

# Digital Museum transformation strategy against the Covid-19 pandemic crisis.

Evangelos Markopoulos<sup>1,2</sup>, Cristina Ye<sup>3</sup>, Panagiotis Markopoulos<sup>4</sup>, Mika Luimula<sup>1</sup>

<sup>1</sup> Turku University of Applied Sciences. Faculty of Engineering and Management, Joukahaisenkatu 3, 20520 Turku, Finland.

<sup>2</sup> Queen Mary University of London, School of Business and Management, 327 Mile End Road, GB E1 4NS, London, United Kingdom

<sup>3</sup> Hult International Business School. 35 Commercial Road, E1 1LD, London, United Kingdom

<sup>4</sup> University of Turku, School of Science and Engineering, Turun yliopisto, 20014, Turku, Finland.

evangelos.markopoulos@turkuamk.fi, cye2018@student.hult.edu, panmar@utu.fi, mika.luimula@turkuamk.fi

**Abstract.** During the last decade, the art industry and especially the museums, the art galleries and the auctions has stagnated due to the global financial crisis (2007-2017) and latest lockdowns brought by the Covid-19 pandemic (2020-). Many art institutions introduced digital technologies into their operations and transitioned to the online art market. Visits to art exhibitions include interaction with other visitors of similar interests. Hence, digital art venues must create the same environment vibes and offer similar opportunities as the physical ones. The paper indicates the application of the avatar technology as an interaction method in digital museum spaces. It also provides the functional requirements, a navigation process, and the implementation scenarios for the adaptation of such technologies. The application of this digital strategy can transform the art market, contribute to the museum's sustainability, and offer the public different ways of learning and entertainment.

**Keywords:** Art Tech · Digital Museums · Gamification · Avatar · Culture · Technology · Covid-19 · Virtual Spaces · Virtual Reality · Innovation

## 1 Introduction

The 'museum' definition has changed over the years, but its core concept remains the same. In 2004, the International Council of Museums (ICOM) has brought forward a new way to define museums. The latter is not anymore just a permanent institution in the service of the society, but a business capable of diversified actions to attract visitors, scientists, sponsors, and investors [1].

Museums start to use different business approaches to increase their visitors and offer creative and interactive services. However, this does not seem to deliver the expected results due to several barriers which prevent people from enjoying art such as lack of time, high admission fees, cultural barriers, health/disability issues, and unattractiveness of exhibitions, among others [2].

Compared to the number of people and groups who had access to art in the past, modern times have more art consumers due to the development of new and interactive technologies such as the virtual reality, virtual spaces, avatars, and others. Museums and art galleries intensified their online presence by offering different virtual art exhibitions and tours.

Many of these technologies already existed but with limited use as emphasis was given on the physical visitors, however the Covid-19 pandemic boosted their effectiveness and opened new opportunities. In general, the art market can become more accessible everywhere, globalized, and without logistic and financial obstacles. It must be noted that the digital technologies are not at the state to fully replace a physical art institution, but they can certainly make the art consumption affordable and accessible to anyone.

## **2 Covid-19: need of digital art**

In March 2020, and a few months after the Covid-19 pandemic outbreak, the situation became uncontrollable forcing many countries to declare national and long-term repeated lockdowns. The cost of this confinement is both economical and psychological. In fact, according to a report by International Council of Museums (ICOM) which counts 1.600 respondents from museums visitors and museum professionals in 107 countries, during the period of April 7 till May 7 2020, 94.7% of the participants replied that their institutions have been closed [3]. Besides the economic issues, Covid-19 brought a considerable additional damage to the population well-being. The social isolation driven by the confinement has increased the level of loneliness in many people. According to the Google Trends index, during the period of confinement, March 2020 to May 2020, many searches have been recorded with words such as 'loneliness' and 'boredom' [4]. Hence, it is important to engage such vulnerable categories in activities and opportunities that could improve their feelings and mental health.

The use of advanced digital technologies helped balance, to an extent, the psychological impact of the imposed isolations. Many platforms and tech-tools have been offered to provide social and cognitive support to the people [5], but also to support the art institutions' economy. The transition to the online art market offered an alternative way to visit museums and other exhibitions spaces from home and proved to be a wise strategy, as the strict lockdowns remain with no sign of improvement [6].

This paper aims to indicate that the art market economic stagnation during the Covid-19 pandemic can be lifted with the use of emerging technologies and the increase of the online presence and online services of art institutions. Nevertheless, the latter does not provide the possibility of physical interaction between visitors, but finds many supporters who seek a new way of social interaction and entertainment in a very difficult period that tends to be last much longer than expected.

The paper emphasizes on the introduction and adaptation of avatar technology in virtual museums spaces that enhance the digital experience. Such technologies service can remain in used even the post-C19 period for those unable to visit museums and/or socialise due to financial, logistical and/or physical issues. It can be considered that VR and avatars democratise the accessibility to art institutions.

### 3 Research methodology and key results

The data used in this thesis derive from both primary and secondary research. The secondary research has been conducted with a comprehensive study on official websites of major museums around the world, and on an extended literature review on reports, books and articles concerning the art market, emerging technologies, and their impact on the economy. The primary research was mainly conducted with a survey with 530 respondents reinforcing the fact that not many people visit art institutions in their city or on holidays due to different socio-economic barriers.

Based on the conducted survey, the main obstacles to hinder people visiting art institutions are time, money, cultural knowledge, physical disabilities and unattractiveness of offered exhibitions. These have brought the art market to stall. In addition, the Covid-19 pandemic crisis with the continuous lockdown was devastating for the art and the museums industry. The latter brought many businesses to close or to seriously risk their operations, including art institutions [7]. The museums' reaction to these issues has been the transition to an online art market and continue to entertain art-lovers, and not only, during the lockdowns. Nevertheless, Covid-19 also increased the level of solitude. The social interaction vibes of art institutions must be reconstructed to reduce loneliness and increase engagement.

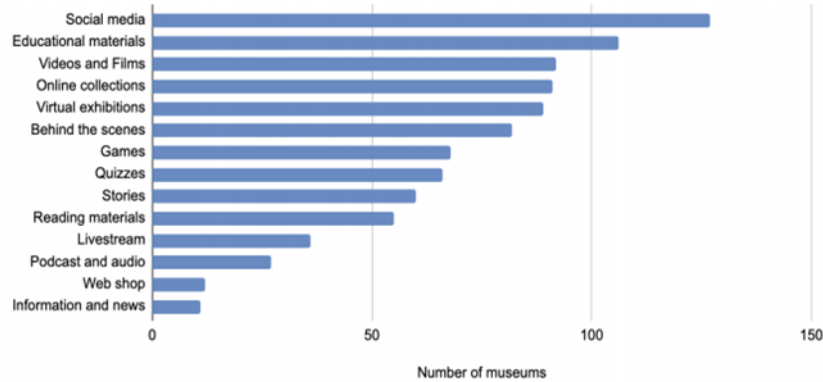
### 4 The COVID-19 impact and opportunities on digital art.

Online virtual museums offer different experiences and ways of learning. They provide various opportunities to the public to visit an art institution anytime and anywhere from their own pace. Indeed, the online presence by museums across the globe has intensified during the Covid-19 pandemic period [8]. A report from the Networks of European Museums Organisations (NEMO) which analysed around 1000 surveys from 48 museums, mainly in Europe, has shown (Fig. 1) that 4 out of 5 museums increased their digital services to reach their audiences [9].



**Fig. 1.** Increase of museum online service. Forecast [9].

Furthermore, half of the respondents stated that their museum provides now one or more new online services and offers permanent and temporary museum exhibitions (Fig. 2.) mainly on communication, education, video production and entertainment activities.



**Fig. 2.** Popularity of museum online services [9].

The cultural industry digitalisation has intensified the consumption and globalisation of art. The key technologies that impact this transformation are the artificial intelligence (AI), virtual reality (VR) and augmented reality (AR), but also cryptocurrency and blockchain. Each one of these technologies contribute from a different perspective, covering the utilization of the big data and decision-making opportunities, to immersive engagement up to the safe and digital transactions. Table 1 indicates some application of these technologies in the digital museum operations.

**Table 1.** Contribution of advanced technologies in the art market.

Artificial Intelligence	VR and AR	Cryptocurrency and blockchain
Find an artwork by uploading an unlabelled image	Dynamic experience within virtual environment	Improve authentication and provenance of artworks
Suggestion of exhibitions based on recent searches, visits, and personality	360° on-screen views of every artwork	Protect the privacy of the art collectors
Storytelling service in virtual museums	Projection of artwork anywhere	Traceability of art sales and commissions
		Fractional ownership of art through tokenization

The development of virtual environments has a critical role in the digital museums transformation as they recreate physical spaces for activities and operations into digital spaces. The user can walk around the virtual space with a similar navigation process used in Google Maps. Virtual spaces can act as learning systems with highly interactive information regarding the artwork (history period, artists, techniques) or any digital object, exhibit, or information tab. Online institutions complement and fill the gap of the physical institutions by opening the accessibility to a wider range of public and improve the museum's efficiency in terms of time, revenue and service offered [10].

This digital transformation of the museums changes the role of the consumers/visitors from passive to active. Visitors don't walk around and observe the exhibits, but they have unlimited time to interact and examine any artwork. On average a proper museum visit lasts 2 hours at least [11], but this does not assure that the visitor will observe and study all the exhibitions of his/her interest. The size of the art institutions and the kind of exhibitions offered might require a second or third visit which does not usually happen. Digital museums change the perceptions of the exhibited artwork and induce visitors to stay more in front of an exhibit and practically live the experience.

## **5 Towards gamified and digital museums**

Digital technologies can change the way art institutions operate, but the challenge will be on addressing the social dimension they impact. According to primary research conducted survey 65.2% of the participants consider art institutions as a place to meet new people and socialise. This demand-gap can be filled with the introduction of avatar technology that can operate in the same way with the video games. Gamification can be used to recreate and increase avatar-based social interaction within virtual museums. The development of characters to interact within the virtual environment is becomes a global market trend.

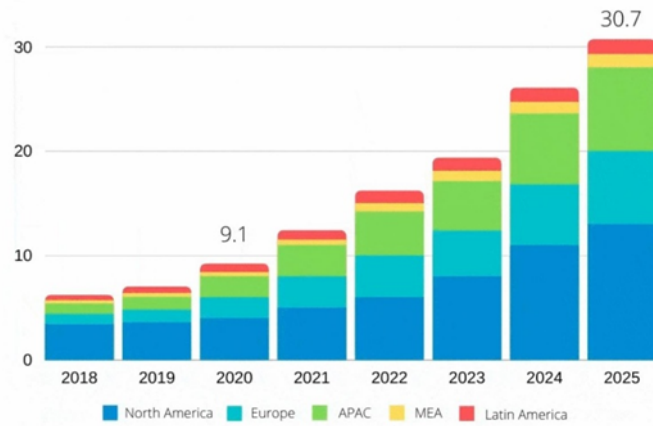
The idea of adding games features into non-game systems started to spread in 2010 with the goal to enhance the consumers' attractiveness and their whole experience [12]. Industries like the automobile racing and F1, in particular, have been studied the way gamification [13] and virtual reality can increase sponsorships [14] and maintain their client base and fans. Furthermore, the use of avatars in gamified businesses applications is considered a marketing strategy [15] which can be monetized globally. (Fig. 3).

Many art institutions introduced games into their physical environments making the museum visit more social, interactive, and attractive but without the use of gamification technologies for immersion and engagement, omitting research that insists on the significance of the gamified experience. This reflects the reality on the degree of awareness art institution have on their practical and actual understating of the gamified services and operations.

Unlike the art industry the gaming industry transformed the Covid-19 crisis into an opportunity to enter the virtual museum market. Nintendo release on 20 March 2020 the game 'Animal Crossing: New Horizons' which gives the possibility to visit and curate a 'virtual museum' (with real-life authentic artworks) and spend the 'gaming-time' as 'learning-time'. The latter consists in a real-life simulation which takes place on a desert island through the use of an avatar. The peculiarity of this game is that users can connect up to eight players per island and play together with friends and family.

Six weeks after its release the game sold 13.41 million units. It became the most popular game for offering a way of social interaction and entertainment during Covid-19 [17].

Another recent avatar-based game that has been released in 2020 is the ‘oMoma’ (online Museum of Multiplayer Art) by LikeLike industry. Compared to Animal Crossing, oMoma has less popularity as the squared pixels design is not appealing enough. The goal of oMoma is to recreate the social dynamics of exhibition spaces. It enables multiple players to interact with both virtual installations and visitors within the virtual environment [18].



**Fig. 3.** Forecast of gamification market by region in billions USD [16].

## 6 The impact of avatar technology in virtual museums

In the last few years, the use of avatars has been adopted by different businesses as a marketing tool to attract more consumers and enhance their perceptions of the product/service offered [19]. This strategy could also be adopted by virtual museums to offer social interactions within their online tours and attract more consumers. Before entering the exhibition and start the visit, every user would be asked to create an avatar which will be used to personify and represent the individual during the whole experience. The whole digital art institution experience would be similar to a game: dynamic and interactive.

Upon the creation of the avatar character, the visit can start at the museum exhibitions, art galleries or the showrooms of an auction which is accessible by a shared link. Within the same virtual environment, there are other avatars around in the same room or different spaces (building, terrace, etc.) visiting the same art institution at the same time just like in a physical experience. Visitors can interact with each other, socialise and exchange opinions by clicking on each other avatar.

Such avatar-based virtual environments offer museums dynamic learning and educational tools to everyone, but also the possibility to connect with each other across the globe [20]. In fact, the use of avatars within virtual environments can increase the sense of presence of an individual, which can decrease one’s feeling of loneliness. In the Covid-19 period avatars can be used within art classes, but also act as an efficient way

to spend time with friends, enjoy the museum visit, and fight the depressing feeling of isolation.

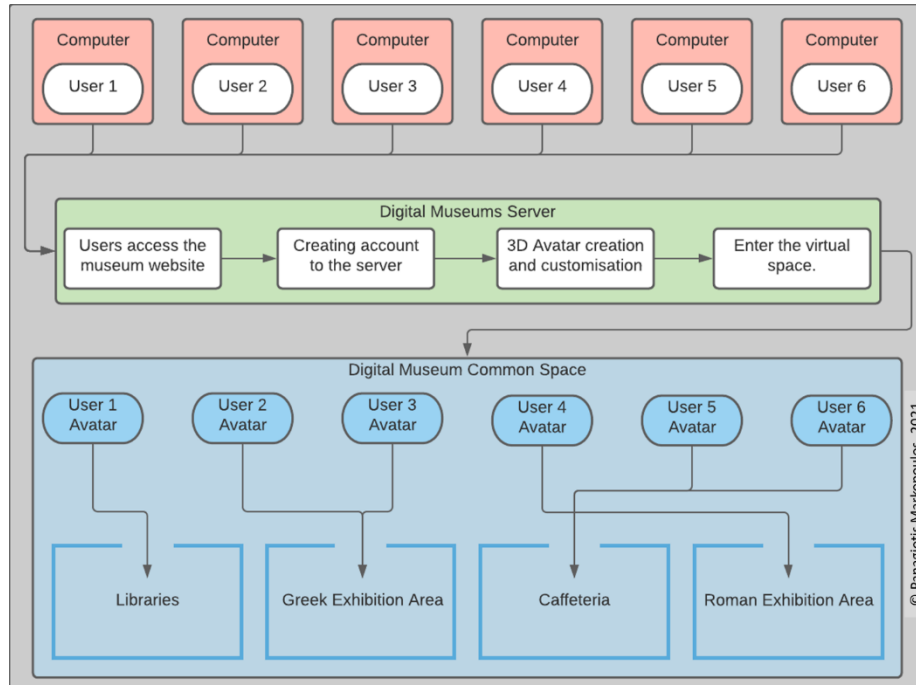
## **7 An avatar based digital museum architecture.**

An indicative avatar-based architecture that can be applied in digital museums consist of three layers. The first layer indicates the users' workstations, the second the login process and the avatar creation, and the third their presence in the exhibition spaces. The users start by accessing the museum website or some other websites the museum has collaborated with for the digitalization of its museum, using their computers in their own space anywhere in the world.

From there they can join the server which contains the tools to create their avatar as well as enter the digital museum environment. They will firstly create an account with the appropriate information asked by the museum and then make and customize their 3D avatars to their liking. Afterwards, they are ready to enter the digital museum common space. This common space is shared by all users that have each created their own accounts and avatars.

Within the common space users can see the exhibits and other users, and interact with the environment and with each other. The amount of interaction varies between different virtual museums but something they all have in common is the exploration of a multi-user 3D digital environment with contents and rooms similar to the real museum. Those can be exhibit rooms or simpler common rooms such as a cafeteria or a library. Users are independent meaning they can go wherever they want within this environment. Within this space some museum staff members may be assigned by the museum to enter the digital environment as users to help the visitors with any questions they may have or even act as museum guides.

After the users are satisfied with their visit to the digital museum, they may simply close the application to leave the environment. They may leave and rejoin whenever they like. Rejoining is easier since they have already created an account and an avatar, so it's as simple as logging in and entering the virtual space.



**Fig. 4.** Avatar based digital museum architecture.

## 8 Limitations and Areas of Further Research

The research conducted for this paper took place during the Covid-19 global pandemic crisis. This significantly impacted the opportunity to conduct personal interviews, visit museums and record the feedback from visitors and clients in museums and other art institutions. The same applies for feedback that could have been gathered from professionals in the sector such as museum directors, investors or service suppliers. Therefore, the data used cannot be considered complete and quite accurate as it is based on the literature review, on-line surveys and discussions. However, the results of the primary research conducted are aligned with the results from the secondary research which indicates that the challenge of distance is common for all researchers.

This research can continue to identify in depth the public preferences of socialisation. It is essential to have a large set of information on the ways people prefer to socialise (virtual, real or both), on the number of virtual friends they have, on their opinions regarding meeting someone virtually and analyse, examine, and explore virtual friendship from the safety, social or other dimension. The research can also be supported with the proper demographics which shall extend beyond the young individuals to those with limited technical knowledge or access to the technology.

Furthermore, the use of avatars and their operations on the virtual spaces needs to be examined in sectors, such as the shipping, the maritime [21] or the firefighting [22] that already began to use them within virtual reality applications integrating tracking with



eye tracking, hand tracking and finger tracking to increase engagement and study the human behaviour in virtual spaces [23], [24].

## 9 Conclusions

Avatar technologies, virtual reality, virtual worlds, gaming and gamification, can offer creative interactivity and unique experiences with low or no cost to the global visitor introducing new revenue streams [25]. This paper has covered the transition from a traditional art institution experience to a digitalised one using emerging technologies that can contribute on resolving financial and logistics barriers that prevent people to consume and enjoy art, especially during the Covid-19 pandemic. As art institutions are seen as a place where to encounter new people and socialise, their digital twin must offer a similar experience. The creation and implementation of a real-time based avatars could be a potential solution to this challenge. They can attract more visitors and provide the opportunities to individual to interact and share experiences with each other

More than that, avatars can be used to fight the depression and the financial catastrophe spread globally by the Covid-19 pandemic. It is certain that the vaccines will fight the virus sooner or later, but the ruined economies and depressed souls will impact the mental health of billion of people for years ahead. The proposed paper indicated that avatar technologies in virtual spaces such as museums can be a way to give people the opportunity to enjoy art, which seems that after the Covid-19 crisis it will be a luxury that will be physically experienced by only the very few.

## References

1. G. Guidi, R. Trocchianesi, G. Pils, G. Morlando and A. Seassaro, "A Virtual Museum for Design: New forms of interactive fruition," 2010 16th International Conference on Virtual Systems and Multimedia, Seoul, Korea (South), 2010, pp. 242-249. (2010)
2. IPSOS (2004). <https://www.ipsos.com/ipsos-mori/en-uk/popularity-museums-and-galleries>
3. Brodeur, A.; Clark, A. E.; Flèche, S. & Powdthavee, N. (2020). Assessing the impact of the coronavirus lockdown on unhappiness, loneliness, and boredom using Google Trends. arXiv:2004.12129
4. ICOM. <https://icom.museum/en/news/museums-museum-professionals-and-covid-19-survey-results/>
5. Shah, S.; Nogueras, D.; van Woerden, H.; & Kiparoglou, V. (2020). The COVID-19 Pandemic: A Pandemic of Lockdown Loneliness and the Role of Digital Technology. *Journal of Medical Internet Research*; 22(11):e22287 (2020)
6. Bu, F.; Steptoe, A. & Fancourt, D. Loneliness during a strict lockdown: Trajectories and predictors during the COVID-19 pandemic in 38,217 United Kingdom adults. *Social Science & Medicine*, vol.265. (2020).
7. Antara N. Sen. S. The Impact of Covid-19 on the Museums and the Way Forward for Resilience. *Journal of International Museum Education*, vol. 2, no. 1, 54-61 (2020)
8. Serrell, B. Paying Attention: The Duration and Allocation of Visitors' Time in Museum Exhibitions. *Curator The Museum Journal*, 40(2) pp. 108 – 113. (2010).
9. NEMO. <https://bluesyemre.files.wordpress.com/2021/01/survey-on-the-impact-of-the-covid-19-situation-on-museums-in-europe-final-findings-and-recommendations.pdf>

10. Badia, F.; & Schiano, V. (2015). Evolution of the business model for contemporary art galleries. Current situation and future challenges. IFKAD 2015, Culture, Innovation and Entrepreneurship: Connecting the Knowledge Dots, Bari (Italia), 10-12 giugno (2015)
11. Li, Y.; Liew, A.; & Su, W. The digital museum: challenges and solution. *Information Science and Digital Content Technology* 8(3). (2012).
12. Robson, K.; Plangger, K.; Kietzmann, J.; McCarthy, I. & Pitt, L. Understanding Gamification of Consumer Experiences, in *NA - Advances in Consumer Research Volume 42*, eds. Cotte, J. and Wood, S., Duluth, MN: Association for Consumer Research, Pages: 352-356. (2014).
13. Markopoulos E., Markopoulos P., Luimila M., Almufti Y., Romano C., Benitez P.V. A Gamified Approach Towards Identifying Key Opportunities and Potential Sponsors for the Future of F1 Racing in a Declining Car Ownership Environment. In: Ahram T. (eds) *Advances in Human Factors in Wearable Technologies and Game Design. AHFE 2019. Advances in Intelligent Systems and Computing*, vol 973. pp 179-191. Springer, Cham. (2020)
14. Markopoulos E., Markopoulos P., Luimila M., Chang Y.C., Aggarwal V., Ademola J. Virtual and Augmented Reality Gamification Technology on Reinventing the F1 Sponsorship Model not Purely Focused on the Team's and Car's Performance. In: Ahram T. (eds) *Advances in Human Factors in Wearable Technologies and Game Design. AHFE 2019. Advances in Intelligent Systems and Computing*, vol 973. pp 364-376. Springer, Cham (2020)
15. Markopoulos E., Markopoulos P., Luimila M., Almufti Y., Aggarwal V. Mapping the Monetization Challenge of Gaming in Various Domains. In: Ahram T. (eds) *Advances in Human Factors in Wearable Technologies and Game Design. AHFE 2019. Advances in Intelligent Systems and Computing*, vol 973, pp 389-400. Springer, Cham. (2020)
16. Market Research Report. <https://www.marketsandmarkets.com/Market-Reports/gamification-market-991.html>
17. Zhu, L. The psychology behind video games during COVID-19 pandemic: A case study of Animal Crossing: New Horizons. *Human Behavior and Emerging Technologies*. Willey. <https://doi.org/10.1002/hbe2.221> (2020).
18. LikeLike. <http://likelike.org/2020/04/14/the-online-museum-of-multiplayer-art/>
19. Hemp, P. (2006). Avatar-based marketing. *Harvard Business Review*, 84(6):48
20. P. Heidicker, E. Langbehn and F. Steinicke, "Influence of avatar appearance on presence in social VR," 2017 IEEE Symposium on 3D User Interfaces (3DUI), Los Angeles, CA, 2017, pp. 233-234 (2020)
21. Bellalouna F., Luimula M., Markopoulos P., Markopoulos E. and Zipperling F., "FiAAR: An Augmented Reality Firetruck Equipment Assembly and Configuration Assistant Technology," 2020 11th IEEE International Conference on Cognitive Infocommunications (CogInfoCom), Mariehamn, Finland, 2020, pp 237--244. (2020)
22. Markopoulos E., Lauronen J., Luimula M., Lehto P. and Laukkanen S., "Maritime Safety Education with VR Technology (MarSEVR)," 2019 10th IEEE International Conference on Cognitive Infocommunications (CogInfoCom), Naples, Italy, 2019, pp. 283-288
- Markopoulos E., Markopoulos P., Laivuori N., Moridis C. and Luimula M., "Finger tracking and hand recognition technologies in virtual reality maritime safety training applications," 2020 11th IEEE International Conference on Cognitive Infocommunications (CogInfoCom), Mariehamn, Finland, 2020, pp 251—258 (2020)
22. Luimula M., Markopoulos E., Kaakinen J. K., Markopoulos P., Laivuori N., and Ravysse W., "Eye Tracking in Maritime Immersive Safe Oceans Technology," 2020 11th IEEE International Conference on Cognitive Infocommunications (CogInfoCom), Mariehamn, Finland, 2020, pp 245--250. (2020)
24. Markopoulos E., Markopoulos P., Luimila M., Almufti Y., Romano C. Digital Cultural Strategies Within the Context of Digital Humanities Economics. In: Ahram T. (eds) *Advances in Human Factors in Wearable Technologies and Game Design. AHFE 2019. Advances in Intelligent Systems and Computing*, vol 973. pp 283-295. Springer, (2020)