that, users can create their art gallery on GAC. Creating a gallery full of their favorite artworks generates a sense of user participation. By doing that, users may reflect their identity on the interface. Moreover, with the help of the share button, which enables users to share their gallery or artwork with the outer world, interaction and interpretation boost among GAC users (Lee and Lee, 2019). In addition, with every action performed on this platform, users earn a new badge. For example, users who take the time to look closely at the artwork can receive the "Art Inspector" badge, while visitors who add the artwork to their collection can be awarded the "Art Collector" badge. While this gamification application gives the users the feeling of achievement, it also elevates their interest in art (Maldre, 2021). GAC also has gigapixel technology, which is "high resolution" for the images. This technology makes it possible to create digital images with more than one billion pixels. Capturing a shot this way takes a couple of hours, but the quality images create a heightened user experience (Tomlin, 2021).

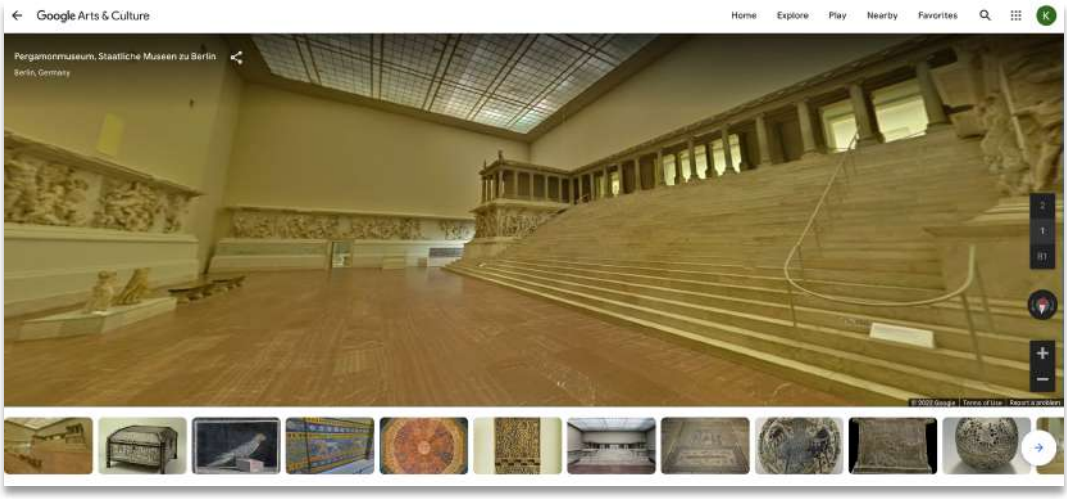



**Figure 2.2.23** Virtual Tour to Bergamonmuseum **Source:** Google Arts and Culture, n.d.

When the project was first created, some museum administrations found collaboration with Google Arts and Culture not quite affordable. However, now

they think reaching out to Google's technology could be more widely accessible. However, as mentioned in the Global Circulation and Availability of Art chapter, some copyright issues have emerged due to accessibility. These issues apply to GAC, as well. Some museums prefer to work with tech companies to find advanced technologies and use high-quality images on their websites or make partial agreements with Google for their websites. According to these partial agreements with the participating museums, Google puts blurry rectangles in place of some artworks. As a result, visitors can only see the artwork the museum has permitted to display (Hylland, 2017).

In addition to the responsive features of GAC for mobile devices, there is also a GAC mobile app with other interactions. These interactive activities aim to enhance intimacy between the visitor and the artwork. This platform allows visitors to view the artworks digitally on their walls through AR, turn their photos into artworks via filters, and create their art collection. In this way, the audiences learn and increase their awareness of art while having fun. Google Arts and Culture is an extensive digital art and culture platform that does not belong to a specific museum. The mobile version has an Art Projector alternative. It lets users see the artworks in their original dimensions in their original museum exhibition context via augmented reality technology. In addition to that, they can zoom in on the artwork to see the most intricate details. The *Art Selfies* feature is one of the app's most recent additions. This feature, which Google introduced with the slogan "come face to face with art," allows people to find figures similar to themselves in the art world after taking a selfie. Then, the user can see the similarity percentage and read detailed information about the artwork (Google, n.d.) (Figure 2.2.24). The *Pocket Gallery* option allows one to see a group of artwork through the screen. This augmented reality addition to the art selection allows users to walk around the virtual artwork and view them on their phone or tablet screen (Anonymous, 2019). In addition, the *Art Transfer* option in the Google Arts and Culture App can transform photos with photo filters inspired by various artists.

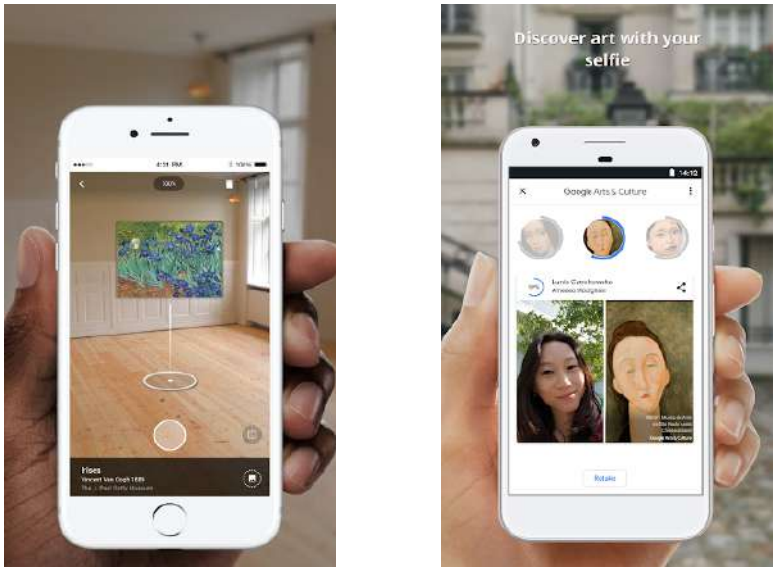
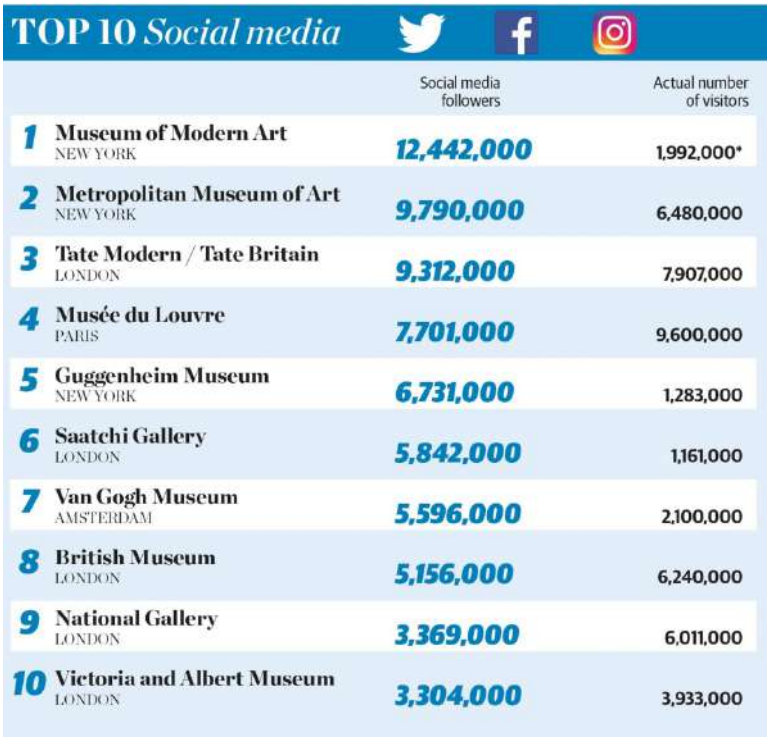



**Figure 2.2.24** Art Projector (left) and Art Selfies (right) from Google Arts and Culture.
**Source:** Google, n.d.

### 2.2.11.3 Social Platforms

Social media is a computer-based technology where people can mutually share their thoughts, ideas, and content, such as pictures and videos, over virtual networks and communities (Dollarhide, 2022). Social media platforms could be both websites and mobile applications. Social media platforms are the most used platforms by museums to create a digital community, reach their visitors by social sharing, and create a network among their visitors. Social media platforms also play a significant role in the digitalisation process of museums providing another channel to connect the museum and its visitors. The three main avenues for museums to use social media. These are marketing (which helps for promotion), collaboration (which maintains communication and relationships with audiences), and inclusivity (which helps to develop real and online communities) (Kidd, 2011 as cited in Padilla-Meléndez et al., 2013). It is also easier to access the already networked communities that have already been created on social media platforms and already consist of some museum visitors. Another critical point of how social media apps interact with

museums and visitors is related to the continuity aspect of social media. The biggest challenge of social media is continuity, which could also be its most powerful feature. Social media content must be updated regularly. Otherwise, it will lose its uniqueness (Caughill, 2009, Evans, 2008, as cited in Fletcher, Lee, 2012) and even relevance. Research conducted in 2020 compares some data about the online followers and physical visitors of the world's most visited museums and observes the relationship between the physical and online popularity of these museums. According to the research, The Museum of Modern Art is at the top of the list, with about 12 million followers (with 15 million total followers in October 2021) on Twitter, Instagram, and Facebook. The museum also had about 2 million physical visitors and was the most visited in 2019. The other most visited museums can be followed in the table below (Dawson, 2021). Nevertheless, the vast gaps between the numbers of physical and online visitors show that social media is all about the ability to create a successful online presence and gain popularity. It is a way to enhance the engagement between the visitors and the museum, but it does not guarantee success. In addition to that, social media is a full-time job that needs so much effort and care. More staff and resources make it possible to have a better online presence for museums (Fletcher and Lee, 2012).



**TOP 10** *Social media*

| | | Social media followers | Actual number of visitors |
|---|---|---|---|
| 1 | Museum of Modern Art NEW YORK | 12,442,000 | 1,992,000* |
| 2 | Metropolitan Museum of Art NEW YORK | 9,790,000 | 6,480,000 |
| 3 | Tate Modern / Tate Britain LONDON | 9,312,000 | 7,907,000 |
| 4 | Musée du Louvre PARIS | 7,701,000 | 9,600,000 |
| 5 | Guggenheim Museum NEW YORK | 6,731,000 | 1,283,000 |
| 6 | Saatchi Gallery LONDON | 5,842,000 | 1,161,000 |
| 7 | Van Gogh Museum AMSTERDAM | 5,596,000 | 2,100,000 |
| 8 | British Museum LONDON | 5,156,000 | 6,240,000 |
| 9 | National Gallery LONDON | 3,369,000 | 6,011,000 |
| 10 | Victoria and Albert Museum LONDON | 3,304,000 | 3,933,000 |

**Table 2.2.25** Top 10 list of Museums in Terms of Social Media Followers. **Source:** Dawson, 2020

YouTube is the second most used social media and networking platform after Facebook worldwide (Statista, 2022). Another way to create a digital presence in museums is to have a YouTube channel that contains videos about collections, digital archival methods, and various artists or artworks. YouTube, in that sense, can be considered a more suitable place to produce content consumed more slowly by viewers than Instagram's 15-second reel videos. In particular, 360-degree videos are one of the newest ways museums embrace, in which an omnidirectional camera records every direction simultaneously and shows it when users interact with the interface (Cohen, 2015, as cited in Jeeyun Oh, 2020). While the video continues, users can rotate 360 degrees around themselves and experience their environment interactively by zooming in-out and panning. Researchers claim that these videos provide higher immersion and receive more significant user reactions than 2D videos (Jeeyun Oh, 2020).

Museums not only share their collections on their YouTube channels but also share interesting content to draw the attention of digital visitors. For example, visitors can take a virtual tour while sipping a cocktail at one of The Frick Collection's exhibitions in New York City. Every Friday, they post a video about a piece of art on their YouTube channel and provide a cocktail recipe as an aperitif (The Frick Collection n.d). This regularly updated and sustainable content can attract the attention of even people who are not directly interested in art, create an interactive relationship with their visitors and increase the number of regular followers.

# 3. DIGITALISATION OF ART MUSEUMS IN TURKEY: PERA MUSEUM EXAMPLE

## 3.1 DIGITALISATION PROCESS OF ART MUSEUMS IN TURKEY

The beginning of museum establishment in Turkey goes back to the Ottoman Empire. One of the first museums in the Ottoman Empire, a weapon museum was established in *Hagia Eirene* called Dar-ül Esliha, which was formed by gathering and arranging the war tools and equipment in Sultanahmet in 1730. The foundations of the current Turkish museology were laid with the *Museum-i Hümayun*, which was first established in *Hagia Eirene* and later relocated to the *Tiled Kiosk* in 1876. Although the first steps on this path were taken in 1846, the museum took the name *Müze-i Hümayun* in 1868. Osman Hamdi Bey was a pioneer in taking these steps, and with the establishment of schools such as *Sanayi Nefise Mektebi*, art awareness began to form in Turkey. The museum, founded in 1891 under Müze-i Hümayun, forms the foundations of the *Istanbul Archeology Museum* (Çal, 2009).

Museum studies gained momentum in the Republican period, and Topkapı Palace was opened to visitors as a museum in 1924. While the first museum established in the Republican era (1925) was the Ankara Ethnography Museum, the Museum of the Ancient Orient (1935) was the first museum with contemporary exhibition techniques. Turkish museology, which initially emerged and developed as part of the westernisation movements, was primarily state-sponsored. In the Republican era, under Atatürk's leadership, laws emerged in the field of museology. By the end of the 20th century, various museums were established in many different cities in Turkey for preservation, presentation, storage, and exhibition (Keleş, 2004, as cited in Kahraman, 2021). The first art museum in Turkey was the Istanbul Painting and Sculpture Museum, which was established in 1937 by the decision of Atatürk. The first modern art museum was Istanbul Modern, which opened in 2004 (Ministry of Culture and Tourism of Turkey, n.d. and Istanbul Modern Museum, n.d.). The

concept of private museums emerged with the emergence of private capitals (Altun, 2007 as cited in Altunbaş, Özdemir, 2012). It was only in 1980 that Sadberk Hanım Museum was established as the first private museum in Turkey.

As mentioned before, the progress of Turkish museology accelerated during the republican period. Despite this acceleration, compared to the West, Turkish museology lagged in terms of technology due to limited opportunities (Kahraman, 2021). Naturally, the digitalisation process was also a later development in Turkish museology. In 1990, Topkapi Palace Museum attempted to transfer a part of its collection to the digital environment. This was the first attempt in Turkey. The project aimed to provide the users with digital versions of drawings, engravings, photographs, and more. The planned software system could not be created, and the project remained limited to a CD version because they could not find a sponsor for the project. This version consisted of twenty photographs and ten technical drawings (Çetin et al., 2000). The first art museum website was created for the Istanbul Painting and Sculpture Museum in 1993, and the website contained sixteen sculptures and 269 paintings formatted into an interactive panorama method (Figure 3.1.1). Following that, Turkey's first private art museum website was established in 1996 for the Sabancı Painting and Sculpture Collection. The CD recordings of the 100 Famous Turkish Films, Turkish Painting, and Turkish Poetry were created as an outcome of the *Habitat in Anatolia from Past to Present* panel discussion from Habitat II. Istanbul conference in 1996. Their creations were significant for digital documentation in the art field in Turkey (Barlas Bozkuş, 2014). Turkey's first private art museum website was established in 1997 for the Sabancı Painting and Sculpture Collection. Despite having a simple design and being only a digital brochure, it received many good reviews then. Afterward, the Koç Museum (rmk-museum.org.tr) and the Sadberk Hanım Museum (sadberkhanimmuzesi.org.tr/en) took their place in the digital environment in 1997, and the digitalisation of Turkish museums started to rise in those years (Atagök, Özcan, 2001). With the opening of private museums supported by foundations in 2000, museums in Turkey have developed in a modern sense. The Sabancı Museum was founded in 2003 by the

Sabancı Foundation, and then the Pera Museum in 2005, with the support of the Suna-İnan Kıraç Foundation (Kahraman, 2021).

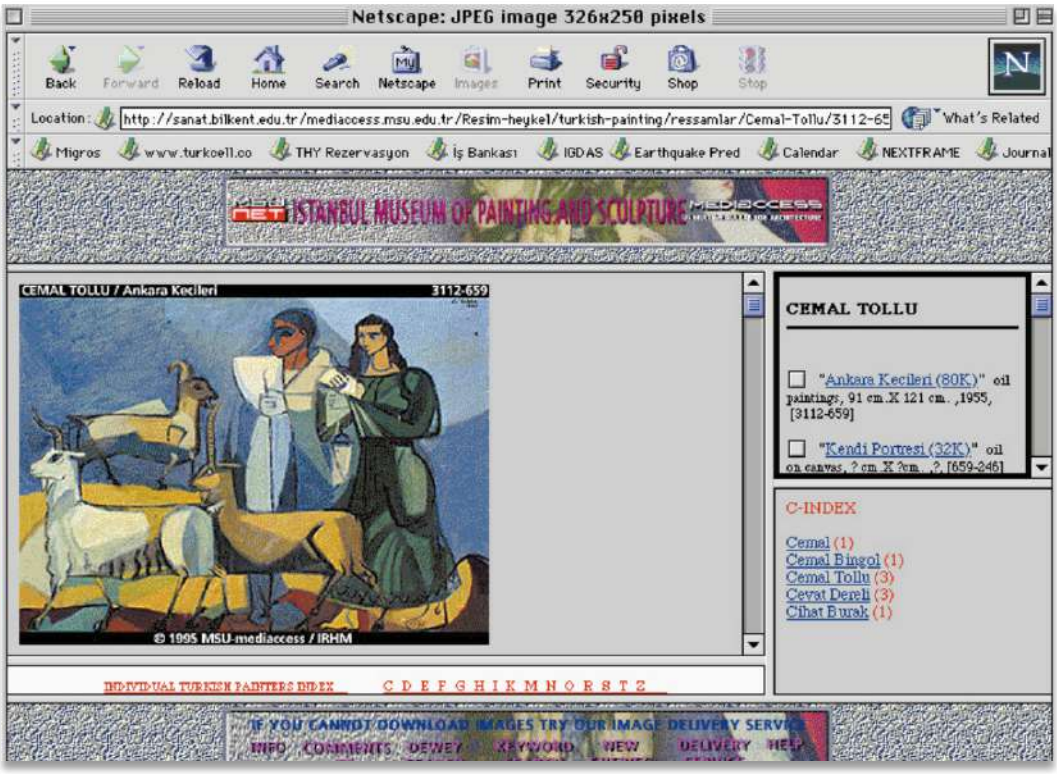



**Figure 3.1.1** A page from the Istanbul Museum of Painting and Sculpture website, 1995.
**Source:** Atagök, Özcan, 2001

According to 2020 data, there are 494 museums in Turkey, 205 of which are affiliated with the Ministry of Culture and Tourism, and 289 are private (TÜİK, 2021).

## 3.2 DIGITAL TECHNOLOGIES IN ART MUSEUMS IN TURKEY

Digitalisation is used in Turkish museums mainly for archiving, safety, information, and interactivity. Most of the technological projects in art museums in Turkey are periodical projects. Many of the examples given here are not currently active. Prominent examples of digitalisation in Turkish museums are generally seen in

science, culture, and history museums, and their purpose is mainly to inform visitors. According to a study conducted in 2020, many museums in Turkey still do not even have a website. Many digital applications worldwide are not used in Turkish museums (Akça, 2020). The prominent examples of digital applications used worldwide are discussed in the previous chapter. Due to the limited applications in Turkish art museums, this section does not include all of the digital practice categories applied in museums around the world, which were examined in the previous chapter. In particular, VR, AR, and AI technologies are generally used in science and culture museums to increase interaction with the audience and to be instructive. Examples of the use of these technologies in art museums are few. Therefore, these examples were examined under the same title.

### 3.2.1 Passive Interactive Digital Technologies

#### 3.2.1.1 Digital Screens and Sound Systems

Digital screens in museums in Turkey are mainly used for video display, guidance, education, and gamification. Public or private sound systems support such digital screens. These types of devices in museums also enhance accessibility to a larger population. For example, the photography exhibition “Dün Bugün İstanbul”, organised by photographer Murat Germen at the Sabancı Museum in 2021, was made accessible to visually and hearing impaired visitors (Figure 3.2.1). In addition to the added audio content for visually impaired visitors, narrations about the photographs were translated into sign language and presented to hard-of-hearing visitors with the help of video screening. In this example, although the visitor does not interact with the technological tool, the digital application improved the experience, and accessibility has increased through this technological application (BİA Haber Merkezi, 2021).


**Figure 3.2.1** Dün Bugün İstanbul Exhibition, Sakıp Sabancı Müzesi. **Source:** BİA Haber Merkezi, 2021

### 3.2.1.2 Projection Mapping

Projection mapping technology is mainly used in culture and history museums in Turkey for the representation of historical scenes (Panorama 1326 Bursa Conquest Museum, 2022). It is a technology that has recently started to be used in Turkey. For instance, Turkey's first digital art museum, *X Media Art Museum* (XMAM) which opened in January 2022, uses this technology for its exhibitions. Its first exhibition was "Leonardo Da Vinci: Artificial Intelligence, Wisdom of Light." The exhibition consisted of the artist's drawings, inventions, and sketches. The music of the exhibition belonged to Ludovico Einaudi and Mercan Dede, the composers of the Oscar-winning film Nomadland (Akgul, 2022). The museum generally uses

projection mapping technology in its exhibitions and aims to create more immersive experiences with sound elements (X Media Art Museum, 2022).

**Figure 3.2.2** X Media Art Museum, The first digital museum in Turkey, Leonardo Da Vinci exhibition. **Source:** RetouchMag, 2022

### 3.2.2 Active Interactive Digital Technologies

#### 3.2.2.1 Virtual Museums (Virtual Tours)

Virtual museums (virtual tours) are one of the most used digital applications by museums in Turkey so far. In the exhibitions, which are transferred to the virtual environment with 3D laser photography, the audience can wander around and have the chance to access information about the works and more digital content.

On the site created by the Republic of Turkey Ministry of Culture and Tourism (https://sanalmuze.gov.tr/), it is possible to visit 50 museums in Turkey with a 360-degree panoramic view. However, only one of these museums is an art museum,

and this is the Eşkişehir Odunpazarı Modern Museum (TC. Kültür ve Turizm Bakanlığı, 2022).

**Figure 3.2.3** Eşkişehir Odunpazarı Modern Museum Virtual Tour. **Source:** Ministry of Culture and Tourism, 2022

This method is used both by some art museums affiliated with the Ministry of Culture and Tourism and private museums. For example, the Ankara Painting and Sculpture Museum, one of the oldest art museums in Turkey, has a virtual tour option on its website. However, inside the tour, it is impossible to read the artwork labels or access to any information. This tour only allows users to walk around the galleries and view the artworks. Also, the permanent collection can be seen on their website's collection tab (AHRM, 2022).

Some private museums have virtual tours as well, such as Istanbul Modern. The museum has six virtual tours currently on its website. Through these virtual tours, it is possible to walk around the museum's corridors, see the artworks and read about them. Since the 3D virtual tour is created with laser scanning technology, both a top view and a model view of the place are created (Istanbul Modern, 2022).

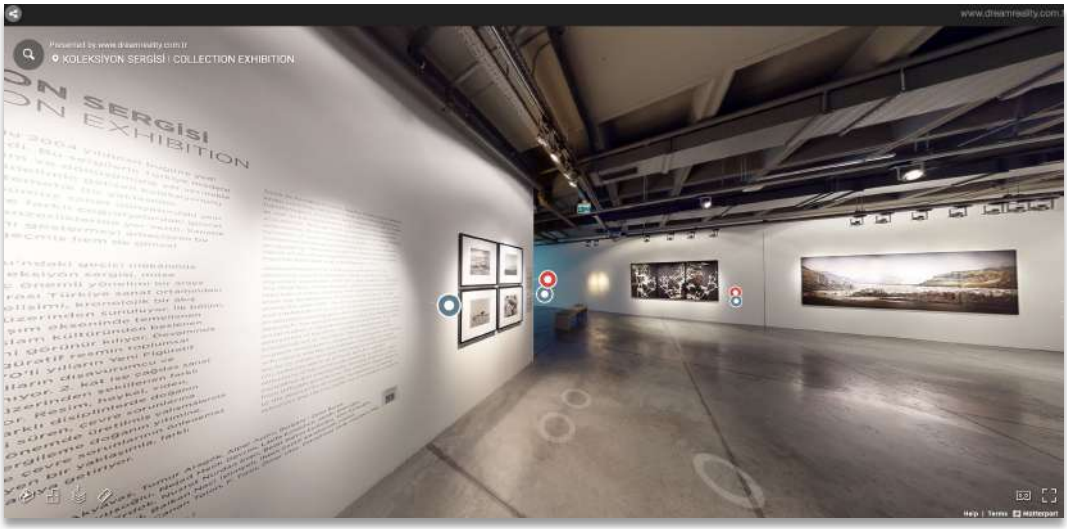



**Figure 3.2.4** Istanbul Modern Virtual Tour. **Source:** Istanbul Modern, 2022

### 3.2.2.2 Virtual Reality (VR) and Augmented Reality (AR)

Augmented reality and virtual reality applications are primarily used in education and advertising in Turkey. There are not many examples in art museums in Turkey. According to a study in 2020, there are six museums in Turkey using examples of augmented reality (AR). While five of these six museums are culture and history museums, there is only the Sakıp Sabancı Museum as an art museum (Sucaklı, Güzel, 2020). The permanent exhibition area in the museum complex consists of Sabancı Families' former residence, which includes sections such as their dining and living rooms. Some of the family's belongings from the period they lived in the house are exhibited in these rooms. The visitors can experience the permanent collection with AR technology provided in the exhibition areas by using the tablets offered by the museum at the entrance. A tablet sign is placed at specific points in the exhibition rooms, and the visitor is expected to hold the tablet in that direction. This action activates the tablet, and period photographs of the Sabancı Family's living space can be viewed (Figure 3.2.5). The pictures documenting the period

bring the museum space and objects to life and help visitors to experience the space more intimately and emotionally (Coşkun, 2021). Users can also see miniature books in the library rooms, watch videos about the creation process of these manuscripts, and display motioned miniatures through tablets (Figure 3.2.6) (Ekinci, 2012).

**Figure 3.2.5** Sabancı Family Photos, Augmented Reality in the Sakıp Sabancı Museum.
**Source:** Sakıp Sabancı Müzesi, 2012


**Figure 3.2.6** Motioned Miniature Works. **Source:** Sakıp Sabancı Müzesi, 2012

In addition to these examples, VR technologies are very new in Turkish art museums. The first VR exhibition in Turkey is the Seasons of Anatolia Photography Contest exhibition, installed in April 2022 in the Istanbul Gazhane Museum (Müze Gazhane, 2022).

### 3.2.2.3 Touch Screens and Kiosks

Kiosks are suitable for use inside and outside the museum because of their portability and easy placement in various locations. For example, through the kiosks that the Istanbul Museum of Modern Art has placed at eight different points in Istanbul, such as Galata, Eminönü, and Sultanahmet, users can have the opportunity to interact with the contents of the museum even outside the museum (Istanbul Modern, 2019). Alternatively, kiosks are used to provide users with more information on the permanent exhibition section and an interactive game on

Istanbul Miniature for *Book Arts and Calligraphy Collection* (Figure 3.2.9) (Uluğ, 2020).


**Figure 3.2.7** Istanbul Modern kiosk implementation. **Source:** Istanbul Modern, 2019

**Figure 3.2.8** Kiosk implementation in Sakıp Sabancı Museum. **Source:** Sakıp Sabancı Müzesi, 2012

**Figure 3.2.9** Interactive game played with touch screen on Istanbul Miniature. **Source:** LOG, 2012

### 3.2.2.4 Qr Code

While QR code technologies are primarily used in the advertising industry in Turkey, they became the first option to reach the menus in restaurants due to the hygiene habits brought with the COVID-19 pandemic. It is also used in museums to get more information and content about the artworks, to get in-museum guidance, and to access virtual applications.

Sakıp Sabancı made accessible the *Book Arts and Calligraphy Collection* more through QR codes and AR technologies (Figure 3.2.10). When sensitive manuscripts had to be exhibited inside glass cases for conservation purposes, it was impossible to examine the exhibition's works in detail. Visitors could examine the artworks through tablets and read them by zooming in on this project. While the

number of visitors to the exhibition increased, younger visitors were also attracted (Bıktım, 2014 as cited in Coşkun, 2021).

**Figure 3.2.10** Sakıp Sabancı Museum Artistic Manuscript Books Exhibition AR Application. **Source:** Coşkun, Augmented Reality Applications in Art Museums, 2021

### 3.2.2.5 Mobile Applications

The use of mobile applications in museums in Turkey is much lower compared to other technologies. The "Turkish Museums" platform[8], created by the Ministry of Culture and Tourism, has a mobile application version which is called Museums of Turkey (Google Play, 2022). In addition, the application called *Müzeasist*, which can be used as a guide in the museums visited, provides users with information about artefacts and museums and offers a professional tour service for the

[8] For more information, see 3.2.2.11 Digital Platforms

exhibitions (https://start.muzeasist.com/). In addition, there are different applications in the style of “Sanal Müze”, which contain information about museums, and travel guides, which also contain content about different museums. In addition, some of the museums have mobile apps, such as Istanbul Modern and Ankara Painting and Sculpture Museum (App Store, 2022). Through these apps, users can access important information about the museums and see currently available exhibitions and artworks.

#### 3.2.2.6 Digital Platforms

Digital platforms that Turkey’s museums have museum websites, art-related websites, Google Arts and Culture, and social media platforms.

##### 3.2.2.6.1 Websites and Art Platforms

Museum websites have essential information about museums, current exhibitions, and opening and closing times. Some museum websites have the museum’s digital archive or virtual tours. For example, Sakıp Sabancı Museum created an online digital archive project in collaboration with Sabanci University Information Centre (Figure 3.2.11). The archive consists of more than seventy-seven thousand high-resolution visuals, which include the Painting Collection, Emirgan Archives, Abidin Dino Archives, Arts of the Book, and Calligraphy Collection. The scanning

and archiving technologies are compatible with international standards, making the collection accessible worldwide (DigitalSSM, 2021).

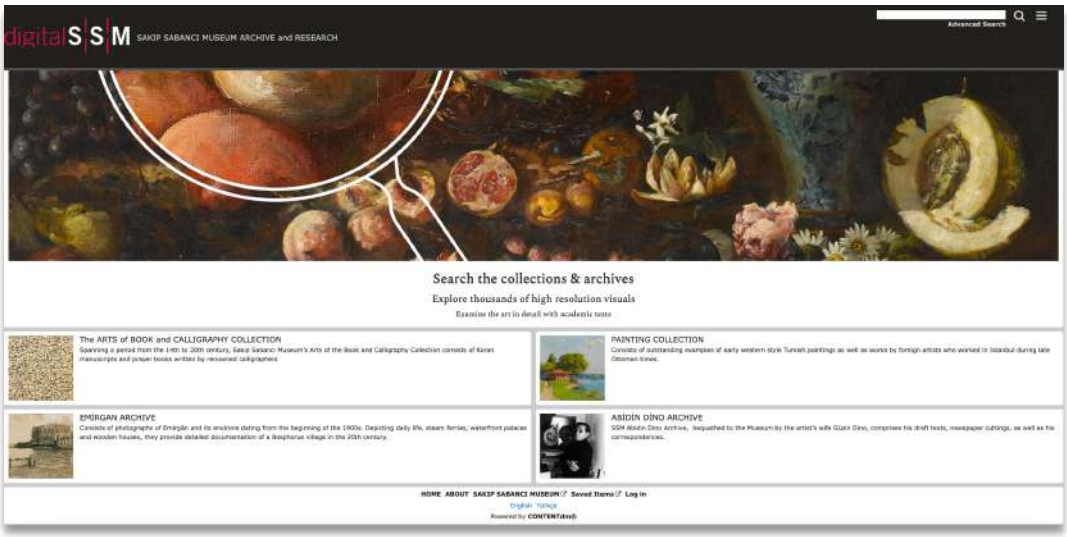



**Figure 3.2.11** Constructing a Dream Digital Exhibit. **Source:** DigitalSSM, 2022

Other than museums' websites, there are also art-related websites. These websites belong to the government, private companies, or foundations. For example, the Republic of Turkey's Ministry of Culture and Tourism created two digital platforms for museums. The first one is sanalmuze.gov[9], and the other is the "Turkish Museums" website. There are 417 museums on the platform in various categories. It is possible to filter them according to their type and location. These sections contain information and photos about museums; virtual tours are also available for

[9] For more information, see 3.2.2.1 Virtual Museums

some museums. There is not a separate category for art, but art museums are included under the "other" category (Turkish Museums, 2021).

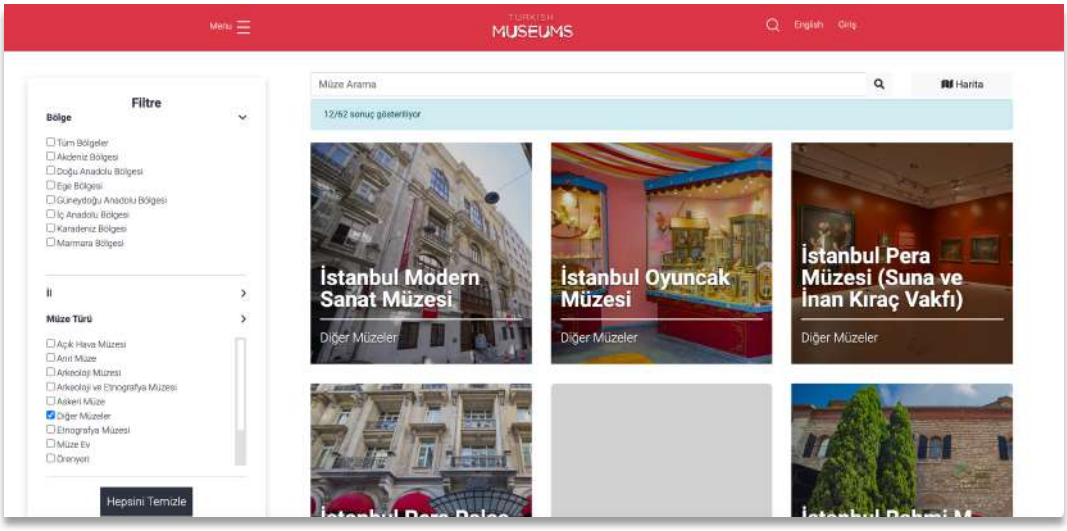



**Figure 3.2.12** Platform with information and photos about museums in Turkey. **Source:** Turkish Museums, 2022

One of the first digital platforms in Turkey, "sanalmuseum.org," was created in 2000 by Eczacıbaşı Foundation. The platform contained information and photographs of the museums. The site included the introduction pages of artists working in the fields of painting and ceramics; Osman Hamdi Bey and his Iconography; 75 paintings from the Eczacıbaşı Collection, a selection of Fikret Mualla and the exhibitions of Ferruh Başağa, Saim Bugay, Neşe Erdok, İrfan Önümen. The site also included many important links to quizzes, screensavers, and reading suggestions for those interested in plastic arts. The purpose of this platform was to create a 'Central Memory Archive' that would keep and preserve the records of art (Hürriyet, 2000). The platform is not active currently.

"Kolekta" should be considered a unique art platform. It is the most extensive collection of Turkish contemporary art, with more than forty art galleries, over 500 artists, and 5000 works. Kolekta has a digital archive that consists of contemporary and modern Turkish artwork (Kolekta, 2022).

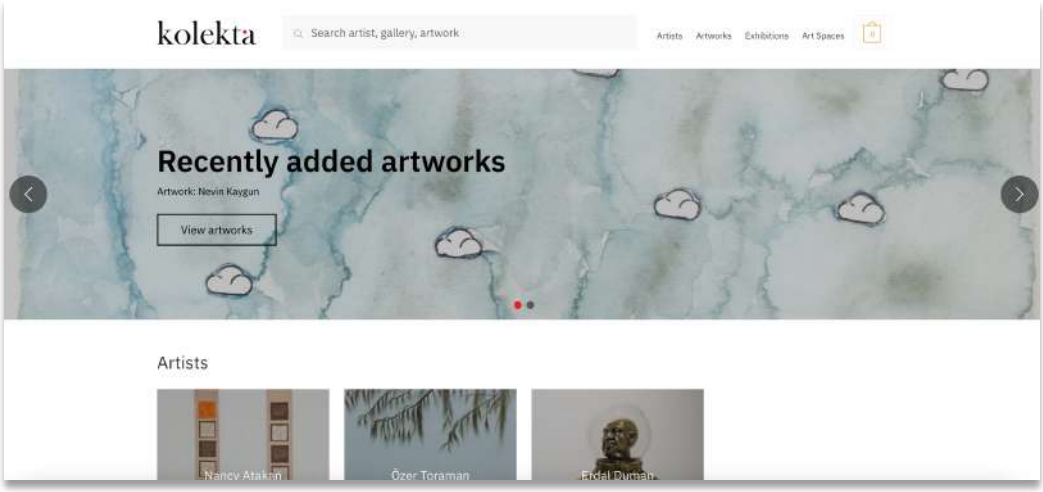



**Figure 3.2.13** Kolektif Art Platform. **Source:** Kolekta, 2022

Lastly, Google Arts and Culture Platform includes eight Turkish museums. These museums are Pera Museum, Elgiz Museum, Istanbul Museum of Modern Art, Sabancı Museum, The Museum of Innocence, Istanbul Toy Museum, Sadberk Hanım Museum, and Rezan Has Museum.

### 3.2.2.6.2 Social Platforms

Many art museums in Turkey are actively involved in social media channels. Although these museums are generally private, the Ministry also has Facebook, Twitter, and Instagram accounts under the name of "officialturkishmuseums". It is possible to access content about different museums and works of art from these accounts (Figure 3.2.14) (Turkish Museums, n.d.). According to the number of followers of museums in Turkey, it can be said that Twitter is the channel that reaches the most audiences in museums (Erkmen et al., 2020). The art museums that use Twitter the most are Istanbul Modern with 2M followers, Pera Museum with 487K followers, and Sakıp Sabancı Museum with 468K followers.

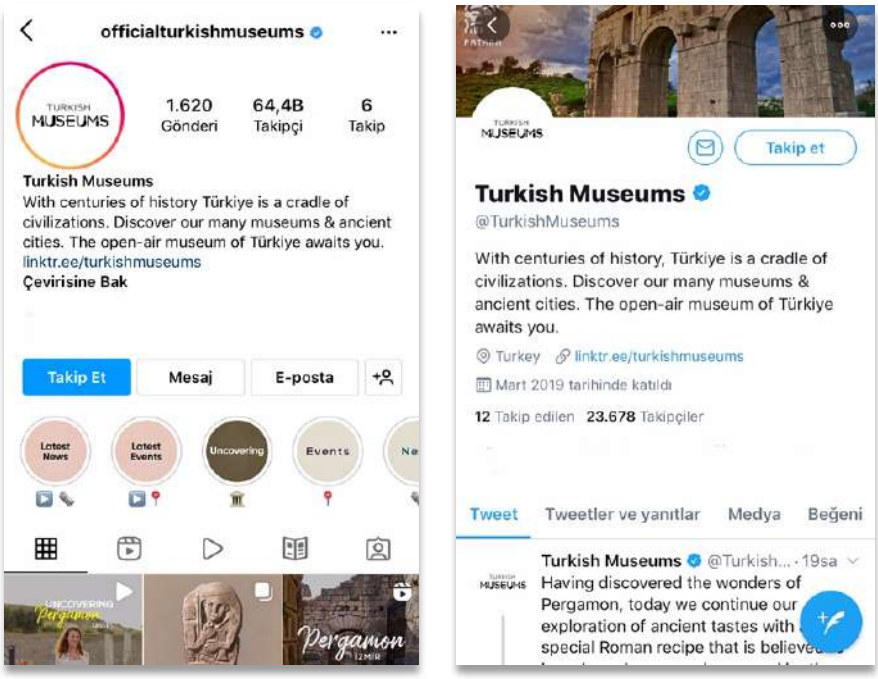



**Figure 3.2.14** Turkish Museums Instagram (right) and Twitter (left) Account. **Source:** Instagram, 2022

Art museums in Turkey also have their own Instagram accounts, and some use them actively. For example, Istanbul Modern Museum has 347K followers and 3123 posts; the museum posts some new content every three days. Their content is mostly about artworks. In addition, Sakıp Sabancı Museum has 201K followers and 3073 posts, and they post content about their current exhibitions in the same frequency as Istanbul Modern. With 231K followers and 2175 posts, Pera Museum is one of the museums that use Instagram the most. While the Pera Museum mostly posts about works of art, there are also a series of posts they regularly post about their current exhibitions (Instagram, 2022).

Art museums that actively use Youtube are also the same. An example of the active use of YouTube can be given with the video broadcast called "Scene in the Museum," launched by the Sakıp Sabancı Museum in 2022. These publications consist of panels and talk about some of the exhibitions held in the museum and the

field of culture and the arts. In addition, the museum regularly publishes video series about its current exhibitions. In addition, İstanbul Modern Museum has a wide range of videos on its YouTube channel. These videos are organised under categories such as Istanbul Modern Home, Education, Exhibitions, and Museums Speak (YouTube, 2022).

Approximately similar or identical content is published on different social media accounts of museums. This system is based on creating a holistic identity. Posts containing the same themes and topics may differ in text or visually, depending on the type of social media channel. The links to the most popular social media channels (Facebook, Instagram, YouTube, and Twitter) for Pera Museum, Sakıp Sabancı Museum, Borusan Contemporary, Istanbul Museums of Modern Art, and Rahmi Koç Museum are listed in the Appendix.

## 3.3 TECHNOLOGICAL APPLICATIONS IN PERA MUSEUM

Pera Museum is an art and culture institution founded in 2005 by the Suna and Inan Kıraç Foundation. One of the prominent art institutions in Turkey, Pera Museum has permanent exhibitions such as Orientalist Painting, Anatolian Weights and Measures Collection, Kütahya Tiles and Ceramics Collection. It is also well known for its temporary exhibitions displaying artworks of notable names from the art world. The museum also conducts scientific studies, provides movie screenings, and offers educational programs (Pera Müzesi, n.d.).

In terms of digitalisation, Hazal Altun, the digital platforms and social media supervisor of Pera Museum (personal communication, February 24, 2022), says that in 2008, a department for social media and public outreach in the museum was established. Afterward, the museum was started to present at Google Arts and Culture in 2012. Museum's digitalisation continued through many different channels. For example, the museum website with different content and virtual tours;

the Journey to Osman Hamdi Bey's World exhibition created with VR technology; online learning programs, especially during the pandemic; and social media channels that ended with different content.

Pera Museum's website is a leading digital communication platform (Altun, personal communication, February 24, 2022). The museum's website has information about permanent and temporary exhibitions, the history of the museum, and the projects they have conducted. An Events page contains a calendar for users to see the exhibitions and other events. It is possible to find digital exhibitions (virtual tours) in the Art tab. There are 23 virtual tours of various exhibitions in the Pera Museum currently. Current and past film screenings and educational program announcements can also be found on the website. On the Publications page, there are catalogues, symposium series, and book series. From the *Explore!* page, it is possible to access articles about various topics. Altun (personal communication, February 24, 2022) states that the Explore! Page is identified as a second main page. It has its audience, who check the contents regularly (Pera Müzesi, 2022).

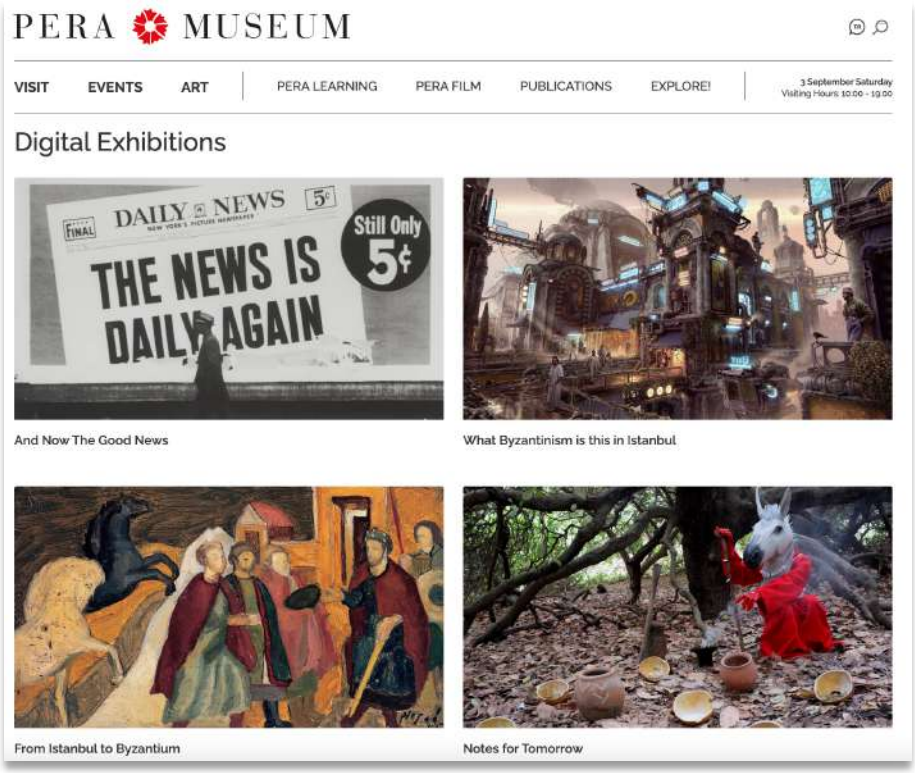



**Figure 3.3.1** Digital Exhibitions (Virtual Tours) on Pera Museum Website **Source:** Pera Museum, 2022

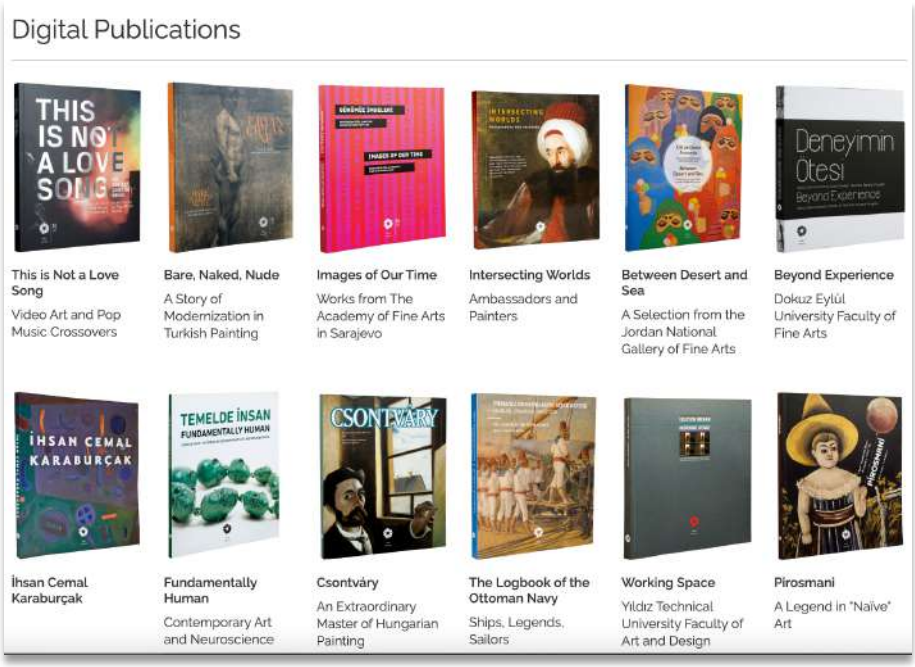



**Figure 3.3.2** Digital Publications on Pera Museum Website **Source:** Pera Museum, 2022

Some of the virtual tours on the digital exhibitions page are Notes for Tomorrow, Crystal Clear, Miniature 2.0, City of Dreams: Istanbul, and Constructing a Dream. In these exhibitions, visitors can "virtually" stand in front of the artworks as much as they want and read about them. The museum has the feel of a real physical space through the 3D exhibition area created by three-dimensional laser photography. Despite being in a digital environment, the visitors can walk down the corridors, turn around, and go back and forth between the artworks (Figure 3.3.3) (Pera Müzesi, 2022). Additionally, its website, Pera Museum also takes part in the Google Arts and Culture platform. It is also possible to view the six digital exhibitions on its website. In addition, users can see 476 pieces from their collection and visit the permanent exhibitions section of the museum virtually (Google Arts & Culture, 2022).


**Figure 3.3.3** Constructing a Dream Digital Exhibit. **Source:** Pera Müzesi, 2021

In 2019, the "Journey to Osman Hamdi Bey's World" virtual reality project was carried out jointly by Pera Museum and MuseVR company (Figure 3.3.4). With the help of a VR set, visitors were able to visit the artist's work environment, which was constructed in line with historical data. Additionally, it was also possible for visitors to go inside his most famous artwork, "The Tortoise Trainer" (Pera Müzesi, 2019). The original of this artwork is already on exhibit in the Pera Museum. Through this VR experience, the visit acquired another dimension. Inside this interactive experience, visitors could look at the books on the table, play the piano,

hold the photos, and even feed the turtles in the room. The experience was created by modelling the artist's belongings in a fictional space shaped according to the architectural features of the period and what is known about the artist's mansion in Kuruçeşme, Istanbul. It took two and a half years to design and create this VR experience. In addition to all this technical modelling, the process also included a long research process about Osman Hamdi Bey (Dindar, 2019). Irmak Wöber, prior digital and social media manager of Pera Museum, states that Pera Museum supports accessibility as a vision and participates in projects following this purpose. She also added that this project attracted many people of all ages by creating a different museum experience (Açık Mimarlık, 2019).

**Figure 3.3.4** A Visitor Testing the Virtual Reality Experience. (Left) **Source:** Pera Müzesi, 2019

**Figure 3.3.5** Osman Hamdi Bey's Room Transformed into Virtual Reality with a 3D Modeling. (Right) **Source:** Pera Müzesi, 2019

During the COVID pandemic, Pera Museum organised online learning programs and exhibition tours through Zoom's digital communication tool. 679 children aged between 7 and 12 attended these online learning programs in 2020. These programs mainly consist of online exhibition tours and painting and drawing workshops (Figure 3.3.6). Pera Museum, which aims to maintain communication with its young visitors outside the museum, also shares the outcomes of such events on its

social media accounts, allowing the events to spread to a broader audience (Independent, 2020).

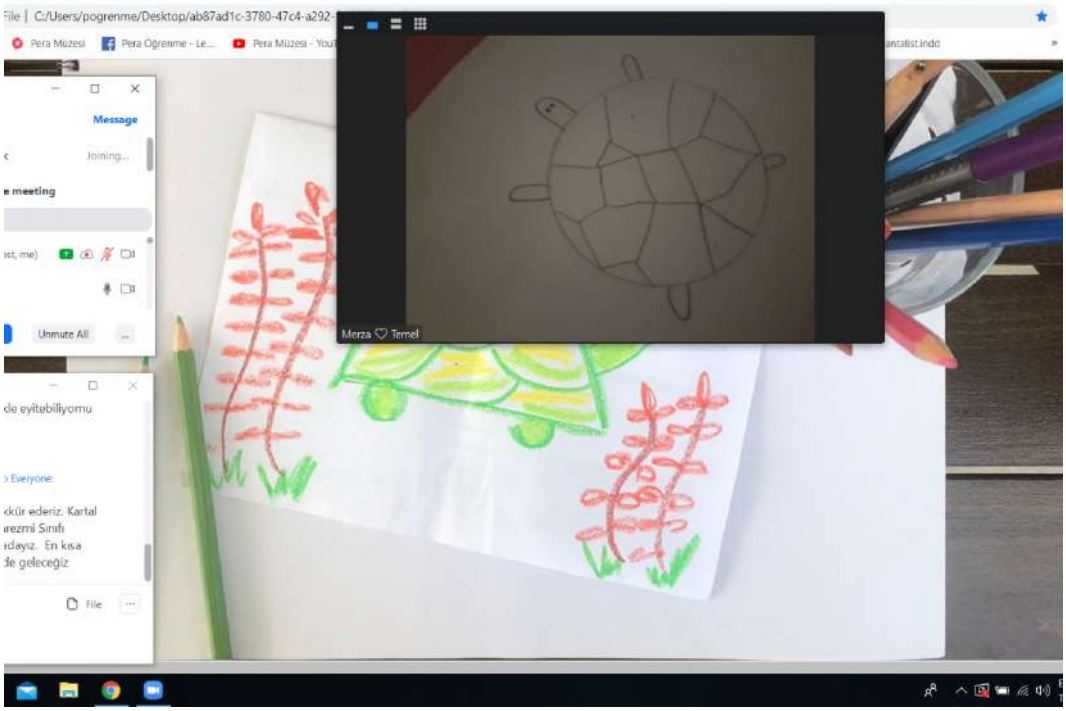



**Figure 3.3.6** Pera Museum Learning Programs. **Source:** Independent, 2020

Considering the number of social media shares and followers, Pera Museum is one of the art museums in Turkey that uses social media most actively. The museum has 2175 posts and 230K followers on Instagram, 487K followers on Twitter, 14,5K followers on YouTube, and 95K followers on Facebook. The museum shares content about special occasions, such as World Photography Day and Victory Day, campaigns, such as free visit days, and current exhibitions and events. Pera Museum's Twitter, Facebook, and Instagram shares are the same in content. The museum also shares videos on its Youtube Channel regularly. There are videos about the current exhibitions and different topics on art and culture. Mini Documentary, Artists, and #PeraMuseumfromhome video series are available on the museum's channel (YouTube, Twitter, Instagram, and Facebook, 2022). Apart from these, Pera Museum had some initiatives on other social media channels. They

created a promotion campaign for Pera Café and Artshop visitors. To receive the discount or promotion, users must be online in the Foursquare app and receive a push notification from the museum. Furthermore, the museum was involved in a movement in 2011 and asked its users to share on Twitter with the hashtag #WhyILoveMuseums. By retweeting the posts, they created a communication campaign and had the chance to collect data about the visitors (Özrili, 2020).

Finally, Hazal Altun (personal communication, February 24, 2022) states that digital platforms and technologies were not developed after the COVID pandemic for Pera Museum. The phenomenon of digitalisation has been included in the vision and plans of Pera Museum.[10] Pera Museum is one of the leading Turkish art institutions that improve itself every day in terms of digitalisation with its social media channels, its website, its digital tours and learning programs, its publications that can be read online, and its activities with the help of digital devices, such as virtual reality sets within the museum.

[10] For more information about digitalisation in Pera Museum, see Hazal Altun, Digital Platforms and Social Media Supervisor for Pera Museum Communications Team, Interview in the appendix.

## DISCUSSION AND CONCLUSION

The museum concept initially emerged with the habit of exhibiting what the noble families owned, then developed over time, and its meaning expanded. Museums are organisations that exhibit and preserve intangible and tangible human heritage, objects, and artefacts of cultural, artistic, and scientific significance (ICOM, 2007). These institutions, primarily object-centred, have aimed to be centers of education and tourism over time, and they have started to adopt visitor-centred attitudes to increase their sustainability.

This research aims to analyse how technology enters museums and what technologies are used in art museums worldwide and in Turkey. While investigating the notable points of digitalisation in museums, some highlights were determined and discussed with initial examples of practices such as first art platforms and virtual museums. Digital technologies have started to be used in museums' finance, management, and visitor experience over time. With the COVID-19 pandemic that entered our lives in 2019, museums and other institutions almost lost their physicality. They turned technological applications into essential communication tools with their visitors (Birnbaum, D., n.d, as cited in Feinstain, L., 2020). In addition to COVID-19, museums have accelerated their activities in digitalisation because of the increase in digital artworks and the emergence of concepts such as NFT (non-fungible token) and Metaverse (Fictional Universe) (He, 2022). The analysis of prominent examples of digital technologies in the art museum context also provides insights into the changing patterns of interaction between the museum and its visitors. In the second chapter, the prominent examples of digital technologies in art museums were grouped regarding the specific technology.

The first chapter examined the historical process of the digitalisation of museums, with three highlights that emerged as a result of my research. The first highlight is photography, which has led to the reproduction of numerous copies of artworks. It led to the idea and practice of reproduction of the artworks, first by printing and

traditional reproduction methods, and then by digital reproduction. With that, the uniqueness of the artworks deteriorated, and the visitors began to experience artworks even without going to the actual environment where they were physically exhibited. The second highlight is the digitalisation of "brick and mortar" museums. Digitalisation started in museum institutions for managerial reasons, and then it was used in studies focused on improving the museum experience in areas such as orientation, information, and gamification. With the digital reproduction of artworks, museums have also started to digitalise their archives. The third and last higlight is the availability and global circulation of artworks. With the digitalisation of artwork and museums, museum administrations create digital presences or get involved in digital platforms that anyone from all over the world can visit whenever they want. Consequently, entirely digitalised museums and artworks have emerged. Throughout this process, museums have worked on digital applications and used various technological devices such as mobile devices (mobile phones and tablets), computers, virtual reality headsets, wearable devices, and kiosks. Museums use these applications for reasons such as education, interactive learning, gamification, providing information about artworks, entertainment, strengthening the bond among visitors, artworks, and the museum, and raising awareness of art. The features of the applications, the places they are used, and the digital devices they are used on may vary depending on their purpose.

In the second chapter, various examples of digital technologies that art museums use are categorically overviewed. In this section, the explanation of the technology, related examples, and images are presented together. This overview also clarifies why museums prefer which specific technologies. These digital technologies are generally used in science and cultural museums to make information accessible worldwide and in Turkey. Although relatively less common, examples also exist in art museums.

In the last chapter, the topic was narrowed down to the level of art museums in Turkey to make this research more meaningful and a comparison. In this section, it

is possible to see the development of art museums in Turkey, the introduction of technology to art museums, and existing applications. The existing applications part includes partially parallel titles with the applications worldwide; however, due to the limited number of examples in Turkey, titles were revised. The Pera Museum was examined in the final section as one of the leading art institutions in using digital technologies in Turkey.

When the examples in the world and those in Turkey are compared, it can be said that what is being done at the level of art museums in Turkey is far behind in digitalisation. In art museums in Turkey, social media channels are areas that are used more actively than other digital applications, and the audiences are contacted regularly. Considering the studies and examples examined, examples with wearable technologies, projectors, and simulators were used for data collection in shorter-term projects or research projects. Due to the rapid obsolescence of technologies, museums prefer to use more sustainable and less costly technologies such as sensors and sound systems. In addition, websites are preferred as the most accessible digital technology. Digital applications are used in museums for subjects such as education, socialisation, promotion, creating interactivity, and guidance. These technologies can be divided into those in which visitors interact actively and passively. While the technologies with which they communicate passively are technologies such as screens and projection mapping, the technologies they actively communicate with are virtual reality, artificial intelligence, augmented reality, QR codes, websites, and mobile applications. Studies in the field of museums in Turkey are few compared to those in other countries. In particular, the developments in the technological field are generally short-term or temporary applications. While science and culture museums generally use digital technologies more in museums affiliated with the Ministry, some private art museums have started to give importance to technological applications in recent years. Some of these museums are Sakıp Sabancı Museum, Pera Museum, and Istanbul Modern, which is Turkey's first modern museum. The most commonly used technologies in Turkey's museums are websites, social media, and virtual tours.

Some additional insights emerged during this research. First, museums are more than mere cultural institutions or historical buildings; they are not only places for spare-time activities. Museums include research areas, such as libraries and archives for research purposes; areas to exhibit and protect artefacts and cultural heritage; and promote socialising and shopping with terraces, gardens, cafes, and gift shops. The activity is not just being in an exhibition. However, it is an experience of having a break at the museum's cafe, meeting other visitors by coincidence, or greeting the people who work there most of the time. Museums are places of interaction. Visitors actively give their immediate reactions to the artworks in front of them, which is also related to the context and other visitors. Walking through the museum, glancing at the artworks, mapping out a route, and interpreting the content are the ways of interacting with the exhibitions. For this reason, for museums' digital presence, digital creators transformed archives into digital archives, social areas into social media accounts, and gift shops into online shops to ensure the continuity of the values that create museums in physical life. With increased social media accounts, YouTube channels, blogs, and online art platforms, these immediate reactions have turned mostly into digital reactions.

The museum experience is also an experience of creation and being part of a community. Museums seriously care about their community (Bautista, 2013). Thus, another significant socialisation element is communities for museums. The best approach for thinking about how museums and communities are evolving is to consider how the visitor, a passive entity, transforms into the community, an active actor (Hamilton et al., 1993). Even though online channels change the perception of this concept of community, the situation of coming to museums to socialise is still in demand. Although many museums and artworks can be accessed without going physically, the concepts of going to the museum and physically seeing an artwork still retain their meaning. Dame Elizabeth Esteve Coll, the former director of the Victoria and Albert Museum in London, observed that "it is important that the museum is not just a passive collection of wonderful objects but a springboard

into the community." (Mosley, 2000). The feeling of enjoying being somewhere simultaneously with other people like themselves creates a community effect. Also, these communities consist of people who have similar interests, goals, and pleasures. Nevertheless, the digitalisation of museums has also impacted and changed this community spirit. With nearly every museum now having its online presence, the community takes on a global dimension through the opportunity to communicate with anyone, anywhere, and at any time via the Internet. Social media accounts of museums are also one way of creating an online community and promoting it (Bautista, 2013). With digitalisation, these conventionally physical communities have turned into social networks. Thus, it can be argued that these digital presences should be created wisely and accurately to be able to have a powerful influence on visitors.

As a user interface and experience designer, it is also essential to consider the digital interfaces (kiosks, screens, websites, and mobile applications) developed daily and their influence on the visitor experience. Pietroni (2018) states that software developers and designers should work together to design user-friendly and profitable digital experiences. They should consider not only computer graphics but also cognition, psychology, art, and information architecture. As digital applications in museum services become widely introduced around the world to meet the needs of museums, new business lines and companies working in this field have emerged. For example, Cuseum, one of these companies, designs technological infrastructures for cultural institutions (Cuseum, n.d.). This company creates mobile applications and digital membership services for museums to deepen the visitor experience and increase member acquisition. As mentioned before in the previous chapters, MuseVR, which worked on the "A Journey into the World of Osman Hamdi Bey" Project for Pera Museums (Pera Müzesi, 2019), and the Emissive Agency, which worked on the Mona Lisa VR (Manalac, 2020) experience for the Louvre Museum, would be other examples of these companies. Overall, museums mostly use social media platforms and websites to create better interaction and sustainability with their visitors. Creating popularity is a good idea

to bring people to a place, for example, approximately 6 million people visit the Louvre Museum every year to see the famous Mona Lisa painting because of its fame (Kazimierska, 2020). Museums use digital technologies for education, archiving, preservation, entertainment, and accessibility. However, the most challenging aspect when evaluating the effects of digitalisation on museum services is that technology is a constantly evolving and changing phenomenon. Even during the writing of this thesis, many innovations and digital inventions occurred and were used by museums.

As a result of this research, some questions emerged that could be the subject of more advanced research in the future. One of them is why various technological applications used in different art museums in Turkey are mostly short-term or temporary. The reason for this may be that these practices are a financial burden on museums or that they did not have enough impact on the audience. This question can be answered as a result of interviews with museums and the visitor analysis outputs that can be obtained from them. A second question may be why digitalisation studies in art museums are not as common as in science and history museums in Turkey. Technology studies in different museums in Turkey should be examined in depth; their purposes, usage, and interactions with the visitors should be compared. Another question is how to choose the most suitable technology and usage area for a museum. Due to the wide variety of uses and purposes of technology, some methods can be developed to find the most efficient and logical technology specific to a museum. Some of these methods may be tests with the visitors that will communicate directly with the technology, preliminary data analysis; or long-term preliminary cost calculations.

In closing, as Proctor (2011) said ten years ago, “Street Views (in the Google Arts and Culture platform) of gallery installations will only fuel the desire to visit in person and increase the power of the museum pilgrimage to unleash the poetry of the encounter with the artwork.” The museum experience is something where physicality comes to the fore and is supported by the physicality of the artwork. The

examples show that digital technologies are mostly used to improve the in-museum experience. As Schweibenz (2004) also stated, virtual museums are not competitors for “brick and mortar” museums because virtual museums cannot provide real objects as physical museums do due to their digital nature. Nevertheless, virtual museums can extend the ideas and concepts of physical collections into the digital space. In other words, they can help uncover the museum's essential nature.

## REFERENCES


Açık Mimarlık, “Sanal Gerçeklikte Osman Hamdi Bey’in Dünyası’na Yolculuk”, August 2019, https://open.spotify.com/episode/5XmlEWhEchqGeltXS4xXqj?si=NSIz-FmIR7mv-SjZshGijg&dl_branch=1

Akça, S. (2020). Museums in the Age of Technology and Information: Overview . *Turkish Librarianship,* 34(2). Retrieved 2022, from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dergipark.org.tr/tr/download/article-file/1156183.

Akgul, E. (2022, January 29). *Türkiye'nin İlk Dijital Sanat Müzesi 'XMAM' Açıldı*. ReTouch Mag. Retrieved August 20, 2022, from https://www.retouchmag.com/turkiyenin-ilk-dijital-sanat-muzesi-xmam-acildi/

Allahyari, M., (2016). Retrieved November 1, 2021, from http://www.morehshin.com/material-speculation-isis/.

Allan, D. (2020, April 2). André Malraux's Imaginary Museum. Apollo Magazine. Retrieved August 10, 2022, from https://www.apollo-magazine.com/andre-malraux-museum-without-walls/

Allen, K. R. (2016). Building bridges between the virtual and real: A study of. augmented and virtual realities in the museum space and the collaborations that produce them (thesis). University of California , Los Angeles. Retrieved 2021, from https://escholarship.org/content/qt67g7f83h/qt67g7f83h.pdf

Alexander, J., Barton, J. Groeser, C., 2013. *Transforming the Art Museum*

*Experience: Gallery One* [Paper presentation]. The annual conference of Museums and the Web, Portland, OR, USA. Retrieved 2022 fromhttps://mw2013.museumsandtheweb.com/paper/transforming-the-art-museum-experience-gallery-one-2/

Altunbaş, A., Özdemir, Ç. (2012). Çağdaş Müzecilik Anlayişi Ye Ülkemizde Müzeler . Retrieved 2022, from https://teftis.ktb.gov.tr/Eklenti/4655%2Cmakale.pdf.

Anderson, G. (2004). *Reinventing the Museum – Historical and Contemporary Perspectives on the Paradigm Shift.* Lanham, MD: AltaMira Press.

Anonymous, (2019). Pocket Gallery by Google Arts & Culture is an AR Museum Showcasing Van Gogh and Picasso. Immersive Technology. https://immersive-technology.com/augmentedreality/pocket-gallery-by-google-arts-culture-is-an-ar-museum-showcasing-van-gogh-and-picasso/.

*Art Terms.* (n.d.) MoMA. Retrieved June, 2022 from https://www.moma.org/collection/terms/

Atagök, T., & Özcan, O. (2001). Virtual Museums in Turkey. *Museum International*, 53(1), 42–45. https://doi.org/10.1111/1468-0033.00299

Azuma, R. (1997). A Survey of Augmented Reality. Presence: Teleoperators and Virtual Environments, 6, 355-385. https://doi.org/10.1162/pres.1997.6.4.355

Barrett, T., D., (2014). How to Create Mixed Offline-Online Community Spaces? A Behavioural Science Position Paper, OTM Confederated International Conferences "On the Move to Meaningful Internet Systems"

Barlas BOZKUŞ, Ş. (2014). Kültür ve Sanat Iletişimi Çerçevesinde Türkiyede Sanal Müzelerin Gelişimi. *The Journal of Academic Social Science Studies*, 8(Number: 26), 329–329. https://doi.org/10.9761/jasss2408

Baudelaire, C., Harrison, C. (1982). The Salon of 1859: The Modern Public and Photography. In F. Frascina (Ed.), *Modern Art and Modernism: A Critical Anthology*. essay, Routledge.

Baudrillard, J., Glaser, S. F. (1994). *Simulacra and simulation*. Ann Arbor, MI: Univ. of Michigan Press.

Bautista, S. S. (2013). *Museums in the digital age : Changing meanings of place, community, and culture*. ProQuest Ebook Central https://0-ebookcentral-proquest-com.opac.bilgi.edu.tr/lib/bilgi-ebooks/detail.action?docID=1574406

Benjamin, W. (1936). *The Work of Art in the Age of Mechanical Reproduction.* Illuminations. https://web.mit.edu/allanmc/www/benjamin.pdf.

Berger, J. (2008). *Ways of seeing*. British Broadcasting Corporation.

Berger, J. “John Berger / Ways of Seeing , Episode 1 (1972)” YouTube, uploaded by tw19751, 2012, https://www.youtube.com/watch?v=0pDE4VX_9Kk&t=958s&ab_channel=

Bernstein, S. (n.d.). *Gallery tag! BKM TECH*. Retrieved January 11, 2022, from https://www.brooklynmuseum.org/community/blogosphere/2010/03/25/gallery-tag/

BİA Haber Merkezi, 2021. *Sabancı Müzesi'nde Erişilebilir Bir Sergi.* Retrieved

March 6, 2022, from https://m.bianet.org/bianet/yasam/251536-sabanci-muzesi-nde-erisilebilir-bir-sergi

Bianchini, R. (2019). Virtual museums,–a history - Part 1: The origins. Retrieved March 12, 2021, from https://www.inexhibit.com/case-studies/virtual-museums-part-1-the-origins

Billinghurst M., K.H., Poupyrev I., The MagicBook: A Traditional AR Interface, Computer and Graphics, 2001. 25: p. 745-753.

Bonner, A. (2019, June 1). *The Complete Beginner's Guide to Deep Learning: Artificial Neural Networks.* Medium. Retrieved August 12, 2022, from https://towardsdatascience.com/simply-deep-learning-an-effortless-introduction-45591a1c4abb

Boniface, P., Fowler, P. J. (1993) *Heritage and Tourism in the Global Village*, London: Routledge. Created from bilgi-ebooks on 2021-01-09 10:44:46.

Bowry, S. J., Knell, S., Macleod, S. (2015). Re-thinking the curiosity cabinet: a study of visual representation in early and post modernity (dissertation). University of Leicester, Leicester, England. Retrieved from https://www.researchgate.net/publication/305641285_Re-thinking_the_Curiosity_Cabinet_A_Study_of_Visual_Representation_in_Early_and_Post_Modernity

Britannica, T. Editors of Encyclopaedia (2017). *Virtual Museum*. Encyclopedia Britannica. https://www.britannica.com/topic/virtual-museum

Britannica, The Editors of Encylopaedia. *"Alexandian Museum".* Encyclopedia Britannica, 15 Jul. 2020, https://www.britannica.com/topic/Alexandrian-Museum. Accessed 28 September 2021.

*Cabinet of curiosities.* The British Library. (n.d.). https://www.bl.uk/learning/timeline/item107648.html.

Calarco, J. (2020). *Online learning will be hard for kids whose schools close and the digital divide will make it even harder for some of them.* Retrieved 2020, from http://theconversation.com/online-learning-will-be-hard-for-kids-whose-schools-close-and-the-digital-divide-will-make-it-even-harder-for-some-of-them-133338

Calcea, N. (2021, November 18). *The 12 companies leading the way in ai*. Investment Monitor. Retrieved August 12, 2022, from https://www.investmentmonitor.ai/ai/ai-companies-innovation-globaldata

Chakraborty, K. (2021, June 29). *What is web 1.0? - definition from Techopedia*. Techopedia.com. Retrieved September 11, 2022, from https://www.techopedia.com/definition/27960/web-10#:~:text=Web%201.0%20is%20the%20term,the%20future%20of%20digital%20communications.

Charr, M. (2021). *Can Audio Tours survive social distancing?* MuseumNext. https://www.museumnext.com/article/can-audio-tours-survive-social-distancing/.

Ciaccheri, M. C. (2020, June 1). *Do virtual tours in museums meet the real needs of the public? observations and tips from a visitor studies perspective.* MuseumNext. Retrieved February 20, 2022, from https://www.museumnext.com/article/do-virtual-tours-in-museums-meet-the-real-needs-of-the-public-observations-and-tips-from-a-visitor-studies-perspective/

Ciecko, B. (2018). *North Carolina Museum of Art Launches Mobile App to Provide Themed Tours for Visitors.* Cuseum. https://cuseum.com/blog/north-carolina-museum-of-art-launches-mobile-app.

Ciecko, B. (2021, November 8). *Life & Death of QR codes in museums.* Cuseum. Retrieved August 13, 2022, from https://cuseum.com/blog/life-death-of-qr-codes-in-museums#:~:text=Early%20museum%20experimentation%20with%20QR,or%20on%20the%20object%20label.

Coşkun, C. (2021). Sanat Müzelerinde Artırılmış Gerçeklik Uygulamaları. *Güzel Sanatlar Fakültesi Dergisi*, 3, 103–123. Retrieved 2022, from https://dergipark.org.tr/en/download/article-file/2043745.

Crow, W. B., Din, H. (2009). *Unbound by place or Time: Museums and online learning.* In Unbound By Place or Time: Museums and Online Learning (p. 56). Washington, D.C: American Association of Museums.

*Culture in Crisis: Arts Fighting to Survive COVID-19 Impact*. UN News. United Nations. United Nations. Accessed January 18, 2021. https://news.un.org/en/story/2020/12/1080572.

Cumins, N. (2022). *What is projection mapping?* Business News Daily. Retrieved August 6, 2022, from https://www.businessnewsdaily.com/10527-projection-mapping-what-is-it.html

Çal, H. (2009). Osmanlı'dan Günümüze Türkiye'de Müzeler . *Türkiye Araştırmaları Literatür Dergisi*, *7*(14). Retrieved 2022, from chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dergipark.org.tr/en/download/article-file/653620.

Çetin, A. E., Gerek, O. N., Tewfik, A. H. (2000). The Topkapi Palace Museum. *Museum International,* 52(1), 22–25. https://doi.org/10.1111/1468-0033.00240

*Çocuklar, Pera Müzesi Sergilerini Rehberli Dijital Turlarla Keşfediyor.* Independent Türkçe. (2020, June 14). Retrieved September 3, 2022, from shorturl.at/abdX4

Dalí lives: *Museum brings artist back to life with ai.* Salvador Dalí Museum. (2020) Retrieved October 29, 2021, from https://thedali.org/press-room/dali-lives-museum-brings-artists-back-to-life-with-ai/.

Dawson, A. (2021). *Which museums have the biggest social media followings? The Art–Newspaper - International art news and events.* Retrieved October 24, 2021, from https://www.theartnewspaper.com/2020/03/31/which-museums-have-the-biggest-social-media-followings.

Dierking, L. D., Falk, J. H. (1998). Audience and accessibility. In S. Thomas & A. Mintz (Eds.), The virtual and the real (pp. 57– 70). Washington, DC: American Association of Museums.

Di Pietro, L., Guglielmetti Mugion, R., Renzi, M., Toni, M. (2014). An audience-centric approach for Museums sustainability. Sustainability, 6(9), 5745–5762. https://doi.org/10.3390/su6095745

Dindar, İ. (2019). *Gençlere ilham vermeye çalışıyoruz: Milliyet Sanat.*

www.milliyetsanat.com.
http://www.milliyetsanat.com/haberler/diger/genclere-ilham-vermeye-calisiyoruz-/11920.

Dollarhide, M. (2022, August 23). *Social media: Definition, effects, and list of Top apps*. Investopedia. Retrieved September 1, 2022, from https://www.investopedia.com/terms/s/social-media.asp

Economou, M., Meintani, E. (2011). Promising beginnings? Evaluating museum mobile phone apps. *Rethinking Technology in Museums,* Ireland, 2011

*Eczacıbaşı Sanal Müzesi*. Hürriyet Ana sayfa. (2000). Retrieved August 27, 2022, from https://www.hurriyet.com.tr/gundem/eczacibasi-sanal-muzesi-39211564

Eghbal-Azar, K., Merkt, M., Bahnmueller, J., Schwan, S. (2016). Use of digital guides in museum galleries: Determinants of Information Selection. *Computers in Human Behavior*, 57, 133–142. https://doi.org/10.1016/j.chb.2015.12.035

Ekinci, E. (2012, May 29). *Geleneksel sanatın iPad Ile Flörtü*. Milliyet. Retrieved August 30, 2022, from https://www.milliyet.com.tr/cadde/geleneksel-sanatin-ipad-ile-flortu-1546658

Erkmen, A., Kılıç, A. M., Kutsal, D. (2020). Accessibility of Art Museums in Istanbul during the COVID-19 Pandemic: An Evaluation via Social Media and Digital Applications. *MSGSÜ Sosyal Bilimler Dergisi*, 2(22). Retrieved 2022, from https://dergipark.org.tr/en/pub/msgsusbd/issue/69526/1107286.

Fabrikant, G. (2009). The good stuff in the back room. Retrieved April 14, 2021, from https://www.nytimes.com/2009/03/19/arts/artsspecial/19TROVE.html#:~:text=%E2%80%9CMost%20museums%20show%20between%202,what%20is%20behind%20closed%20doors.

Falk, John H., and Lynn D. Dierking. *The Museum Experience Revisited*, Taylor & Francis Group, 2012. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/bilgi-ebooks/detail.action?docID=1104662.

Fantoni, S. F. (2003). *Personalization Through It In Museums. Does It Really Work? The Case Of The Marble Museum Website.* Cultural Institutions and Digital Technology. Retrieved 2021, from https://www.archimuse.com/publishing/ichim03/070C.pdf.

Feinstein, L. (2020). *"Beginning of a new era": How culture went virtual in the face of crisis.* Retrieved November 29, 2020, from https://www.theguardian.com/culture/2020/apr/08/art-virtual-reality-coronavirus-vr

Fletcher, A., Lee, M. J. (2012). Current social media uses and evaluations in American museums. Museum Management and Curatorship, 27(5), 505–521. https://doi.org/10.1080/09647775.2012.738136

Gammon, B. (2017). *How to write an audience development plan: A quick guide - museum-id.* Retrieved February 06, 2021, from https://museum-id.com/write-audience-development-plan-quick-guide-ben-gammon/

George, T., Merkus, J. (2022, August 17). *Explanatory research: Definition,*

*Guide, & Examples.* Scribbr. Retrieved September 23, 2022, from https://www.scribbr.com/methodology/explanatory-research/#:~:text=Explanatory%20research%20is%20a%20research,occurring%2C%20and%20predict%20future%20occurrences.

Google. (n.d.). *Achievements* - Google Arts & Culture. Google. Retrieved November 16, 2021, from https://artsandculture.google.com/achievements.

Google. (n.d.). *Explore* - Google Arts & Culture. Google. Retrieved November 7, 2021, from https://artsandculture.google.com/explore.

Google. (n.d.). *6 Things to Do With Your Camera Phone at Home* - Google Arts & Culture. Google. https://artsandculture.google.com/story/5-things-to-do-with-your-camera-phone-at-home/6AISWNxkfTniIA.

Gruen, A., Remondino, F., Zhang, L. (2003). Image-based automated reconstruction of the Great Buddha of Bamiyan, Afghanistan. 2003 Conference on Computer Vision and Pattern Recognition Workshop. https://doi.org/10.1109/cvprw.2003.10003

Guggenheim. (n.d.). *Digital Guide*. Retrieved June, 2022 from https://www.guggenheim.org/plan-your-visit/resources-for-your-visit/digital-guide

Gün İsmayılov, N. (2007). *Modern Sanat Müzeleri Ve Toplum İlişkisi* (thesis). İstanbul . Retrieved 2022, from file:///Users/n63977/Downloads/190348.pdf.

Haber, A. (2006). *MUVA Virtual Museums of Arts.* Retrieved May 09, 2021, from

http://avicom.mini.icom.museum/technologies/websites/#:~:text=The%20Museo%20Virtual%20de%20Artes,educational%2C%20informative%20and%20qualitative%20nature.

Harris, J. (2012). Turning to the visitor's body: Affective exhibition and the limits of representation.
*ICOFOM Study Series*, 41, 121-133.

Harris, J. (2015). Embodiment in the Museum-What is Museum? *ICOFOM Study Series*, 101-115. doi:https://doi.prg/10.4000/iss.422

Hamilton, C., Karp, I., Kreamer, C. M., Lavine, S. D. (1993). Museums and communities: The politics of public culture. *The Journal of American History,* 80(3), 1041. doi:10.2307/2080423

Hawkey, R. (2007). Learning with Digital Technologies in Museums, Science Centres and Galleries. *HAL Open Science.* Retrieved 2022, from https://telearn.archives-ouvertes.fr/hal-00190496.

Hayes, A. (2020, December). *Augmented reality definition.* Investopedia. Retrieved August 11, 2022, from https://www.investopedia.com/terms/a/augmented-reality.asp

He, Y. (2022, April 29). *Commentary: Museums are not history. they're embracing gamification, nfts, and the metaverse.* Fortune. Retrieved June 8, 2022, from https://fortune.com/2022/04/28/museums-history-gamification-nfts-metaverse-tech-art-yizan-he/

Hegde, A. (2022). *QR codes for museums: Improve visitor experience.* Beaconstac

RSS. Retrieved August 13, 2022, from https://blog.beaconstac.com/2021/03/qr-codes-for-museums/

Hillier, L. (2021). *How museums are using immersive digital experiences (pre- and post-pandemic).* Retrieved March 21, 2021, from https://econsultancy.com/how-museums-are-using-immersive-digital-experiences/

Hooper-Greenhill, E. (2011). Museums and their visitors. Routledge. *Holograms in real life: How the Technology Works and Industry Use Cases*. Voice Cloning Software for Content Creators. (2021, February 3). Retrieved September 10, 2022, from https://www.respeecher.com/blog/holograms-real-life-technology-works-industry-use-cases

Hu, L. (2020). *Image Recognition Technology Use in Museums*. AMT Lab @ CMU. https://amt-lab.org/blog/2020/1/image-recognition-technology-in-museums.

Hylland, O. M. (2017). Even better than the real thing? Digital copies and digital museums in a Digital Cultural Policy. *Culture Unbound*, 9(1), 62–84. https://doi.org/10.3384/cu.2000.1525.179162

Istanbul Modern, I. M. O. M. A. (n.d.). *Hakkında* - İstanbul Modern. Retrieved August 19, 2022, from https://www.istanbulmodern.org/tr/muze/hakkinda_3.html

*İstanbul Modern.* İstanbul Modern. (n.d.). Retrieved August 27, 2022, from https://www.istanbulmodern.org/tr/video?v=%2Fvideo%2Fmodern-sanata-dokunun.mp4&s=%2Fvideo%2Fmodern-sanata-dokunun.jpg&w=844&h=478&autoPlay=1

*Improve your museum visitor experience with Directional Speakers.* Akoustic Arts Directional Speakers. (n.d.). Retrieved August 7, 2022, from https://www.akoustic-arts.com/blog/directional-speakers-in-museums

Jeeyun Oh, J., Sudarshan, S., Jin, E., Nah, S., and Yu, N. (2020). How 360-Degree Video Influences Content Perceptions and Environmental Behavior: The Moderating Effect of Environmental Self-Efficacy. *Sagejournals*, 42(4). https://doi.org/https://doi.org/10.1177/1075547020932174

Jung, T., tom Dieck, M. C., Lee, H.,and Chung, N. (2016). Effects of virtual reality and augmented reality on visitor experiences in museums. *Information and Communication Technologies in Tourism* 2016, 621–635. https://doi.org/10.1007/978-3-319-28231-2_45

J. Paul Getty Museum. (n.d.). *GettyGuide*. Retrieved June, 2022 from https://www.getty.edu/visit/app/

Kahraman, Z. (2021). Sanal Müzecilikte Yeni Yaklaşımlar. *Güzel Sanatlar Fakültesi Dergisi*, 3(2), 145–160. Retrieved 2022, from https://dergipark.org.tr/tr/download/article-file/2032220.

Karayılanoğlu, G., Arabacıoğlu, B. C. (2020). Digital Interactive Experiences in contemporary art museums. *Turkish Online Journal Of Design Art And Communication*, 10(4), 423–440. https://doi.org/10.7456/11004100/007

Karayılanoğlu, G. (2020*). Çağdaş Sanat Müzelerinde Dijital Etkileşimli Teknolojilerin İç Mekân Deneyimine Etkileri* (dissertation). Retrieved 2022, from https://dergipark.org.tr/en/pub/my/issue/57609/798817.

Kazimierska, M., 2020. *Going To The Louvre To See The Mona Lisa? Here's What To Expect*, The Travel. Retrieved 2022, from shorturl.at/kAIL5

Khalil, L. (2019). *The psychology of UI and UX*. Retrieved February 04, 2021, from https://medium.com/media-reflections-past-present-future/the-psychology-of-ui-and-ux-ca34c674fb88

Kızılhan, T. (2017). Evaluating The Digital Museums In Turkey via Content Analysis. *e-Journal of New Media*. Retrieved 2022, from https://www.researchgate.net/publication/317045704_evaluating_the_digital_museums_in_turkey_via_content_analysis.

Klavins, A. (2022, July 27). *7 augmented reality ideas for interactive museum experiences: Overly App*. Overly. Retrieved August 11, 2022, from https://overlyapp.com/blog/7-augmented-reality-ideas-for-interactive-museum-experiences/

*Kolekta.* Güncel sanatı keşfedin. (2021, June 11). Retrieved August 31, 2022, from https://www.kolekta.com.tr/en/

Kuo, C.-W., Lee, Y., C.,and Wang, M. C. (2016). The Digital Museum: A Case Study of Digital Applications in the National Palace Museum. *Global Journal Of Human-Social Science: A Arts & Humanities* - Psychology, 16 (2). Retrieved 2021, from https://globaljournals.org/GJHSS_Volume16/4-The-Digital-Museum.pdf.

*Kültürel Miras,* 2020. Tüik Kurumsal. (2021). Retrieved August 19, 2022, from https://l24.im/iKaGvQ

Larsen, E. (n.d.). *The work of art in the age of mechanical reproduction.*

*Modernism Lab*. https://campuspress.yale.edu/modernismlab/the-work-of-art-in-the-age-of-mechanical-reproduction/.

Lee, J.W., Lee, S.H., (2019). Digital Museum and User Experience: The Case of Google Arts & Culture, *ISEA 2019*, June 2019

Levoy, M. et al. (2000). *The digital Michelangelo Project, in 3-D Digital Imaging and Modeling.* Proceedings, Second International Conference on, Ottawa, Canada, 1999.

Levoy, M. (2002). *An interactive kiosk for the Tribune Del David*. Retrieved May 13, 2021, from https://accademia.stanford.edu/mich/kiosk/

Lewis, G. (2020). *Museum.* Retrieved 2021, from https://www.britannica.com/topic/museum-cultural-institution

Lewis, T. (2014, December 4). *A brief history of artificial intelligence*. LiveScience. Retrieved August 12, 2022, from https://www.livescience.com/49007-history-of-artificial-intelligence.html#:~:text=The%20beginnings%20of%20modern%20AI,%22artificial%20intelligence%22%20was%20coined.

Liarokapis, F., Sylaiou, S. (2010). *Experiencing personalised heritage exhibitions through multimodal mixed reality interfaces.* iUBICOM '10: The 5th International Workshop on Ubiquitous and Collaborative Computing (IUBICOM), 2020. doi:10.14236/ewic/iubicom2010.5

Loscos, C., Tecchia, f, Frisoli, A., Carrozzino, M., Ritter Widenfeld, H., Swapp , D.,and Bergamasco, M. (2004). *The Museum of Pure Form: touching real statues in an immersive virtual museum.* The 5th International Symposium on Virtual Reality, Archaeology and Intelligent Cultural Heritage,

incorporating 2nd Eurographics Workshop on Graphics and Cultural Heritage, Conscience-Auditorium, Brussels and Ename Center, Oudenaarde, Belgium, December 7-10, 2004.

Macdonald, S., Hooper-Greenhill, E. (2006). Studying Visitors. *In A companion to museum studies.* essay, Wiley-Blackwell.

Maldre, M. (2021). *Gamification of Google Arts & Culture.* Spudart. Retrieved November 23, 2021, from https://www.spudart.org/blog/google-arts-culture-badges/.

Marshall, C. (2017). *The 1991 Tokyo museum exhibition that was only accessible by telephone, fax & Modem: Features works by Laurie Anderson, John Cage, William S. BURROUGHS, J.G. Ballard & Merce Cunningham.* Retrieved April 01, 2021, from https://www.openculture.com/2017/11/the-1991-tokyo-museum-exhibition-that-was-only-accessible-by-telephone-fax-modem.html

Martin, J. (2021). *The Met Launches Virtual Art Exhibition with Augmented Reality.* Retrieved March 21, 2021, from https://www.lonelyplanet.com/articles/the-met-unframed-online

Marty, P. F. (2007). Museum websites and Museum visitors: Before and after the Museum Visit. *Museum Management and Curatorship*, 22(4), 337-360. doi:10.1080/09647770701757708

Manalac, A. (2020). *Mona Lisa: Beyond the Glass.* Virtual Reality Marketing. Retrieved January 11, 2022, from https://www.virtualrealitymarketing.com/case-studies/mona-lisa-beyond-the-glass/

Manzella, Christina, and Alex Watkins. “Performance Anxiety: Performance Art in Twenty-First Century Catalogs and Archives.” Art Documentation: *Journal of the Art Libraries Society of North America*, vol. 30, no. 1, [The University of Chicago Press, Art Libraries Society of North America], 2011, pp. 28–32, http://www.jstor.org/stable/27949564.

McCouat, P. (n.d.). Early Influences of Photography on Art - Part 1. *Journal of Art in Society*. Retrieved 2022, from https://www.artinsociety.com/pt-1-initial-impacts.html#:~:text=Baudelaire%20described%20photography%20as%20%’2%80%9Cart's,bourgeois%20class%E2%80%9D%20%5B13%5D.

Mclean, F. *Marketing the Museum*, Taylor & Francis Group, 1997. ProQuest Ebook Central, http://ebookcentral.proquest.com/lib/bilgi-ebooks/detail.action?docID=166763.

Mehdi, S. (2017). *Summary “The work of art in the age of its Technological Reproducibility”.* Medium. https://medium.com/@shahbazmehdi/summary-the-work-of-art-in-the-age-of-its-technological-reproducibility-ea073a48cc2b.

*M. F. Husain: An AI Experience at the Museum.* MAP. (2022, August 18). Retrieved September 10, 2022, from https://map-india.org/the-ai-husain-experience/

Milgram, P., Kishino, F. (1994). A Taxonomy of Mixed Reality Visual Displays. *IEICE Transactions on Information and Systems*, E77-D. Retrieved 2022, from

https://www.researchgate.net/publication/231514051_A_Taxonomy_of_Mixed_Reality_Visual_Displays/citations.

*Mobile vs. desktop internet usage (latest 2022 data).* BroadbandSearch.net. (2022). Retrieved January 30, 2022, from https://www.broadbandsearch.net/blog/mobile-desktop-internet-usage-statistics

Mohamed, F., Pescarin, S., (2013). Terminology, Definitions, and Types for Virtual Museums (Rep.). *Virtual Museum Transnational Network*. (V-must) Retrieved 2021, from https://www.academia.edu/6090456/Terminology_definitions_and_types_of_Virtual_Museums.

Mokrohajská, B. (2020). What is a Wunderkammer? BEST cabinets of CURIOSITIES: *DailyArt.* Retrieved March 14, 2021, from https://www.dailyartmagazine.com/cabinets-of-curiosities/

Moma design store. *MoMA Design Store.* (n.d.). Retrieved October 24, 2021, from https://store.moma.org/.

Moore, L. (2020, February 4). *Smart museums: How RFID is making its mark.* atlasRFIDstore. Retrieved August 22, 2022, from https://www.atlasrfidstore.com/rfid-insider/smart-museums-how-rfid-is-making-its-mark

Morris, L. G. (2020, March). *The physical museum must evolve. Can spatial design help?* Retrieved November 03, 2020, from https://www.frameweb.com/article/the-physical-museum-must-evolve-can-spatial-design-help

Mosley, I. (Ed.). (2000). *Dumbing down: Culture, politics and the mass media*. Imprint Academic. Retrieved 2022, from https://books.google.com.tr/books?id=RpmRUkuGfFsC

*Most used social media 2021*. Statista. (2022). Retrieved January 30, 2022, from https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/

*Museums.* UNESCO. (2020, September 18). Retrieved December 19, 2021, from https://en.unesco.org/themes/museums

*Museum Definition.* (n.d.). Retrieved December 28, 2020, from https://icom.museum/en/resources/standards-guidelines/museum-definition/

*Museum of Rapid Transition: Museums in a world facing existent–al crisis.* Museum-ID. (2019, April 10). Retrieved December 29, 2020, from https://museum-id.com/museum-of-rapid-transition-the-role-of-museums-in-a-world-facing-existential-crisis/

*Museum of the World.* (n.d.). The British Museum & Google Cultural Institute. Retrieved June, 2022 from https://britishmuseum.withgoogle.com/

Network of European Museum Organisations, (2020). *Survey on the impact of the COVID-19 situation on museums in Europe Final Report (Rep.).* Retrieved May, 2021, from https://www.ne-mo.org/fileadmin/Dateien/public/NEMO_documents/NEMO_COVID19_Report_12.05.2020.pdf.

Neufang, R. (1994). *Le WebLouvre*, Paris. Retrieved April 18, 2021, from http://www.bowdoin.edu/~samato/IRA/reviews/issues/dec94/louvre.html

*New York : Metropolitan Museum of Art.* (1995). Press release issued by the Metropolitan Museum of Art. libmma.contentdm.oclc.org. https://libmma.contentdm.oclc.org/digital/collection/p16028coll12/id/11107/.

Norton , M. I., Mochon , D.,and Ariely , D. (2011). The “IKEA Effect”: When Labor Leads to Love. *Harvard Business School*, Cambridge. https://www.hbs.edu/ris/Publication%20Files/11-091.pdf.

Okuyan, H., Taslaman, C. (2018). The Concept of Seduction in Jean Baudrillard's Simulation Theory. *International Journal of Religion & Philosophy Studies,* 1(1).

*Our mission at smartify.* Smartify. (n.d.). Retrieved June 11, 2022, from https://about.smartify.org/about-us/mission-statement

*Osman Hamdi Bey'in Dünyasına Yolculuk Sanal Gerçeklik Deneyimi.* Pera Müzesi. (2019). Retrieved June 12, 2022, from https://www.peramuzesi.org.tr/sergi/osman-hamdi-bey%E2%80%99in-dunyasina-yolculuk-sanal-gerceklik-deneyimi/260

Özrili, Y. (2020). Müzelerde Markalaşma ve Kurumsal Kimlik. *Bitlis Eren Üniversitesi Sosyal Bilimler Dergisi*. https://doi.org/10.47130/bitlissos.675597

Padilla-Meléndez, A., del Águila-Obra, A. R. (2013). Web and social media

usage by museums: Online value creation. *International Journal of Information Management*, 33(5), 892–898. https://doi.org/10.1016/j.ijinfomgt.2013.07.004

Parry, R. (2013). *Museums in a digital age*. London: Routledge. Retrieved 2021, from https://www.routledge.com/Museums-in-a-Digital-Age/Parry/p/book/9780415402620

Pera Müzesi: *Bir Rüyanın inşası – 3 boyutlu Sergi Turu. Pera* Müzesi | Bir Rüyanın İnşası – 3 Boyutlu Sergi Turu. (n.d.). Retrieved October 25, 2021, from https://www.peramuzesi.org.tr/3b-tur/bir-ruyanin-insasi/.

Perry, S., Roussou, M., Economou, M., Young, H.,and Pujol, L. (2017). *Moving beyond the virtual museum: Engaging visitors emotionally*. 2017 23rd International Conference on Virtual System & Multimedia (VSMM). https://doi.org/10.1109/vsmm.2017.8346276

Pescarin, S. (2014). Museums And Virtual Museums in Europe: Reaching Expectations. *SCIentific RESearch and Information Technology*, 4(4), 131-140. doi:10.2423/i22394303v4n4p131

Pietroni, E., Pagano, A.,and Fanini, B. (2018). UX designer and software developer at the Mirror: ASSESSING sensory immersion and emotional involvement in Virtual museums. *IUScholar Works Journal*, 2(1), 13–41. https://doi.org/10.14434/sdh.v2i1.24634

Porter, H. (2017, March 18). *What is an ecomuseum?* Retrieved January 27, 2021, from https://ecomuseums.com/what-is-an-ecomuseum/

Proctor, N. (2011). The Google Art Project: A New Generation of Museums on

the Web? Curator: *The Museum Journal*, 54(2), 215–221. https://doi.org/10.1111/j.2151-6952.2011.00083.x

Quackenbush, C. (2016, February 22). *These ISIS-destroyed artifacts are now available to download and 3-D print*. Observer. Retrieved November 1, 2021, from https://observer.com/2016/02/these-isis-destroyed-artifacts-are-now-available-to-download-and-3-d-print/.

Reuter, P., Granier, X., Graf, H., Corsini, M., Pagano, A., Farouk, M. (2014). Virtual Museums evaluation on portability, tangible visualisation and interaction techniques: Methodological guidelines with respect to portability, usability and integration.

Rodini, E. (2019). *A Brief History of the Art Museum.* Retrieved March 14, 2021, from https://www.khanacademy.org/humanities/approaches-to-art-history/tools-for-understanding-museums/museums-in-history/a/a-brief-history-of-the-art-museum-edit

Rodney, S. (2016, July 7). *A Brooklyn Museum App Encourages Visitors to Ask Questions*. Hyperallergic. https://hyperallergic.com/300564/a-brooklyn-museum-app-encourages-visitors-to-ask-questions/.

Rosenblum, N. (2000, last edited in 2021). *History of photography*. Encyclopædia Britannica. Retrieved January 4, 2022, from https://www.britannica.com/technology/photography

*"Revolution : Velvetx digital" , museums and freedom of information 30 years after the fall of the Iron Curtain.* (2019). Retrieved March 15, 2021, from https://icom.museum/en/news/revolution-velvet-x-digital-museums-and-freedom-of-information-30-years-after-the-fall-of-the-iron-curtain/

Richardson, J. (2020). *What's next for Museum Audio Guides.* https://www.museumnext.com/wp-content/uploads/2020/09/museummate_research_report-1.pdf.

Richardson, J. (2021, March 8). *How are some of the world's best known museums doing amazing things with 3D printing?* MuseumNext. Retrieved August 14, 2022, from https://www.museumnext.com/article/how-museums-are-using-3d-printing/

Richardson, J. (2021, August 31). *How are museums using artificial intelligence, and is AI the future of Museums?* MuseumNext. Retrieved August 13, 2022, from https://www.museumnext.com/article/artificial-intelligence-and-the-future-of-museums/

Sanal Müze - T.C. Kültür ve Turizm Bakanliği. SANAL MÜZE - T.C. KÜLTÜR VE TURİZM BAKANLIĞI. (n.d.). Retrieved August 25, 2022, from https://sanalmuze.gov.tr/

Schweibenz, W. (2004). The Development of Virtual Museums. Retrieved 2022, from https://moam.info/the-development-of-virtual-museums_5a59810e1723dd9dc97e9053.html.

Shafernich, S. M. (1993). On-site museums, open-air museums, museum villages and Living History Museums: Reconstructions and period rooms in the United States and the United Kingdom. *Museum Management and Curatorship*, 12(1), 43–61. https://doi.org/10.1016/0260-4779(93)90005-a

Shneiderman, B. (2003). *Leonardo's laptop human needs and the new computing technologies*. Cambridge, Mass: MIT Press. Retrieved 2021, from https://0-eds-a-ebscohostcom.opac.bilgi.edu.tr/eds/ebookviewer/ebook/ZTAwMHh3d19f

NzgwOTFfX0FO0?sid=c692dbb1-4297-4e0b-b52d-ef439945729d@sdc-v-sessmgr02&vid=3&format=EB&rid=14.

Skov, M., Ingwersen, P. (2014). Museum web search behavior of special interest visitors. *Library Information Science Research*, 36(2), 91-98. doi:10.1016/j.lisr.2013.11.004

Smith, D. (2003). The surrogate vs. the thing. Art Documentation. *Journal of the Art Libraries Society of North America,* 22(2), 11–15. https://doi.org/10.1086/adx.22.2.27949fvirtual259

Sparacino, F. (2002). *The museum wearable.* Retrieved May 01, 2021, from https://www.archimuse.com/mw2002/papers/sparacino/sparacino.html

Stenson, B. (2018, July 26). *Paris's first Digital Art Museum: All lit up at Atelier des Lumières.* The Guardian. Retrieved August 6, 2022, from https://www.theguardian.com/travel/2018/jul/26/atelier-des-lumiere-paris-digital-art-museum-klimt

Sucaklı, G., Güzel , T. (2020). Müze turizminde artirilmiş gerçeklik teknolojisi uygulamalari; Dünya ve Türkiye örnekleri. *Journal of Tourism Research Institute*. Retrieved 2022, from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dergipark.org.tr/en/download/article-file/1609728.

Sundar, S. S., Go, E., Kim, H.-S.,and Zhang, B. (2015). Communicating Art, Virtually! psychological effects of technological affordances in a virtual museum. *International Journal of Human-Computer Interaction*, 31(6), 385–401. https://doi.org/10.1080/10447318.2015.1033912

*Talk to Me: Tate Trumps*. MoMA. (2010).

https://www.moma.org/interactives/exhibitions/2011/talktome/objects/140016/.

Tallon, L. (2017). *Digital Is More Than a Department, It Is a Collective Responsibility.* metmuseum.org. Retrieved September 24, 2021, from https://www.metmuseum.org/blogs/now-at-the-met/2017/digital-future-at-the-met.

TC Kültür ve Turizm Bakanlığı Kültür Varlıkları ve Müzeler Genel Müdürlüğü. Kültür Varlıkları ve Müzeler Genel Müdürlüğü - T.C. Kültür ve Turizm Bakanlığı. (n.d.). Retrieved August 19, 2022, from shorturl.at/lyILS

*The Met Collection.* Metmuseum.org. (n.d.). Retrieved October 3, 2022, from https://www.metmuseum.org/art/the-collection#start-exploring

*The British Museum Official Website*. (n.d.). Retrieved from http://www.britishmuseum.org/

*The British Museum.* Sketchfab. (2014). Retrieved June, 2022, from https://sketchfab.com/britishmuseum

The Editors of Encyclopaedia Britannica. (2022). *Ashmolean Museum*. Encyclopædia Britannica. Retrieved June 25, 2022, from https://www.britannica.com/topic/Ashmolean-Museum

The Frick Collection (n.d.). *Cocktails with a Curator*. Retrieved April 19, 2021, from https://www.frick.org/interact/miniseries/cocktails_curator

The Met Museum. (n.d.). *The Met App is Now Available on Android Smartphones.* Retrieved June, 2022 from https://www.metmuseum.org/press/news/2015/met-app-for-android

*The Seat of the Muses*. (2018). Retrieved January 09, 2021, from https://expandthevisual.com/the-seat-of-the-muses/

Tom Dieck, M. C.,and Jung, T. (2015). A theoretical model of mobile augmented reality acceptance in urban heritage tourism. *Current Issues in Tourism*, 21(2), 154–174. https://doi.org/10.1080/13683500.2015.1070801

Tomlin, D. (2021). *Google's Gigapixel "Art Camera". Expressing Your Vision*. Retrieved November 13, 2021, from https://dawntomlincreativeartist.com/2021/02/06/googles-gigapixel-art-camera/.

Tsirulnik, G. (2017). *Mobile phone ranked most used electronic device: Forrester. Marketing Dive.* https://www.marketingdive.com/ex/mobilemarketer/cms/news/research/7473.html#:~:text=technology%20adoption%20finds%20that%2073,third%2Dmost%2Dused%20device.

Tucci, L. (2014). *What is information age?.* SearchCIO. Retrieved May 4, 2022, from https://www.techtarget.com/searchcio/definition/Information-Age

Turkish Museums. (n.d.). Retrieved August 27, 2022, from https://turkishmuseums.com/?langId=1

Turkish Museums [@officialturkishmuseums]. (n.d.). [Instagram profile]. Retrieved 2022 from https://www.instagram.com/officialturkishmuseums/?hl=en

Ubiquity staff. (2002). The new computing. *Ubiquity*, 2002(September), 1. https://doi.org/10.1145/763932.763933

Uluğ, A. B. (2020). *Müze Sergilerinde Artırılmış Gerçeklik Uygulamaları (thesis).* ResearchGate, Istanbul.

Undeen, D. (2013). *Good Photographs Make for Great Digital 3D Models*. Metmuseum.org. Retrieved October 6, 2022, from https://www.metmuseum.org/blogs/digital-underground/posts/2013/photographs-for-digital-3d-models

Vargün, Ö. (2022). Teknolojinin Belirleyiciliğinde Müzelerde Dijitalleşme Süreci Ve İnsan Odakli Tasarim Yaklaşimlari. *İdil*. https://doi.org/10.7816/idil-11-92-09

V&A · *sound in museums: New engagements, new tool, new audiences. Victoria and Albert Museum*. (2019). Retrieved August 7, 2022, from https://www.vam.ac.uk/research/projects/sound-in-museums-new-engagements-new-tool-new-audiences

Velazquez, R. (2022). *Artificial Intelligence*. BuiltIn. Retrieved August 12, 2022, from https://builtin.com/artificial-intelligence

Verde, A., Valero, J. M. (2021). Virtual Museums and Google Arts & Culture: Alternatives to the face-to-face visit to Experience Artrt. *International Journal of Education and Research*, 9(2). Retrieved 2021, from https://www.ijern.com/journal/2021/February-2021/05.pdf.

Vieira, T. (2020). *A brief history of UX design and its evolution.* Retrieved February 02, 2021, from https://thenextweb.com/syndication/2020/01/26/a-brief-history-of-ux-design-and-its-evolution/

*Virtual Museum.* (n.d.). Retrieved January 31, 2021, from https://www.britannica.com/topic/virtual-museum

*Virtual.* (n.d.). Retrieved March 12, 2021, from https://dictionary.cambridge.org/dictionary/english/virtual

Walsh, D., Hall, M. M., Clough, P., Foster, J. (2018). Characterizing online museum users: A study of the National museums LIVERPOOL Museum website. *International Journal on Digital Libraries*, 21(1), 75-87. doi:10.1007/s00799-018-0248-8

Wang, H.,and Sun, C. T. (2012). *Game Reward Systems: Gaming Experiences and Social Meanings.* https://www.researchgate.net/publication/268351726_Game_Reward_Systems_Gaming_Experiences_and_Social_Meanings.

Wang, Q., Li, R., Wang, Q.,and Chen, S. (2021). Non-fungible token (NFT): Overview, evaluation, opportunities and challenges. *arXiv preprint arXiv:2105.07447.*

*What is a website? - definition from Techopedia.* Techopedia.com. (2020). Retrieved October 3, 2022, from https://www.techopedia.com/definition/5411/website

White, M. (1997). *Where Is the Louvre?* [PDF]. Santa Cruz: Univeristy of California, Santa Cruz.

White, M., Petridis, P., Liarokapis, F.,and Walczak, K. (2–04). *ARCO - an architecture For Digitization, management and presentation of virtual exhibitions.* Proceedings Computer Graphics International, 2004. doi:10.1109/cgi.2004.1309277

White, M., Petridis, P., Liarokapis, F.,and Plecinckx, D. (2007). Multimodal mixed
reality interfaces for visualizing digital heritage. *International Journal of Architectural Computing*, 5(2), 321-337. doi:10.1260/1478- 0771.5.2.322

*Why Cuseum?.* (n.d.). Cuseum. Retrieved June, 2022 from https://cuseum.com/why-cuseum

Wigmore, I. (2016, August 18). *What is Cave (Cave Automatic VIRTUAL Environment)?* - WhatIs.com. shorturl.at/vyzCP

Yuna, P. (2021, October 5). *Leeum Museum of Art suggests redefining who we are.* The Korea Herald. Retrieved August 7, 2022, from https://www.koreaherald.com/view.php?ud=20211005001034

## APPENDIX

This chart contains the most used digital applications, contents, and social media accounts of the world's top 20 and Turkey's top 5 museums.*

| Name | Place | Website | Virtual Tour | Google Arts & Culture | Google Arts & Culture Virtual Tour | 360 Degree Video | Youtube Channel | Instagram | Twitter | Facebook |
|---|---|---|---|---|---|---|---|---|---|---|
| WORLD | | | | | | | | | | |
| Louvre Museum | Paris | Link | Partial | Link | - | Link | Link (93.3K) | Link (4,8M) | Link (1.5M) | Link |
| J. Paul Getty Musem | Los Angeles | Link | - | Link | Link | - | Link (120K) | - | Link (1.3M) | Link |
| Pergamon Museum | Berlin | Link | - | Link | Link | - | Link (6.87K) | - | - | Link |
| The British Museum | London | Link | - | Link | Link | - | Link (511K) | Link (2M) | Link (2M) | Link |
| Rijksmuseum | Amsterdam | Link | Link | Link | Link | - | Link (15K) | Link (720K) | Link (260K) | Link |
| Uffizi Gallery | Florence | Link | Link | Link | Link | - | - | Link (700K) | Link (60B) | Link |
| Victoria and Albert Museum | London | Link | - | Link | - | - | Link (241K) | Link (1.6M) | Link (1.3M) | Link |
| Solomon R. Guggenheim Museum | New York | Link | Link | Link | Link | - | Link (39K) | Link (2.6M) | Link (3.4M) | Link |
| Museum of Modern Art (MoMA) | New York | Link | - | Link | - | - | Link (459K) | Link (5.5M) | Link (5.3M) | Link |
| Metropolitan Museum of Art | New York | Link | Link | Link | Link | Link | Link (309K) | Link (4M) | Link (4.3M) | Link |
| Museo del Prado | Madrid | Link | - | Link | - | - | Link (141K) | Link (914K) | Link (1.2M) | Link |
| Hermitage Museum | St Petersburg | Link | Link | Link | Link | Link | Link (82.7K) | Link (962K) | Link (4K) | Link |
| Musée d'Orsay | Paris | Link | - | Link | Link | - | Link (33K) | Link (1.3M) | Link (745K) | Link |
| Van Gogh Museum | Amsterdam | Link | Link | Link | Link | - | Link (41.1K) | Link (2.1M) | Link (1.6M) | Link |
| Whitney Museum of American Art | New York | Link | Link | Link | - | - | Link (18.5K) | Link (1.1M) | Link (1M) | Link |
| The Art Institute of Chicago | Chicago | Link | - | Link | Link | - | Link (32.7K) | Link (685K) | Link (375K) | Link |
| Brooklyn Museum | New York | Link | Link | Link | - | - | Link (13K) | Link (1M) | Link (657K) | Link |
| National Gallery of Art | Washington, D.C. | Link | Link | Link | - | - | Link (32.5K) | Link (487K) | Link (290K) | Link |
| The Egyptian Museum | Kahire | Link | Link | Link | - | - | - | Link (1853) | Link (28K) | Link |

| Name | Place | Website | Virtual Tour | Google Arts & Culture | Google Arts & Culture Virtual Tour | 360 Degree Video | Youtube Channel | Instagram | Twitter | Facebook |
|---|---|---|---|---|---|---|---|---|---|---|
| TURKEY | | | | | | | | | | |
| Rahmi Koç Museum | İstanbul | Link | | - | - | Link | - | Link (30K) | Link (12K) | Link |
| Sakıp Sabancı Museum | İstanbul | Link | | Link | Link | Link | Link (4.83K) | Link (197K) | Link (466K) | Link |
| Borusan Contemporary | İstanbul | Link | - | Link | Link | - | Link (470) | Link (90K) | Link (32M) | Link |
| İstanbul Museum of Modern Art | İstanbul | Link | Link | Link | - | - | Link (11K) | Link (348K) | Link (2.8M) | Link |
| Pera Müzesi | İstanbul | Link | Link | Link | Link | - | Link (14K) | Link (226K) | Link (485K) | Link |

**This data was collected during the period of the thesis was written, between November 2021 and February 2022. Inputs and links can be changed.*

**Interview with Hazal Altun (Digital Platforms and Social Media Supervisor for Pera Museum Communications Team), 23 February 2022**

1-How was the digitalisation process of the Pera museum, and can you talk about the digital applications made in the museum?

Digitalisation is not just something that stands out in the pandemic. Pera Museum is an institution that always follows this. In 2008, a department for social media and public outreach was established. Afterward, the museum was started to present at Google Arts and Culture in 2012. Different collections are digitalised and exhibited, such as works in the Orientalist Painting Collection, Anatolian Weights and Measures Collection, Kütahya Tiles and Ceramics Collection. Thus, we provide not only spatial access but also unlimited access to digital spaces that are entirely open to the public. Here, of course, a part of museology includes spatiality and locality, but in this way, digitalisation also indicates your place on that global stage. Of course, the Pera Museum is a place that always cooperates with international institutions, but digitalisation is something that goes beyond the limits of visiting

the museum. That's why it’s a crucial area. We also use virtual reality technology. In 2019, we had an experience designing a virtual reality that enables the audience to pay a visit to Osman Hamdi Bey’s working space, to analyse in detail the books which inspired his works, his brushes and personal items, and step into his painting The Tortoise Trainer, where they can look the artist in the eye. The visitors could experience this before the pandemic. We are currently on hold as it is a situation that requires close contact with the devices and the guide. It may reopen as conditions change. Apart from that, all our process and collection exhibitions, in fact, all of our exhibitions that you can see in the museum, are transferred to digital in three dimensions that have become part of the installation process. It offers our visitors and followers the opportunity to visit the exhibitions whenever and wherever they want. This ensures that the exhibition is known not only to the physical visitors but also to digital audiences. All of our exhibitions that you can see in the museum are transferred to a digital environment.

-How do you evaluate the feedback of your visitors? How do you plan digitalisation progress of the museum?

Currently, all the exhibitions at Pera Museum are presented to the audience in three dimensions. Also, we partnered with Google Arts and Culture to strengthen persistence. At the same time, the aim was to turn Suna and İnan Kıraç Foundation’s collections into open sources accessible to everyone.
We have accomplished successful projects as we have always progressed in a way that meets this need and demand. The increasing number of physical and digital visitors to the Pera Museum ensures the continuity of such practices.

-As far as I know, Pera Museum does not have an application at the moment. What is the main reason why you choose not to design a mobile app?

Everything in Pera Museum can be followed on our website. Collections, exhibitions, Pera Film and Pera Learning programs, and events can also be followed

on the website. That’s why we use our website as the main platform. Apart from this, we are working to reach more people by using social media platforms.

-What do you think about the digitalisation processes of museums? Do you believe digitalisation harms the museum concept or affects the museum's development positively?

The museum’s website is a platform that can be viewed and shared with content and information for spending quality time rather than just the motivation to come to an event, visit the museum, or do something about it. For this reason, our website visitor puts it among the sites people visits every day, rather than looking at the exhibitions or visiting the rules. We are working on this position, we have a page called “Explore!” that is like a secondary home page.
“Explore!” is a feed where you can read stories, and articles, learn about artworks and objects, and take a look at past exhibitions. It aims to be an accessible digital data source. Therefore, our website visitors are not only visitors to the museum, and we can see this from the numerical data. That's why it already aims to adapt to digitalisation and make everything accessible, even during physical access restrictions. Since it didn't start with this pandemic, it's a corporate perspective for us. Realising projects both in the physical space and in the digital area. Of course, especially during the pandemic period, this has become a question, especially on museology platforms. But having both physical and digital space is not a process that will destroy each other, but rather one that will support each other.