



## **Art and Museums in the Digital Age: An Overview of the Concepts and Spatial Design**

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### **ABSTRACT**

Starting in the 20th century, with the acceleration of technological developments, the increasing use of technology, and the change in social structures due to the computer or the internet, there has been a transition to the so-called 'technological age', or 'digital age'. With these technological developments, the products of the 'individual', whose perception has changed, define the past, culture, and future through art in order to exist in the society that surrounds it, to sustain its existence, and to internalize the culture of the society. Digital art is located at the intersection of culture, art, media, contemporary art, digitalization, and technology. Digital art enables both visual thinking and software skills to be learned together. At the same time, the process of creating dynamic images using digital applications requires a multifaceted design phase. Through digital art, the viewer who examines the work of art has become active. Digital art transforms the traditional understanding of art and changes the way artworks are created and experienced. By interacting with the artwork, viewers have become active participants and users of artwork. In the digital age, the exhibition of art on digital platforms enables art to reach wider audiences. This situation has made participants/users eager to visit. In addition, digital museums and digital exhibitions are attracting a lot of attention and their number is increasing every year. Digital art therapy is a rapidly growing practice in recent years. With the opportunities brought by the digital age, digital art brings along a new search for aesthetics and meaning in the art world. In this research, the concept of digital art in the digital age and the works published in this field are examined as an area that has been widely discussed and attracted attention in recent years. This research aims to contribute to the field by focusing on digital art, digital museums and digital exhibitions. In addition, in order to make the existing publications visible, the texts will be visualized to make them more effective for the reader.

**Keywords:** Digital age, digital art, digital museum, technology, keyword and visual analysis.

### **1. INTRODUCTION**

In the 20th century, with the acceleration of technological developments, increasing use of technology, and the change in social structures due to computers or the internet, the transition to the period called the 'digital age' / 'technological age' or "information age" (TDK, 2024) was made. With these technological developments, the products of the



'individual', whose perception has changed, define the past, culture, and future through art to exist in the society surrounding it, sustain its existence and internalize the culture of the society. In the 20th century, with the acceleration of technological developments, the increasing use of technology, and the change in social structures due to the computer or the internet, there has been a transition to the so-called 'technological age', or 'digital age'. With these technological developments, the products of the 'individual', whose perception has changed, define the past, culture, and future through art in order to exist in the society that surrounds it, to sustain its existence, and to internalize the culture of the society. Digital art is located at the intersection of culture, art, media, contemporary art, digitalization, and technology. Digital art enables both visual thinking and software skills to be learned together. At the same time, the process of creating dynamic images using digital applications requires a multifaceted design phase. Through digital art, the viewer who examines the work of art has become active. Digital art transforms the traditional understanding of art and changes the way artworks are created and experienced. By interacting with the artwork, viewers have become active participants and users of artwork. In the digital age, the exhibition of art on digital platforms enables art to reach wider audiences. This situation has made participants/users eager to visit. In addition, digital museums and digital exhibitions are attracting a lot of attention and their number is increasing every year.

Digital art therapy is a rapidly growing practice in recent years. With the opportunities brought by the digital age, digital art brings along a new search for aesthetics and meaning in the art world. What is the digital age? The digital age, also known as the information age (German: Informationszeitalter; English: Information Age), is a historical period and process based on information technology that began in the twentieth century (Figure 1). It is defined by a quick shift from the industrialized economy ushered forth by the Industrial Revolution. The term digital age refers to a period in human history marked by the development of digital information and communication technology. As a result, the digital age refers to the period of digital change and transformation caused by digitalization, during which digital technologies have advanced to the point where they have had a formative impact on people's lives (Lengsfeld, 2024).

In literature music in the digital age (Tepper & Hargittai, 2009), painting (Serafini et al., 2016), education (Bowen, 2015), reading (Baron, 2017), learning (Grand-Clement, 2017), art (Wands, 2007), architecture (Kolarevic, 2003), architectural modeling (Stavric et al., 2013), art, culture, and design (Lovejoy, 2004; Mura, 2015; Shen & Yu, 2021). The digital age concentrates on eight themes (Alberts et al., 1997). These include: 1) Advanced semiconductors, 2) Advanced computers, 3) Fiber optic conductors, 4) Cellular (mobile) communication technologies, 5) Artificial satellite technology, 6) Digital (numeric) communication and data compression, 7) Advanced computer networks, and 8) Enhanced human-computer interaction.

This article aims to evaluate digital art and digital museums in the digital age from a general perspective. For this purpose, a general evaluation was made of art and museums in the process that developed with digitalization. The current situation regarding digital art themes worldwide and in Turkey is explained. In addition, word and visual analyses of physical and art museums have also been presented. The research aims to provide a general perspective for those interested in this field. There will be significant developments in this field in the future with technologies such as virtual reality, augmented reality, and the metaverse.

The focus of this article is on the topic and research questions;

A) What is digital art? B) What are the platforms/applications/software used for digital art and design? C) What is the meaning of a digital museum? D) How to design a digital museum? E) What is the difference between a traditional/physical museum and a digital

museum? F) Which software and technological elements are used in digital museums? G) Which digital museums are there in the world? H) What are the themes of digital museums?



Figure 1 Digital Age (INC, 2024)

### 1.1. Digital Art

Digital art is a type of art that emerged as a result of the combination of traditional art disciplines with digital technologies. This type of art is produced using computers, digital cameras, software programs, and other digital tools. Digital art gives artists greater creative freedom and flexibility because they can go beyond boundaries and combine different techniques and styles in the digital environment. The topics that researchers focus on digital art are digital art history (Manovich, 2015; Baca et al., 2019; Brey, 2021; Russell, 2024) and digital art (Lieser et al., 2009; Drucker, 2013; Paul, 2023). Digital art and the metaverse (Hurst et al., 2023). Some research suggests that digitalization has changed the way we see and relate to art in the digital age. How have advancing technologies, widespread distribution, and screen interaction changed our perceptual field (Kholeif, 2018)? Digital artworks are often displayed on digital screens and offer interactive experiences to art lovers (Wands, 2007). Digital art refers to computer-generated artworks and does not only consist of code, software, or data. Digital art includes installations, performative works, and works produced through digital media. The use of digital technologies forms the basis of digital art, and generative software and interactive artworks are also included under the umbrella of digital art. After the Industrial Revolution, the effects of Industry 4.0 on digital art have started to be seen in galleries, biennials, fairs, and museums. These spaces offer new perspectives on the art and audiences of the future, with new ways of seeing shaped by digital art (Erby & Uz, 2022: 143).

According to Avila and Bailey (2016), after the 1970s, organizations began to incorporate computer design into the fine arts curriculum. Computer art became popular in the 1980s, thanks to widespread computer use and a variety of already prepared painting applications. At the same time, computer graphics and special effects have gained popularity in the entertainment industry through Hollywood films, television shows, and video games. By 1990, computers had become the norm in visual and performing arts (Avila & Bailey, 2016). Digital art announces a new age in the art world, demonstrating the impact of technology on the growth of art. Artists are pushing the boundaries by reimagining conventional art forms and creating creative works with digital tools. Digital art makes art more accessible and empowers creators. Digital art forms can be classified as digital imaging (photography and printing), sculpture, installation art, video and animation, painting, sound and music, and software art (Toptaş, 2022). In recent years, the subject of digital media art has attracted attention, and the number of studies on the subject is increasing in the digitalizing world (Rinehart, 2007; Gong, 2021; Qian, 2022; Li & Xiong, 2022; Gui-wei & Guo-bao, 2024).

Digital artworks are works produced through digital technologies and are usually exhibited in digital environments. They can be created with computer graphics, digital photographs,



interactive installations, virtual reality experiences (Li, Lin, and Tian, 2024), and other digital media. Digital artworks have the potential to provide viewers with an interactive and experimental experience, and artists can use elements such as sound, movement, and time in digital environments to enable viewers to interact with the artworks. In this way, digital artworks encourage active participation rather than passive spectatorship, creating a closer relationship between art and the viewer. Digital artworks reflect the advances of technology in the art world and the transformation of art. Artists can develop new forms of expression and expand the universal language of art. Digital art can be a field that shapes the future development of art and allows for the creation of innovative and inspiring works.

## **1.2. Digital Museum**

Museums preserve human creativity and culture, share knowledge, promote research, contribute to education, and serve cultural development. Digital technologies help museums fulfill their functions and serve the public more effectively. With the digital transformation, museums have started to accept technology and offer online interaction opportunities (Winesmith & Anderson, 2020). With these changes, the concept of the digital identity of museums has gained importance. The digital identity of museums reflects how they respond to technological innovations, how they accept technologies, and how they develop their digital assets. In the digital age, museums are changing the meaning of place, community, and culture (Bautista, 2013). The digital identity of museums expects museums that invest in digitization and innovative development to have positive impacts on culture and society. Some of these positive impacts include the presentation of free, authentic, and rational knowledge to all humanity in a socially egalitarian and just manner (Tuğal, 2022). In this process, the digital identity of museums is shaped by factors such as content production, designing digital exhibitions, and attracting online audiences. The digital identity of museums includes virtual museums as digital extensions of physical museums (Povroznik, 2024).

According to Bostancı (2019), a digital museum is a virtual platform that uses digital technology to showcase artworks and cultural heritage online, providing a unique perspective to traditional museum experiences. Digital museums allow visitors to see and discover works of art. They enable visitors to view them online without physically visiting a museum (Rzayeva, 2019). Nonetheless, while the concept of digital museums has received a lot of attention over the last decade, there are still many hurdles to overcome (Li et al., 2012; Bonnefoit & Rerat, 2018). These platforms frequently display artworks with high-resolution visuals and interactive experiences, allowing viewers to examine and interact with them in depth (Ayu & Octavanny; Hutagaol & Simanjuntak, 2023).

Digital museums can also be used to demonstrate how art has grown in the digital age and how technology has impacted the art experience. These platforms can reach a larger audience while also providing art enthusiasts with fresh and inventive experiences (Parry, 2013). Software applications serve as canvases for art; software packages with broad accessibility, such as three-dimensional modeling, Illustrator, and Photoshop, propel digital art to new heights (Karaöz).

Digital museums make art more accessible by letting art enthusiasts interact with artworks and experience its power (Povroznik, 2024). In addition, several strategies are being developed to maintain these digital resources (Zhao et al., 2023). Digital museums include different interactive technological elements such as digital media, virtual reality (Li & Lin & Tian, 2024), augmented reality, and touch screens. These technologies include "artificial intelligence," "virtual reality," "interactive screens," "infrared," and "depth sensors." In the museum, which is the meeting point of local creativity with a global experience, software such as virtual reality (VR) (Luo, Aumeboonsuke, and He, 2024) and augmented reality (AR) software, touch screen software, mobile application development software, interactive surface software, sound and light control software, data analysis software, and

management software are used for all technologies that provide a 3- and 4-dimensional experience.

Recently, in addition to learning, socializing, and playing games in the Metaverse three-dimensional virtual universe, the number of Metaverse Museum examples is increasing (Choi & Kim, 2017; Lee et al., 2022; Gao & Braud, 2023; Doğruer, 2023; Hudson & Hudson, 2023). Additionally, digital museum research is as follows: websites and museum visitors (Marty, 2008), digital museum projects (Hirose, M., & Tanikawa, 2010), university digital museums (Yuhui et al., 2015), virtual exhibitions (Wu et al., 2022), visitor experiences (Hijazi & Baharin, 2022), virtual tours (Yang et al., 2023), and digital tourism and digital museums (Guo et al., 2023).

### 1.3. Digital Museums in the World

There are digital museums in numerous nations worldwide. Users can see artifacts, take virtual tours, and visit museums all over the world with these digital museums. According to Guo et al. (2023), the museum experience provides a comprehensive, multi-sensory visual and audio encounter for these users. Numerous studies have focused on the experiences of visitors to these museums (Hijazi & Baharin, 2022). Table 1 lists some of the most well-known digital museums in the world. This research will also cover the themes of these museums. The idea of a theme is incredibly significant in digital art. Artificial Intelligence, Abstraction, Virtual Reality, Augmented Reality, Cyber Space, Contextual Design, Interactive, and Dual Coding are some of the themes that capture the audience's attention and create an intriguing atmosphere (Toptaş, 2022).

#### 1.3.1. Museum of Digital Art in Zurich – MuDA

MuDA is a museum that is the first place in Europe to exhibit digital art. Founded in 2016 by Caroline Hirt and Christian Etter, it survived on mass donations. The Zurich Museum of Digital Art is located in the former storage center of the Migros Cooperative, the country's largest food chain. The museum aimed to convey the innovations in digital technologies and art to the audience and organized educational programs and workshops for various age groups. It has conducted experimental studies on exhibition processes and hosted the works of various important media artists (Taş & Korkmaz, 2022). The themes of the Zurich Digital Museum can be seen in Figure 2.

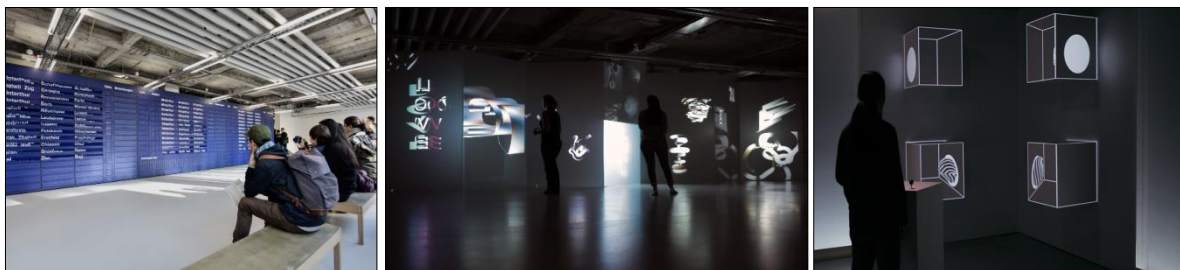


Figure 2 Thema: Interactivity, human and technology relationship in the digital age (MUDA, 2024)

#### 1.3.2. Atelier Des Lumières Digital Art Centre

The Light Workshop Digital Art Center is a center located in the Chemin-Vert Foundry of Paris. It opened in 2018. The center has a large space for exhibiting digital artworks and is equipped with multimedia equipment. It also offers an educational program called art immersion. This program includes art and technology-oriented practices for children. The center also offers rentable spaces for collective events or private events. Bruno Monnier stated that the purpose of the museum's establishment is to bring technology together with artistic practices, and in this way, they aim to reach large masses by enlarging emotions (Taş & Korkmaz, 2022). The themes of Işık Atölyesi Digital Art Center are shown in Figure 3.



Figure 3 Thema: Egypt of the Pharaohs, Foreign Nature and Oceans (ATELIER, 2024)

### 1.3.3. Mori Building Digital Art Museum

Mori Building The Digital Art Museum is located on Odaiba Island, Tokyo, and was established in 2018 in collaboration with TeamLab and the Mori Building. It is the world's first digital art museum and occupies approximately 10,000 m<sup>2</sup> in Palette Town Shopping Center. The museum uses 520 computers and 470 high-tech projectors to stimulate different senses and provide interactive visitor experiences. There are also special educational programs and interactive applications for children. The museum aims to create an environment of unlimited interaction by removing the barriers between art and the audience. TeamLab's "Borderless" exhibition is the first exhibition of the museum and consists of different interactive sections.

The museum uses multiple projections, interactive animations, LED lights, sounds, and other technological elements to provide a rich experience. The Mori Building Digital Art Museum does not have classical texts, and visitors are guided to the rooms with arrows. Thanks to the digital guide application in the museum, information about the artworks can be obtained, and viewers can change the artworks in some exhibition sections. The artworks react to the viewers' movements and offer ever-changing and non-repetitive visuals. In this way, a museum experience without borders is provided. Tokyo Digital Museum themes are shown in Figures 4.



Figure 4 Thema: The Way of the Sea: Cosmic Void, Flowers and People Cannot Be Controlled But Live Together, The Universe Made of Water Particles (MORI, 2024)

### 1.3.4. The IDEAL Centre D'arts Digitals

IDEAL Digital Art Center is located in Barcelona and collaborates with institutions such as the Technical University of Catalonia, Pompeu Fabra University, Ramon Llull School of Design, and Elisava Faculty of Design and Engineering. The center has 2,000 m<sup>2</sup> of space for the exhibition and production of digital artworks and the provision of training (Taş & Korkmaz, 2022). Opened in 2019 in a former cinema building, IDEAL aims to create a new relationship between art and society. The themes of the IDEAL Digital Art Center can be seen in Figures 5.



Figure 5 Thema: Tutankhamun, Dalí Cybernetics, Frida Kahlo. Life of an Icon (IDEAL, 2024)

### 1.3.5. The Bassins de Lumières Digital Art Center

Bruno Monnier, founder of Culturespaces, describes the Basins of Light Digital Art Center as a cultural sharing space that offers audiovisual experiences to visitors. The center was created by converting a former submarine base in Bordeaux, France. With an area of 13,000 m<sup>2</sup>, it is one of the largest digital art centers in the world. The exhibition space consists of different functional sections and offers visitors a unique and impressive art experience. The themes of the Basins of Light Digital Art Center can be seen in Figure 6. (Taş & Korkmaz, 2022).



Figure 6 Thema: Dutch Masters, Architect of Colors, Tales of the Wind (LUMIERES, 2024)

### 1.3.6. Hamburg Digital Art Museum

The digital art museum, which started construction in 2021 in Hamburg's Hafencity neighborhood, is planned to open in 2024 to become the largest museum exhibiting digital art in Europe. The founder of the museum, Lars Hinrichs, was inspired by the TeamLab Borderless exhibition he experienced at the Tokyo Mori Museum of Digital Art. The museum aims to offer viewers the opportunity to transform artworks through touch and become part of the exhibition (Taş & Korkmaz, 2022). The main theme of the museum is Borderless, and the exhibition will consist of three main sections: Boundless World, Forest of Athletics, and Forest of Lamps. With the opening of the museum, it will host the first, largest, and most permanent teamLab exhibition outside Asia. The themes of the Hamburg Museum of Digital Art can be seen in Figures 7.



Figure 7 Thema: Water, Flower, Wind (HDAM, 2024)

### 1.4. Digital Museums in Turkey

In Turkey, digital museums play a critical role in the preservation and dissemination of cultural heritage. Thanks to technological advancements, museums may now provide visitors with enhanced experiences through digital tools such as virtual tours, interactive displays, and instructive games. Cultural objects reach a larger audience and help the transmission of historical information. Museums were closed, particularly during the pandemic, emphasizing the significance of internet museums (Kunt, 2023). These digital

museums allow users to digitally visit museums, study objects, and acquire information. These digital museums offer visitors virtual tours, interactive exhibitions, and digital collections, helping to preserve cultural heritage and reach a wider audience.

The X Media Art Museum, which opened in 2022, is Turkey's first digital art and new media museum. The museum displays digital artworks by presenting innovative productions that combine technology, science, and art to the public. The museum engages the public through interactive and interdisciplinary art productions and seeks to provide fresh insights through collaboration with creative enterprises. It also intends to incorporate topics such as gender equality, archiving, and renewable energy into cultural policies. Figures 20 and 21 illustrate the concepts of the X Media Art Museum.

The Digital Experience Museum, which will open in 2024, mixes traditional museology with technological potential to provide visitors with an immersive experience that pushes the boundaries of art and technology. The museum employs a variety of technologies, including virtual reality, augmented reality, touch displays, and artificial intelligence-powered interactive programs, to allow visitors to directly communicate and interact with the items. Turkish software experts and designers have painstakingly crafted interactive designs and software, which are on show. The museum allows visitors of all ages to explore the wondrous world of art and technology by telling a fresh tale and adventure with each visit. The bookstore at the museum's exit encourages visitors to interact with the museum by featuring books specially selected for DDM. The Theme of the Digital Experience Museum is shown in Figure 8.



Figure 8 Masterpiece, Leonardo Da Vinci: Artificial intelligence The Wisdom of Light. Humanity and the Metaverse from Cern to NASA, The Virtual Adventure of a Genius: Nikola Tesla (DDM, 2024)

## 2. MATERIAL AND METHOD

There are two methodologies in this article. The methodology applied in the first step is the survey model. The survey model is "a research approach that describes a past or present situation as it exists." In this theoretical framework, "the individual or object that is the subject of the research is tried to be defined in its conditions and as it is" and "no effort is made to change or influence the variables in any way" (Karasar, 2012). Secondly, publications on the subject were accessed by keywords, and visual analysis of these publications was made with the software program (Tu et al., 2021; McAllister et al., 2022; Yan et al., 2024).

## 3. FINDINGS AND DISCUSSION

This study aims to present a comprehensive picture of art and museums in the digital age. As a result, existing publications were analyzed utilizing a multidimensional approach to acquire a comprehensive grasp of the problem. The current publications are listed in the table below.



**Table 1.** Current publications on digital museums digital art and museum in Web of Science database (created by authors)

Author(s)	Year	Title	Publication Titles
Marty, P. F.	2008	Museum websites and museum visitors: <b>digital museum</b> resources and their use	Museum Management and Curatorship
Ying, C., & Gao-yue, R.	2013	Application of thematic <b>digital museum</b> in communications of ceramic culture	8th International Conference on Computer Science & Education
Yuhui, Y., Hao, Z., & Jiang, Y.	2015	The development and educational application of editable university <b>digital museum</b>	International Journal of Online Engineering,
Yang, Y., Bai, Z., Zhang, H., & Wang, Y	2023	The construction and application of a cloud editing <b>digital museum</b> oriented to virtual tour	International Journal of Computer Games Technology
Dumont, C., De Backer, F., Dewinter, H., & Vandermeersche, G.	2024	Museum educators' views on <b>digital museum</b> education: opportunities and challenges	Cultural Trends
An, J.	2024	Assessment and application of <b>digital museum</b> visitors' emotional experience based on virtual reality technology and emotion recognition algorithm	PRESENCE: Virtual and Augmented Reality
Song, Z., & Evans, L.	2024	The <b>museum of digital</b> things: extended reality and museum practices.	Frontiers in Virtual Reality

Table 2 and Figures 9 and 10 show keyword analyses and visual analyses. These analyses are the analysis of publications focusing on digital art and digital museum subjects through software programs. These analyses are shaped according to percentage and frequency values. Words with higher percentage and frequency values are seen more clearly in visual analysis. If the number of frequencies is low, its visibility decreases. Word clusters and visual networks create a network map with words related to the subject. These networks indicate that the relationship is strong.

**Table 2.** Keyword and visual analysis on digital art and museum (created by authors)

keywords clusters	occurrences & total link strength	
3d modeling 3d printing access ajax and 3-d interfaces ar archaeoastronomy architectural survey archive art audience augmented reality avatar big data blockchain british museum image processing	information flow information quality information richness learning learning experience media richness metadata metaverse mobile ar mobile device mobile vr multi-media museum museum management museum visit museum websites	digital archiving digital collections digital content digital cultural heritage digital exhibition digital heritage digital humanities digital museum digital museum communication digital museum guide digital museums digital technology digital transformation digitalization digitization
e-learning education edutainment embodied cognition evaluation exhibition design eye-tracking gamification gion festival grid groupwork and groupware heritage	co-design computer graphics covid-19 cultural heritage cultural identity culture database design smart museum technologies technology user experience	virtual exhibition virtual exhibition hall virtual heritage virtual modelling virtual museum virtual reality virtual space virtual tour visitor studies visitors visualization vr



human-computer interaction image-based rendering	yamahoko parade	web3 d works of art
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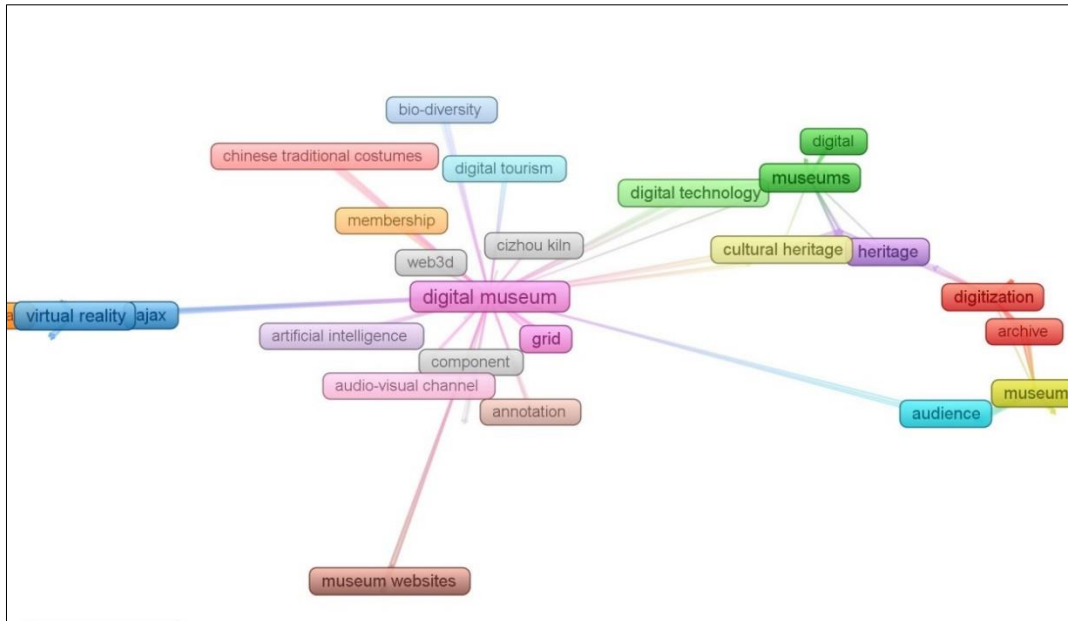


Figure 9 Co-occurrence/title keywords

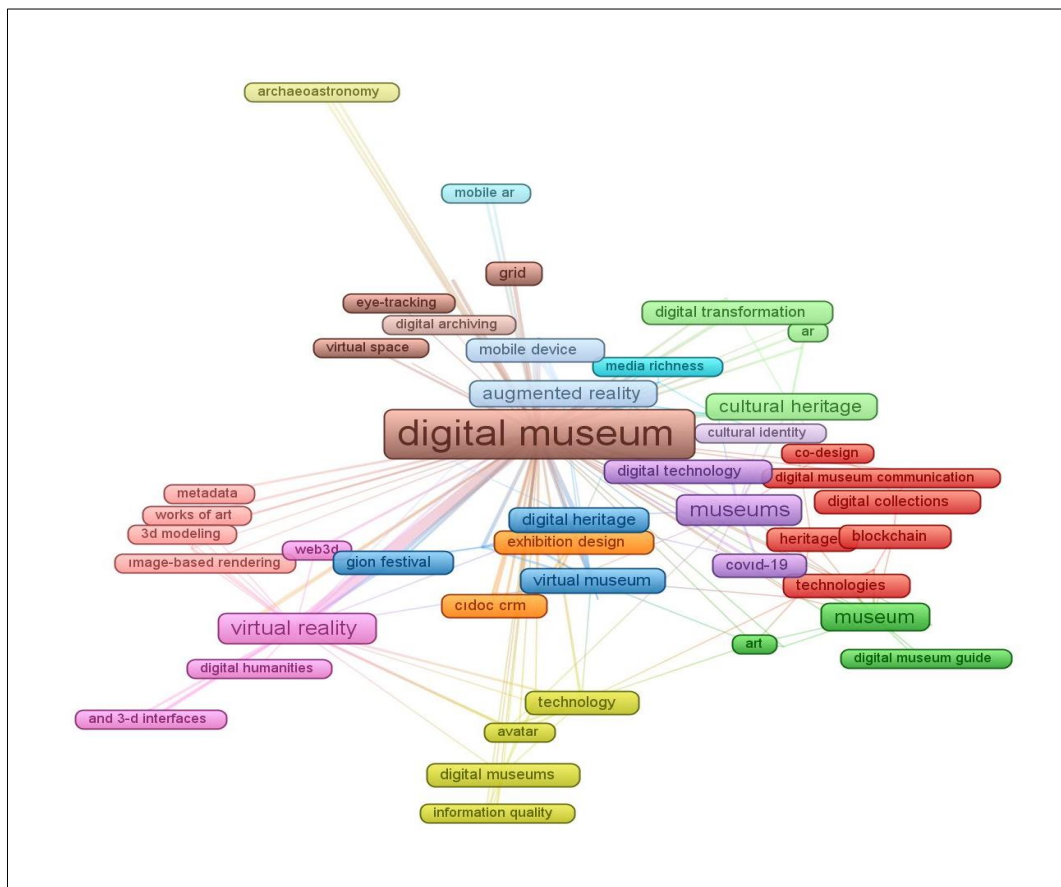


Figure 100 co-occurrence/author keywords



#### **4. CONCLUSION AND SUGGESTIONS**

This article examined the digital age, digital art, and digital museums. The study takes a theoretical and conceptual approach to the subject, revealing the conceptual frameworks and themes of digital art applications and digital museums that are becoming more popular as a result of digitization. Furthermore, it will close a gap in the literature on this subject. The article's conclusion includes several visually appealing images of worldwide and national digital art approaches and themes. It is plausible to assume that the development of these themes has a multisensory impact. Digital museums present users with light, sound, shadow, colors, and pictures, as well as a variety of design-related interests and research fields.

Digital art's new methods of perceiving will have a significant impact on future art and audiences. The number of these examples is projected to grow dramatically in the future. With the rapid growth of technology, it will be possible to come across various digitally inventive and inspiring works. It additionally makes art easier to access, allowing those interested in art to interact with artworks and experience their power. As a result, the new methods of seeing shaped by digital art will have a significant impact on future art and its audience. The number of these examples is projected to grow dramatically in the future. With the rapid advancement of technology, it will be possible to discover many digitally inventive and inspirational works. It is thought that there will be significant developments in this field with technologies such as virtual reality, augmented reality, and metaverse as suggestions for researchers in this field in the future. It is recommended to identify deficiencies in the field and improve existing traditional methods using technology.

Recently, much interdisciplinary research has focused on the digital, digital art, digital exhibition, digital museum, digital video, painting, and visualization. These topics and concepts, which are also important from an academic and artistic point of view, attract the attention of users. In the future, with the rapid increase in technological developments, these topics will be examined by researchers with artificial intelligence and the metaverse.

#### **Acknowledgements and Information Note .**

The article complies with national and international research and publication ethics. Ethics Committee approval was not required for the study.

This study was presented at the 2<sup>nd</sup> Interdisciplinary International Symposium on Art, Design, and Social Sciences, 'Boundless/Borderless: After the Digital Age' Symposium. Beykoz University's Faculty of Art and Design is organizing the event on May 21-22, 2024. The paper follows national and international research and publication ethics.

#### **Author Contribution and Conflict of Interest Declaration Information**

All authors contributed equally to the article

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