



Cultural Engagement and Interactive Communication: A Study on the Implementation of New Media on Museum's Digital Interpretations

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Abstract. Museology is undergoing a sea change in the digital era. Studying new technologies or pioneering experiments on digital art alone is far from enough for us to fully grasp such a revolutionary change. As a matter of fact, the influence of digital technology is so pervasive that it is extended over almost all aspects of the society and even leads to cultural reorientation. To the extend, we can see an accelerating trend towards creating works of art with digital media technology, an innovative tool that also occupies a crucial role in the maintenance, preservation, and display of art institutions' collections. Against this background, this paper attempts not only to identify the latest development of this trend by case studies, but also to investigate how digital technology helps preserve and perpetuate traditional arts and crafts, so as to provide suggestions on reducing the preservation costs and increasing the perpetuation efficiency. In addition, by reference to the results of the case studies and the analysis of professionals' experiences, this paper seeks to explore the possibilities of facilitating cultural exchange and interactive communication with digitalized display and innovative transformation. This paper concludes with reflections on some cultural issues concerning the application of digital media technology to museum collection display.

Keywords: Cultural engagement · Interactivity · Digital technology

1 Introduction

Museology is undergoing a sea change in the digital era. Studying new technologies or pioneering experiments on digital art alone is far from enough for us to fully grasp such a revolutionary change. As a matter of fact, the influence of digital technology is so pervasive that it is extended over almost all aspects of the society and even leads to cultural reorientation. Therefore, the museological turn is manifested in multiple dimensions, such as place (space), community, culture, and technology [1]. In his article "Manifesto for a New Museum," Peter Weibel pointed out that art museums must try to

cooperate with science and technology if they want to survive the future. This argument was perfectly exemplified by the emergence of techno art, in which many media artists use tools surprisingly similar to those adopted by physicists and engineers [2]. Swept along on this wave, the digital culture has become an essential element in social, cultural, artistic, and economic dimensions. Digital technology has transmuted the achievements of traditional cultures and arts into the forms that meet the requirements for archiving or display. Whatever form they may take, the transdisciplinary integration within the contemporary knowledge system has made media technology a unique medium for artistic creation. Besides, the whole process from production to collection and exhibition bears the signature of digital interaction and participation.

We can see an accelerating trend towards creating works of art with digital media technology, an innovative tool that also occupies a crucial role in the maintenance, preservation, and display of art institutions' collections. Against this background, this paper attempts not only to identify the latest development of this trend by case studies, but also to investigate how digital technology helps preserve and perpetuate traditional arts and crafts, so as to provide suggestions on reducing the preservation costs and increasing the perpetuation efficiency. In addition, by reference to the results of the case studies and the analysis of professionals' experiences, this paper seeks to explore the possibilities of facilitating cultural exchange and interactive communication with digitalized display and innovative transformation. This paper concludes with reflections on some cultural issues concerning the application of digital media technology to museum collection display.

2 Media Technology and Museums

The rapid development of digital media and new technologies have dramatically affected museums' traditional roles in exhibition, collection, restoration, and education. Electronic media have established a continuing existence in museums of science, technology, natural history, and art since the 1980s, which was primarily because the curators of these museums tried to attract a greater number of visitors by adopting new interactive technologies in exhibitions. Corporate sponsors and donors have shown their keen interest in new media. Museum visitors, especially the young generation, have also made a beeline for interactive exhibitions and deemed such interaction as a major part of their museum experiences. Curators advocating the use of digital technology claimed that interactive display is relatively flexible so that it offers an alternative solution to the presentation of complicated ideas and processes. These interactive technologies (e.g. interactive touchscreen, computer game, large screen installation, TV wall with various images, digital information center, smart badge, 3D animation, and virtual reality) have collectively constructed the so-called digital museum system. These technologies have substantially altered museums' physical characters. Nowadays, museums transcend the physical confines of time and space via the Internet, making their online databases accessible for virtual visitors, and allowing them to interact with the exhibits in an innovative way.

Introduced by André Malraux in 1947, the term "*musée imaginaire*" refers to "a collection of digitally recorded images, sound files, text documents and other data of

historical, scientific, or cultural interest that are accessed through electronic media” [3]. Today’s digital museums not only go beyond traditional communication and interaction with visitors, but also utilize the resources in a more agile manner. To seamlessly connect media technology with museums, we need to promote, position, and strengthen the role of “digital application” in terms of strategy, practice, technique, and theory, so as to graft “technology” onto “content” as well as to mediate and integrate the two parts. Digital application is a “superimposed third-party profession” that responds accordingly to the introduction of digital technological innovation into museums’ traditional contents and functions. The projection-like technology of edge blending and warping also contributes to the seamless integration and augmentation of digital “content + technology.” Moreover, digital application is a crucial third pillar supporting the structure and development of museum technology. The importance of digital application is clearly highlighted here.

3 Digital Application: The Wide Applications of Display Technology

In terms of technology, aesthetics, and associated concepts, digital media technology has become a “visual interpretive program” dedicated to tackling the following questions. In what way and form can artistic images be represented? How can the chosen form of representation be connected with museums’ constituent elements, works of art, and exhibition design? What implications should be embedded in the conveyed information and displayed images? How can the meaning of a museum’s collection be redefined to create a perfect fusion of the displayed images and the other elements in the exhibition when creators blend digital media technology into the given forms of the exhibits [4]? In sum, digital archive is an active management technology that ensures the constant accessibility of museums’ digital contents.

What content interpretation attempts to produce is the major achievement of the guidance on display technology—“interpretive planning,” which emphasizes that interpretation should meet the needs of transdisciplinary content transformation and conform to the actual situation of introducing technology into display (even though “interpretation” is a term more suitable for describing the exhibition content design technique) in view of the inexorable trend towards presenting exhibition contents with technologies in a transdisciplinary fashion. Research materials that underpin exhibitions are crucial contents. However, some technical issues (e.g. data decipher, content interpretation, and transmedia storytelling) still need to be resolved if one is going to present these materials in the digital form. The issues arising from flourishing display technology further highlight the significance of interpretative planning, a task that entails the specialty of content analysis and design, digital literacy, as well as the ability to direct or coordinate proper digital forms.

Accordingly, a museum can employ a two-pronged strategy that involves technology display and display technology. The former refers to the introduction and display of advanced or daily life technologies, while the later focuses on the instrumentality of technologies, urging the museum to rethink traditional values and the roles they play, as well as the ways to enhance visitors’ experiences and the museum-visitor

relationship [5]. As museums have become an important part of our digital life, voices from the outside world beyond the museums have been made heard so that museums must find a faster and more effective way of communication to maintain a healthy relationship with their visitors and communities. That is why museums have metamorphosed from collection-oriented into visitor/user-oriented operation [6]. The applications of new media and digital technology in contemporary museum collection, restoration, and exhibition are summarized as follows:

3.1 Museum Collection Presented in the Form of Techno Art

The combination of contemporary thinking with new media has fundamentally changed the one-on-one relationship between creators and their oeuvres as well as the entire creative process. “Re-creation,” namely reinterpreting original works of art, not only embodies the spirit of contemporary culture, but also facilitates modern people to perceive, interpret, and re-create arts. For instance, carried along on the tide of digitalization, the National Palace Museum has undertaken the Digital Archives Project, devoting itself to the promotion of transboundary (i.e. culture and technology) cooperation, transdisciplinary art, and social education. Besides, the project has introduced relevant technologies, audiovisual media, and artistic digitalization. Its achievements in associated projects and transboundary cooperation have also garnered international reputation.

Other examples include the kinetic installation of dynamic display by Taiwanese artist Tien-Chang Wu at the 2015 Venice Biennale, and “A Reform of Lotus Pond in Zuoying—Multi-Sensory Interactive Exhibition in Virtual Reality” at the National Taiwan Museum of Fine Arts (NTMoFA) that transformed traditional static presentation of paintings into technological display. The question as to how we can employ a “contemporary technology,” which can exert its effect only in a specific era, to preserve, archive, and then restore and represent originals in an effective and artistic fashion has become a radical challenge to digital art.

3.2 Online Display

A museum’s online display requires the establishment of a content management system and a distinct database. People tend to use museum databases for historical search. However, the design of ordinary databases is not aimed at playing tricks, rekindling memories, or encouraging users to search in a retrospective manner. Instead, the *raison d’être* of data is to run certain application programs, and the role of algorithms is to predict and optimize its future functions. To put it another way, museum databases give prominence to historical memories, and the pieces of information they collected and stored are not passive data but potential materials for creators to produce more contents [7]. The most telling example is “Points of Departure: Connecting with Contemporary Art,” a project carried out by the San Francisco Museum of Modern Art (SFMOMA) in 2001. It created a stimulating environment for visitors to experience contemporary art with the interactive model developed collaboratively by MIT, the Ideal Integration in San Francisco, and the Compaq Computer Corporation in Silicon Valley. It was SFMOMA’s first time to use SmartTables that combine touch table with interactive

computer screen for introducing each gallery and the works therein. Meanwhile, it was also the museum's first time to adopt PDA as the multimedia guide, whereby the visitors could view artists explaining their own works by clicking on the thumbnails. The museum's another experiment allowed the visitors to hang works in a virtual gallery via "Make Your Own Galley" on the interactive kiosk. "Point of Departure" won the 2002 Gold MUSE Award for the best use of new technologies in an art museum setting [8].

The Europeana Collections is a prime example as well. Built on Europe's rich heritage, the website has not only gathered the digital contents of European galleries, libraries, museums, archives, and audiovisual collections, but also made these cultural resources easily accessible to the users whether for work, study or fun [9]. In 2011, the Rijksmuseum started to cooperate with the Europeana Collections, making its public domain images and metadata accessible through the latter's web portal [10]. In addition, the M+ Museum of Visual Culture is an emerging institution dedicated to digital archive, digital display, and online curating. It is under construction and will soon become a new contemporary visual art center in Hong Kong's West Kowloon Cultural District. What the M+ has so far is not so much a physical museum as the compact M+ Pavilion hosting small-scale exhibitions and communicating its vision. Nevertheless, the M+ has operated actively in the form of a museum since 2012, and its online activities have become its main focus at the current stage. In 2018, the M+ not only released its bilingual story platform to build up its niche audience on social media, but also participated in a series of museum-related events around the world. Digitalized online display not only enables museums to share and interact with audiences around the globe, but also stimulates, encourages, and supports many creative communities.

3.3 Interactive Display

Interactivity gives birth to various forms of browsing and ways of combination, making the admiration of works of art no longer just a pure psychological operation. An increasing number of museums (incl. the Metropolitan Museum of Art, the Virtual Museum of Canada, and SFMOMA) have allowed their visitors to create personalized digital collections, whereby the visitors can repeatedly admire the works in their collections on an irregular basis. Some museums also allow their online visitors to download the images of exhibits into personal galleries, add captions, and share with other online visitors. Digital technology not only affords interaction between museums and their visitors, but also offers the latter new routes to engagement, interpretation, and experience. The enormous potential of digital technology in changing the visitor-exhibition relationship speaks for itself [11].

As technology advances every day, museums have taken different forms (e.g. digital museums, integrated museums, and open museums) that not only reshaped their social images, but also modified visitors' way of participation. Such formal change of museums is characterized by interactive multimedia display and the popularization of interactive multimedia exhibitions. For example, the National Palace Museum adopted digital technology to create the digital version of *Up the River during Qingming*, which was nothing if not aesthetically impressive. In 2015, the NTMoFA presented "Decoding the Treasure Trove: An Exhibition of Collection and Conservation" that

addressed three main themes, including “Interpretation of Collection: The Formation of Taiwanese Art,” “Looking into Collection: Art Preservation and Maintenance,” and “Linkage of Collection: Extension and Application.” This exhibition featured the display of its distinguished collection, the environment control of its collection repository, the preservation and maintenance of its collection, the application of scientific detection, and the scenario display of restoration process. In particular, it combined interactive technology with a masterpiece designated as national treasure in its rich collection—Lin Yu-Shan’s Asian gouache painting *Lotus Pond*—to create a VR version of this enthralling painting, thereby immersing the viewers in the lyrical atmosphere and offering them multi-sensory experiences.

After renovation, the Cooper Hewitt Smithsonian Design Museum has reopened and devoted itself to modern interactive art. To this end, the museum developed the “Cooper Hewitt Pen” in collaboration with a Taiwanese technology firm for the visitors to collect and share its exhibition information. The smart-pen consists of two main technologies. The first is the conductive material used in its nib and the touch screen interacting with it. The second is the near-field communication interface of the interactive screen. The pen even allows the visitors to view the information of the exhibits they collected during the tour on the high-definition interactive table. This function turns the visitors into their own curators who can design their own exhibitions. After collating the collected works and associated information, the visitors can store their “exhibitions” on a cloud database and will receive the corresponding collect symbol and code. Then the visitors can access their own “exhibitions” by entering the code on the website cooperhewitt.org/you at home.

Digital archive databases and special exhibition research data provide profound contents for digital guide service. By means of mobile screens, these contents open up new opportunities for the visitors to actively explore the information of exhibits, which not only allows the viewers to admire the exhibits in different ways, but also grants them a wider scope of options on related knowledge.

3.4 Virtual Presentation

VR and AR are the most common interfaces adopted by museums for virtual presentation. As digital technology and social media flourish every day, the Internet has been construed as a virtual “third place,” which not only meets the criteria of personalization, accessibility and comfortability, but also satisfies the public needs for social intercourse. In 2012, the California Association of Museums issued its foresight research report titled “Museums as Third Place,” in which “virtuality” was included as one of the key characteristics of a third place. In fact, an online/virtual museum has transcended the limitations of traditional visitor participation. It is not so much a cyber-colony of physical museums as a digital existence with complementary functions, because all the interactive mechanisms, games, videos, 3D simulations, forums, and community management that online/virtual museums provide can supplement or enhance the visitors’ viewing experiences.

The objectives shared among online/virtual museums (e.g. remote, alternative, differential demand, and pre-visit) have been attained in the current environment underpinned by advanced digital technology, popularized digital devices, and

improved cultural literacy. The creative, highly amusing digital interactive design with a low entry threshold, the growing participation of digital service users, and the efforts of digital museums, have collectively transmuted the unapproachable archives stored in the form of readme file in obscure corners of databases into the subjects of searching and browsing as well as the contents for entertainment and interaction via smartphones. These digital knowledge/information service designs are tantamount to a significant landmark in the history of digital technology. Anyway, to fulfill knowledge exchange, the underlying principle for museums is to select and present proper contents to visitors, through which enjoyable cultural experiences can be created [12].

3.5 3D Scanning and 3D Printing

3D scanning and database systems have become necessary commodities for museums to enrich the public understanding of their collections. Some museums have embarked on the 3D scanning of their collections. By virtue of 3D scanning and 3D printing, artifacts' details can be preserved and presented in the form of digital sculpture. Photogrammetry, a 3D photo modeling technology, can transform real-time graphic big data into hyper-realistic 3D digital files by algorithms. Then the files are styled through parameter adjustments and 3D fusion, and finally combined with full-color 3D modeling technology to fit them into real-life scenes. A surreal atmosphere is thus created. Photographers become sculptors. Photo modeling and digital sculpture will spur revolutionary innovations of digital cameras.

The Museum of Pure Form is undertaking an experiment of sharing and displaying 3D information. In 2004, it scanned a whole set of sculpture database. It also developed installations of its collection, allowing the visitors to interact with the works by using 3D digital technologies such as stereo vision, virtual cave technology, and haptic devices [13]. Established by the Smithsonian Institution in 2013, Smithsonian X 3D platform provides the 3D open-source files of its collection (incl. data area, browsing interface, as well as augmented information files of texts, images and audiovisuals) for online appreciation, education, and valued-added development. More important, it extends the use of digital artifacts to real classrooms by dint of 3D printing files. In her keynote speech at the 7th International Euro-Mediterranean Conference, Diane Zoric, the director of the Smithsonian's Digitization Program Office, introduced the Smithsonian Museum's Digital-First Strategy. The Smithsonian X 3D platform on the one hand tries to increase and connect the digitalized information of its collection with linked open-data, and on the other hand continues using value-added applications of AR, MR and VR to enlarge, represent, and immerse digital artifacts in a realm interlaced by the virtual and the real.

3.6 Immersive Projection Display

To attract more visitors, contemporary alternative museums have utilized software to merge different projections seamlessly into a huge one and transform the exhibition space into an immersive field with images as the contents of display. The "MORI Building Digital Art Museum: Epson teamLab Borderless" featured a total of 50 interactive exhibits created by enlisting 520 computers and 470 projectors in a space

covering more than 33,058 m². Its five interconnected exhibition areas constituted a completely immersive, gorgeous digital art space. The sense of immersion brought by the museum's interactive projections did allow the visitors to enjoy the borderless aesthetic beauty visually and somatosensorily. The content design and technology design of an exhibition involve the accumulation of relevant literature and practical experiences about the traffic flow, content design, interactive installation, and multimedia display, so that digital application and display can produce narratives that are appealing to visitors.

The Culturespaces, a world-renowned curatorial team and a pioneer of AMIEX (art and music immersive experience), was in charge of the software and hardware design for the three inauguration exhibitions of the Atelier des Lumieres in 2018. The special exhibition featuring the works by Gustav Klimt was the most eye-catching. It projected the images of Gustav Klimt's paintings with more than 140 projectors in the exhibition space covering 3,300 m², thereby immersing the visitors in the alluring brushstrokes, colors, images, and figures created by Klimt. Following the Gustav Klimt Exhibition, the Van Gogh Show took place on February 22, 2019, which was curated by the Culturespaces and executed by the Danny Rose Studio.

These professional light art curatorial firms, be they the teamLab or the Culturespaces, have proved their market value, though the teamLab focuses on techno-art, whereas the Culturespaces accentuates immersive audiovisual exhibitions. Leaving their scale and technology aside, the two firms demonstrate the commercial value and value-added applications of "culture plus digital" and "art plus technology." Art is by no means confined to museums and galleries.

4 Conclusions

Many museums have introduced portable electronic tour guides since the 1950s. Visiting museums has also become a source of social experience. Therefore, grasping the exhibition contents that visitors would like to share has constituted a real challenge to museums. In her "post-museum" discourse, Eilean Hooper-Greenhill argued that museums, as cultural institutions emerging with modernization, can no longer act like before, namely treating themselves as the only place capable of imparting knowledge and truth. She proposed the approach of visual culture, providing the contents of education and learning by focusing on the way of "display." As one of the core functions of museums, display per se is a presentation of visual arts at the material dimension. This approach aims to trigger richer and more diverse imagination and discussion about museum display. In addition, archiving, also a core function of museums, is a manifestation of our material civilization. However, the archived exhibits do not speak for themselves. Their meanings are produced within their respective contexts through the interpretive strategy of curating. What the visitors see, identify, grasp, or interpret is structured by their own knowledge backgrounds. Michel Foucault's concept of "gaze" refers to the experience of knowing things by viewing. We can use it to question the boundaries between the visible and the invisible, as well as between the describable and the unspeakable [14].

This paper offers synthetic suggestions concerning the application of digital media technology in the following four dimensions: (1) the display and re-creation of digital archive; (2) the introduction of digital technology into research and development; (3) the practice of display technology; and (4) the digital preservation and application of new media art. We conducted several interviews with professionals in this field. All of them agreed that innovation is absolutely necessary whether in terms of digital technology R&D or application.

1. Jay Tseng, the director of Ultra Combos, claimed that we know nothing but mere formality about digital technology. People tend to grasp it from the keywords such as AI, AR, or VR. However, digital technology should be understood as flowing and replete with possibilities. It can reorganize the world, and its applications are limitless. It should not be confined to the concepts of these keywords.
2. Tsun-Hung Tsai, an assistant professor at the Shih Chien University, pointed out that information security tends to be ignored in the process of digitalization. In fact, once digital data leak out, there is no way to get them back. Therefore, museums or galleries should be very cautious about security leak when they attempt to apply digital data for further promotion or platform construction.
3. Kudo Takashi from the teamLab highlighted the idea of boundary-crossing. In his opinion, the teamLab has never been perplexed by the issues concerning the balance among technology, art, and market. It treats digital technology as a tool and art as the content. The teamLab believes that art proposes questions and design delivers answers, which is exemplified by its exhibition venue in which no sign of exit is provided so that the visitors have to engage in finding their own answers.
4. Ulanda Blair, a curator from the M+, also adopted a cautious stance towards the museum application of technology which should be meaningful, reflective and critical.

In general, all these interviewees are capable of cultural content thinking (at least attending simultaneously to content and technology). According to their practical experiences, these experts prefer cultural practice with externalities, which is similar to Friedrich Kittler's idea of "cultural techniques." They employ technologies to sustain culture, while cultural practice is embedded in the context of cultural techniques. In terms of digital application and its functions, these professionals place a higher priority on representation's condition (technology) than on its meaning (content).

Kei Arai, a professor at the Tokyo University of the Arts, said bluntly that the rapid development of contemporary digital technology has not only attracted considerable attention of galleries and museums around the world, but also prompted them to explore its potential for application. Arai also pointed out that the application of digital technology to the restoration, preservation, and display of traditional arts must lay greater emphasis on cultural education than on display of spectacles, and should not habitually cater to the fashion of the day. Digital technology empowers people to increase their human potential, and ergo its application should set great store by the parts unable to be seen in ordinary exhibitions, such as the underlying textures, compositions, and structure of exhibits. Diane Wang, the digital program producer of the M+, made it clearly that contemporary museums and galleries must adopt a three-pronged strategy in response to the impact of new media and digital technology.

Firstly, they should improve their abilities to utilize technologies and facilitate innovation, so as to establish a sound, powerful foundation (e.g. database, and art evaluation system). Secondly, they should build a data structure that allows their users to retrieve information and conduct technological experiments. Thirdly, they need to prepare themselves for more responsive, dynamic application of technologies, which will in turn enable museums and galleries to keep up with the latest trends.

The experts we interviewed for this study are active in digital engineering and techno-art. Based on their astute observations and extensive experiences of the planning, R&D, implementation, and innovation of large-scale digital projects and programs, these experts shared their insights and made many valuable suggestions about many issues, including “the valued-added application of digital archive,” “virtual museum,” “display technology development,” “AI and big data application,” “3D printing,” “new media art archiving and documentation,” “the introduction and application of AR and VR devices,” “3D scanning,” “digital tools and experiences,” “digital strategy and organizational policy,” “the design of digital participation,” “the introduction of user experiences,” “the technologies of new media art preservation and maintenance,” and “the balance between technicality and artistry.” To sum up, when applying innovative technologies, be it AI, AR, MR, VR, IoT, 5G, or cloud computing, museums and galleries must use digital technology to design “emotive projects” that feature not so much objects as stories and underpin the interaction among virtual characters, real visitors, and objects. Furthermore, apart from connecting online experiences with on-site ones, museums and galleries should render their activities before, during, and after exhibitions coherent, and make a unique blend of tangible and intangible experiences, insofar as to create a captivating hybridization of 2D planes and 3D spaces, in which the narrative frameworks for social and emotional engagement can be developed.

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