VIRTUAL MUSEUM

Towards a new typology of the museum in the future

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Abstract. Architecture is affected by the information technology, one must consider two conditions: that the physical spaces of architecture as we have always known it (enclosure, form and permanence) will without a doubt persevere, and that it will exist alongside the virtual architecture, surfacing in the digital domain of the internet. Museums are now being constructed, navigated, experienced, comprehended, and altered in their virtual states by countless people across global networks. This new architecture of liquidity, flux and mutability is predicated on technological advances and fuelled by basic human desire to probe the unknown. The path that both types of architecture, the real and the virtual, take will be one of convergence. VR seems to be the next logical step in the path laid by CAD, but it will have a more extensive impact, since it not only transforms the way architects design and visualize, but can also be integrated into the final product of architecture itself: such as museums. The main goal of this paper is to emphasize the new typology of museums of the future in which digital technologies support all kinds of museum activities such as gathering, preserving, researching, exhibiting, and educating. Also, to introduce digital technologies for the digital museum such as media and new human interface technologies for novel exhibition styles and data processing technologies for digital archiving of cultural or historical artifacts. The paper highlights the technology used in this new typology of museums; the virtual museum. It also discusses the advantages and the disadvantages of the virtual museum.

1. Introduction

The distinctive mission of real museums is to collect and preserve objects, record information, study and make available to the public for educational and entertainment purposes. They are valuable sources of knowledge and understanding about humanity and the natural world and are seen as centers that can provide a focus for a sense of

community that is being threatened by population movement, social deprivation or property development. Information Technology has recently made striking improvements that large sectors of visitors can now access remote multimedia data with low cost computers and standard software tools. The purpose of virtualization is not solely to view data placed in a virtual space. This digital archive technology is also important for the permanent preservation of exhibits which are vulnerable to deterioration.

A major goal of these digital exhibitions is educational, championing museums as part of the educational infrastructure – a longstanding perception of museums – and providing online resources for instructors as well as students. (Marstine, 2006)

2. Real and Virtual Museums

Virtual museums are museums in a pure information space, and real museums are museums in a physical space where actual materials exist; both contrast one another and mutually complement one another. The ideal museum for the 21st century is defined as a museum that extends across both spaces and organically integrates these two types of museums using digital technology. (Sakamura, 1997).

One of the disadvantages of virtualization is that some types of information cannot be communicated as digitized information. If one was to visit all of the museums throughout the world and hold and measure each actual item, it would be possible to get new information which could be obtained through the sensory pattern recognition unique to humans, something that could not be obtained through normal database searching. However, there are some cases where digitally archived materials have more information than the original items. Adding descriptions and related information to exhibits using hyperlinks are such examples. This accumulation and expression of information about relationships through a temporal and spatial axis is where a virtual museum may have advantages over a real museum.

3. Technologies Used in Real Museums (PDMA, electronic tags, laser pointers)

In order to make virtual museums and real museums complement one another, it is necessary to ensure that computers are able to recognize entities such as actual materials and visitors. Electronic tags and sensors act as the intermediaries of information between real and virtual in this way. On the other hand, the intermediaries of information from virtual to real are displays and speakers in each exhibition venue, and the special small terminals –PDMA (Personalized Digital Museum Assistant) designed for museums and lent to visitors.

By attaching small electronic tags using contactless IC card technology, it is possible to read the tags with a sensor attached to the computer, thereby specifying the materials. Using such electronic tags it also becomes possible to adopt systems which automatically recognize where particular items are in storage.

Electronic tags can also be applied in exhibits. If a visitor has a PDMA with a built-in sensor, it becomes simple for the PDMA to provide an explanation about the exhibits which the visitor approaches. For large exhibits and exhibits comprising a large number of components, it becomes possible to provide detailed explanations about the areas approached by the PDMA.(Lui, 1999).

It has become clear, however, that with this system there are some situations where users cannot bring their PDMAs close to an exhibit, in order to accommodate such situations, a system has been developed by which visitors use a laser-pointer to indicate the actual materials about which they would like an explanation. This is then detected by a sensor near that material, and an explanation is sent to the terminal.

4. Personal museum

Recognition of visitors is carried out by human sensors, but it is necessary to specify the individuals in order to personalize the information to meet the characteristics of the visitor. The Personal Museum is another example of supplementing the real with the virtual. In the real world, as illustrated by terms such as mass production and economies of scale, in many cases it is inefficient to respond separately to individuals. For example, if efforts are made to match the expressions on museum panels to the visitors, as much as

possible, attention has to be paid to the following at the least; differences in the level of contents for general adults, for experts, and for school children, the accessibility to people with weak eyesight, color blindness and other physical conditions, languages used for visitors and foreign visitors.

It is clear that a wide range of combinations have to be accommodated. In contrast, in the world of computers and information, responding separately to individuals is not a big overhead. If visitors input information about their own characteristics into their PDMAs when they first arrive, then it is possible to display text in accordance with those attributes. The information can be displayed in larger fonts if necessary, and it is possible to have the information read out for visually impaired visitors. This may be instead of exhibits of the past where visitors mainly looked into glass boxes; unique exhibits become possible in which exhibits are arranged freely in a panorama (it may be necessary to use replicas), and visitors are able to walk around them freely, looking at the commentary on their PDMAs as it suits them.

In the future, it is likely to become possible to use an artificial intelligence recognition technology called image recognition to act as the intermediary between virtual and real information. The exterior appearance of materials is digitally archived, i.e. it is in the records of the museum, so it is quite conceivable that it may become possible to specify materials from the exterior appearance by referring to this archive. The use of artificial intelligence technology is very likely become the research theme in museums of the future.

5. Virtual Reality in museums

Virtual reality (VR) is a technology that enables a user to see and interact with a synthetic world generated by a computer and communicated to the users' senses by various input/output devices. The complexity of the input/output devices determine just how immersive the VR experience is, with the current state of the art VR relying on 3D stereoscopic head-tracked displays, hand/body tracking and binaural sound. (Donald, 2001). Museums require different technologies to input data in computers. All data currently held is digitalized. As a result, data input technologies have developed a wide range of tools, according to the ties of the data being digitalized. It is desirable that the format enables rapid searches and allows data to be

modified easily. A standard data format proposed is called Museum TAD (Tron Application Data) that is suited to museums, but the data that has been input and can be viewed must be considered in the virtual computer space. In order to develop virtual museum technology, where visitors can freely walk around the 3-dimensional data space (called a MMMUD, Multimedia Multi User Dungeon) and obtain the information they need, virtual museums need to establish access, context, and outreach by using information technology. The internet opens the "Virtual Museum" to an interactive dialogue with virtual visitors and invites them to make a virtual museum experience that is related to a real museum experience (Schweibenz, 1998). The Virtual Museum is a three dimensional computer – generated museum incorporating a display of spaces and exhibits. The equipment may consist of a rotating circular platform that holds a large video projection monitor, a computer, and chair on which the viewer can sit. From this chair the viewer interactively controls his movement through the virtual museum.

6. Museums with Digital Archives

The first concept of a digital museum is a digital archive. The digital archive is a database which receives the input via a digitalization function from the primary media (actual item), and accumulates and stores that information and enables users to use it. The digitization functions are offered by a variety of different input devices that read information from actual items, such as image scanners and three-dimensional digitizers.

There are two backgrounds of digital archives; first, it is the only practical way to record and preserve current states of museum collections without deterioration. Second, it provides a method to solve the well-known contradictory between preservation and exhibition, by utilizing the stored data in digital archives.

On the other hand, preservation and exhibition have remained to be the major requirements of museums since ancient times. However, they have been contradictory. The objective of preservation is future use, but if those materials are used, deterioration in the state of preservation is unavoidable. In this case, if it is adequate enough to obtain only information, not having to take out actual collections is important in terms of preventing their deterioration. Digital archives will contribute to this process.

In other words, a digital archive promotes the effective use of actual collections, while simultaneously reducing the necessity of using actual items, thereby protecting the original items (Koshizuka, 2000).

7. Digital Archive Technologies

The digital archive is just the core of the Digital Museum, because it is used for collection, preservation and exhibition. The quality of digital archive is supposed to decide the quality of Digital Museum. In constructing digital archives, there are many key digital technologies; technologies for databases, huge storages, and data representation. Compared with other technologies, this is especially important because insufficient data format causes important information of collections to lose, and will make the digital archive somehow useless in the future.

As resources for research, digital museum archives hold a wealth of materials in all areas of history, science, technology, and art. They also serve an essential purpose for the museums themselves, for holdings of self-generated records of the founding, policies, and problems of the past form the basis of an institution's identity. (Marstine, 2006)

8. Museums as Information Providers

The Digital Museum incorporates with not only virtual galleries but also real galleries. As for digital virtual exhibitions, virtual museums upon WWW system have been built on the internet. Major institutions such as the Louvre in Paris, the Museum of Anthropology in Vancouver, the National Gallery of Art in Washington, DC, and the Hermitage Museum in St Petersburg feature virtual tours of their galleries as part of more extensive sites. Other websites associated with established museums – particularly the Museum of Modern Art (MOMA) in New York – present digital exhibitions and art works created exclusively for the internet. They portray the web itself as an artistic medium, instead of using it to enhance the experience of gallery spaces. Not all virtual museums, however, are linked with specific buildings; some exist exclusively on the World Wide Web – including the Alternative Museum, the Museum of the Person, and the Virtual Museum of Canada. (Marstine, 2006)

The following set of tools is introduced as an example of the technologies that could be used in virtual reality museums:

Explanation Tool: is a tool for reading explanation texts, which will be displayed as hypertext documents containing links to other texts or other materials. Moreover, this tool can read the explanation text by using speech sound, and also can handle general sound data embedded in the explanation hypertext documents.

Magnifying Glass Tool: Usually, digital archives contain much higher resolution images than the resolution of usual computer displays. Thus, to see image data in the digital archive in its full resolution, a tool is needed to magnify the image data on the visitor's display. Glass tool is a MMMUD tool to apply image data several operations such as magnification, reduction, and scrolling.

Figure 1. Explanation tool, Source (Sakamura, K.,2000)

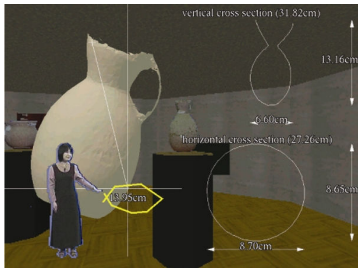

Figure 2. Video avatar with rotation tool, Source (same source)

Rotation Tool: is a tool to observe 3D geometric data created by 3D scanners. By using this tool, users can rotate and magnify materials represented in the 3D geometric data. Moreover, this tool provides functions to measure distance between two points on surface of materials.

Special Tool to Visualize the Distribution of Seismic Centers: is a very special tool to visualize the spatial, time, and scale distributions of seismic centers. For instance, this tool provides a command to change time scales. This can enable users to view the spatial distribution of seismic centers of earthquakes occurred during any period. In the same way as the rotation tool, this tool can rotate and magnify the 3D maps of seismic centers. (Koshizuka, 2000)

Cooperation Tool: is a tool to observe other user's behavior using tools. When a user uses the cooperation tool, he can see the observed users' screen. The observing user's screen will change in real-time

according to the actions of the observed users. The observing and observed users can talk with each other while they use the same tool. This mechanism supports users to exchange information or to discuss about materials.

In real museums, visitors can hear explanation of materials by curators and museum guide tours. The MMMUD virtual museum can also provide this function, called video guide tour function. The video guide tour function shows a special avatar in the form of human video images created by digital image processing. This special avatar gives users guidance and explanation of museum exhibit. This special avatar, called video avatar, has a function to move in the virtual environment and, moreover, other usual users participating the video guide tour follow the video avatar automatically.

10. Museum Navigation System using AR Technologies

Augmented reality merges the virtual reality world with the real, actual environment where the participant can see the actual surrounding environment combined with computer-generated imagery, instead of creating representations whose perception replaces that of a real world. The actual and virtual worlds coexist in the participant's perceptions as a tool to improve the participant's understanding of the exhibition environment.

An example of augmented reality is shown in the following shots captured from the virtual modeling of M. Khalil's museum, Giza, Egypt.

Figure 3. Selecting particular exhibits to be perceived by the visitor as html in Mahmoud Khalil Museum and his wife website, Source (Rashed,2004)

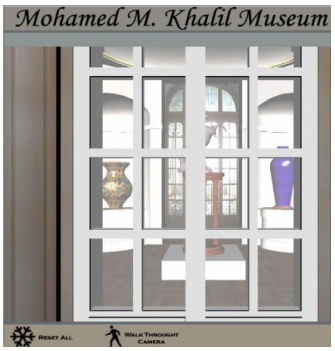

Figure 4. Shot of Mohamed M. Khalil museum using Augmented Reality Technology, (previous source)

Figure 5. Shot of Hall 5 in Mohamed M. Khalil museum using Augmented Reality Technology, (previous source)

11. Conclusion

According to museum expert Wolfgang Ernst, digitization actually recalls those Renaissance cabinets of wonder which exhibited an astonishing mixture of natural specimens and human-made objects. Like those cabinets, Ernst argues, digital collections display objects that are co-present and discontinuous – not made to conform to an historical narrative.

Virtual reality galleries represent museums that are not neutral spaces, fading into the background while viewers have immediate experiences of art works. This implication to the way spaces mediate

experience challenges traditional conceptions of the authentic museum visit – conceptions which state viewers should have personal, intellectual, and spiritual encounters with art works, without distraction. Some critics have argued, however, that such experiences have never been possible in museums: by de- and re-contextualizing art works, museums can only offer inauthentic experiences. (Marstine, 2006)

Features of exhibitions in the virtual museums constructed in the virtual environments differ from that of the real world. Firstly, large exhibition spaces can be acquired in virtual museums; many academic materials can be shown that can't be shown in the real museums because infinite exhibition spaces are available in the virtual environment. Furthermore, the other feature is that the virtual museums are used not only as database systems of museum collections; but also as communication spaces for users. However, one of the deficiencies depicted in the virtual museums is that images of art works portrayed in these types are often deficient, erasing distinctions of texture and scale. (Young, 2002)

Online resources make collections more accessible, offering diverse users an "interactive" experience. Visitors of virtual museums are empowered by the sites, and actively engage with them - able to follow their own interests rather than passively submit to institutional authority. Virtual reality galleries and museums are much favored by visitors in that they do stress movement, encouraging them to break the physical barriers of traditional museums. Internet users can jump from one corner of the building to the other, or between floors at will; they are not obliged to take a standard path through the museum. Nor are virtual visitors constrained by geographical boundaries. Anyone with access to and comprehension of the internet can view installations in Paris or Ottawa without incurring the cost of travel. Furthermore, online visitors can devise their own itineraries, avoiding limited museum hours, crowded spaces, and worry about whether or not specific galleries will be open. (Marstine, 2006)

The future of online museums is difficult to predict. It remains to be seen how a new generation of virtual museums will reshape, reinforce, or undermine notions of genuineness, interactivity, and even the museum itself.

References

Lui, A., 1999. Virtual space Vol. 3. China Planning Press, Beijing, Hong Kong.

Marstine, J., 2006. *New Museum Theory, An Introduction*. ed. Blackwell publishing, Hong Kong.

Sakamura, K. and Suzuki H., 1997. *Virtual Architecture*. ed. The University Museum, The University of Tokyo, Japan.

Koshizuka, N., et al., 2000. Hyper Gallery: A Museum Information Space Integrating Real and Virtual Galleries for Digital Museums. *Proceedings of 8th Workshop on Interactive Systems and Software Science and Technology*.

Rashed, H., 2004. The Role of Virtual Reality in Museum Design. Cairo University, M.Sc. Thesis. Egypt.

Donald, M.,2001. User Interfaces for Virtual Reality Systems. http://www.ecp.co.za/~DonaldM/TdOFc/Thesis/html. (10.10. 04).

Young, J., et al, 2002. *Six-Degree-of-Freedom Haptic Display Using Localized Contact Computations.* http://citeseer.ist.psu. edu/536072.html. (05.10.2004).