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E-B Environment - Behaviour Proceedings Journal

International Virtual Colloquium on Multi-disciplinary Research Impact (2nd Series)
Organised by Research Nexus UiTM (ReNeU)
Office of Deputy Vice Chancellor (Research and Innovation)
Universiti Teknologi MARA 40450 Shah Alam, Malaysia, 15 June 2022

e-IPH e-International Publishing House Ltd., United Kingdom

Interface Design Review on Interactive Exhibition for Nagasaki Atomic Bomb Museum

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Abstract
Nowadays, interactive digital exhibitions have become common at many museums, offering us a memorable experience. However, past research found many digital initiatives do not deliver the result as promised. These issue also troubled the losing connections within visitors, involving the process and execution, as well as stability and usability of the systems, which resulted in the visitor's experiences. In this paper, the focus is on the interface design principles and usability that are either confirmed or interrupted, which may affect the visitors psychologically. In conclusion, this paper suggests how to utilize interface design principles in a context of a museum.

Keywords: Interface Design; Interactive Digital Exhibition; Museum

DOI: https://doi.org/10.21834/ebpj.v7iSI7%20(Special%20Issue).3788

1.0 Introduction

Nowadays, the exhibitions for the museum collections are not limited to the preservation of the objects but also became an effective tool for research and education while at the same time gaining popularity among the general public. Moreover, the exhibition's roles are ever-expanding. One of them is a communication medium not only for the museums but also widely used in the commercial and public sectors. As a result of being used as a means of communication in various domains, the exhibition has evolved from the object-based exhibition (displaying artifacts in museums) to the information-based exhibition which referred to displaying images or texts in museum halls or information kiosks (Hafizah & Norfadilah, 2020).

The increase in information-based exhibitions has resulted in changes in museum exhibition style. The changes are not only to the most conventional panel display at eye level but also the various media and technology-enabled applications such as digital interactive equipment, environmental graphics, and digital installations. With such expansion of the role of the exhibition, most museums have brought about a diversity of presentation methods to attract the visitor's attention for effective communication. Moreover, the concept of new museology is where visitors have turned from passive observers to active participants (Simon, 2010). In line with this, museums have been implementing a wide range of interactive technologies and installation techniques for their exhibitions.

Likewise, by referring to the interactive digital exhibitions, it is referring to the digital installations at the museums so that the museum visitors can interact with them. Therefore, not all interactive digital exhibitions succeed in delivering content (Rowe, 2014). Thus, the study was conducted to ascertain how interactive digital museum exhibitions are interrupted by the interface design principles and how the

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DOI: https://doi.org/10.21834/ebpj.v7iSI7%20(Special%20Issue).3788

interface design principles affect the visitor's experiences. The study was conducted at the Nagasaki Atomic Bomb Museum in Nagasaki, Japan.

2.0 Understanding the relationship of interface design with interactive digital exhibition

One way of defining the "interface design" is by referring to a look and feel of an object demonstrated by some agents, intended to accomplish goals in a particular environment by using a set of components (Jakob, 2012; Norman, 2002; Preece, Rogers & Sharp, 2002). Moreover, as defined by Ralph and Wand (2009), interface designs are meant to accomplishing goals and satisfying a set of requirements, amongst other things. In a museum context, one of the main goals of interactive digital exhibitions is to satisfy the users' needs. For instance, in the context of the museum content delivery, this could be an interactive exhibition (object), created by programmers and designers (agents), who are intended to communicate a message or to entertain visitors (goals) in the museum (environment) by performing in a specific way (components) as shown in Fig. 1.

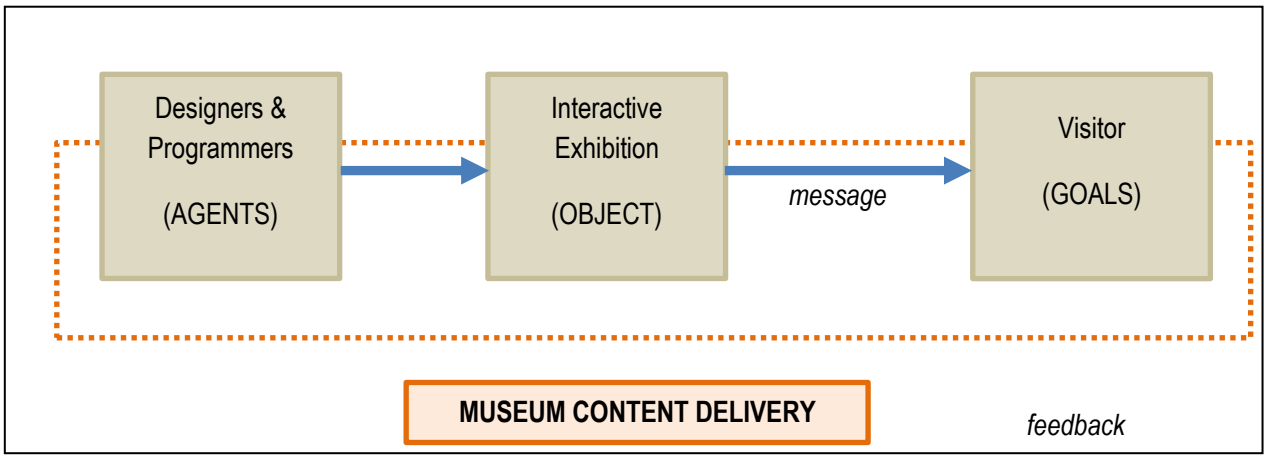

Fig. 1: The context of museum content delivery towards the interactive exhibition, agent creator, and visitor.

At the very least, an interface design must be functional before being able to address the higher-level user needs. In an example, where the interface design is to be analyzed, some questions could be asked, including the design's ease of use, empowering the user to do something and reliability (Goodman E, Stolterman E, Wakkary R. , 2011). Thus, an interactive museum exhibition might consist of some electronic hardware installations (Morgan, 2012; Rahim, Normala, et al., 2016; Shah & Ghazali, 2018). As illustrated in Fig. 2, the main focus of this paper is on the technology itself, the user, and the function of interface design in the museum exhibition.

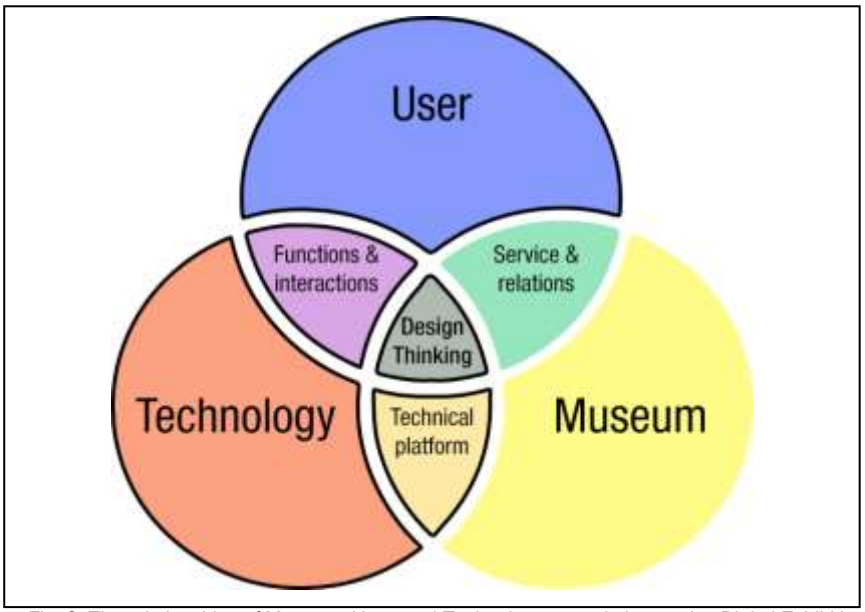

Fig. 2: The relationships of Museum, User, and Technology towards Interactive Digital Exhibition.

The concept of interface design has several meanings and is always based on the scope of understanding. Alternatively, the user interface can be defined from the point of view of the intended user of a system. In most cases, users do not distinguish between layers in architecture and often do not even have a clear view of the difference between hardware and software. Discussions on the interface

design systems have come up with many models being proposed in which some of them suggested separating the model from the user interface. This model describes the interface as the outer layer of the system. This outer layer is also defined as an agent responsible for the actual interaction between the user and the application. Indeed, it consists of two supporting elements: (ii) the presentation–screen design and (ii) the function's information. Within this approach, the interface design replacing the museum exhibition design is seen as the important element in each museum. Thus, there are two main reasons for taking this broader view of what interface design is (should do) on museum exhibitions:

(i) the exhibition panel design should help the user perform certain tasks
(ii) the dialog of the presentation should provide sufficient information

3.0 Methodology

To answer the problem, individual participant observation as a research method was used within one month. The participant observation was conducted at Nagasaki Atomic Bomb Museum, which is located in Nagasaki, Japan. The observation focuses on how the interaction and reaction of the visitors (including spoken comments, facial expressions, and body language) across the different types of digital interactive exhibitions at Nagasaki Atomic Bomb Museum. Observation findings of the interactive digital exhibitions are documented through handwritten notes, recorded video footage, and still photographs. The empirical data presented in this paper is gathered based on how the interactive digital exhibitions at the museum performed toward the interface design principles and how the interface design principles affect the visitor's experience.

For this study, the Nagasaki Atomic Bomb Museum was chosen as a sample of the study. In Asia, Japan has the highest number of museums, with around 65 such institutions located around the country. The exhibition's content in this museum is on the narratives of the suffering and damage experienced by local people during the war between the Japanese and the United States.

4.0 The Outcomes and Discussion

4.1 The Nagasaki Atomic Bomb Museum.

The Nagasaki Atomic Bomb Museum, located in Nagasaki, Japan, is a remembrance of the atomic bombing of Nagasaki by the United States of America in 1945. The Nagasaki museum was completed in April 1996, covering the history of the event as the story of the development of nuclear weapons. The museum displays photographs, artifacts, and documents related to the bombing of Nagasaki. The historical timeline as displayed at the Nagasaki Atomic Bomb Museum conveys the feeling of reading a pure historical chronology, which can roughly be categorized as before and after the bombing, the dropping of the atomic bomb on Nagasaki, the damage resulting from the nuclear fallout, and the nuclear weapons situation in the contemporary world. All the exhibition objects come with narration in four languages, Japanese, Chinese, Korean, and English.

4.2 Interface design usability evaluation for interactive digital exhibition

In the present work, a usability assessment of interface design is performed with the "Interface Design Evaluation" inspection method based on the five interface design principles. The term usability, according to Jacob Nielsen (2012), stands for the quality attribute that assesses how an interface is easy to be used by both novices and experts. Those related principles are shown in Table 1 with an individual score.

Table 1. Interface design usability evaluation checklist

Interface Design Evaluation		**YES**	**NO**
Principles			
CONSISTENCY	Consistency of font, color, and style	Yes	
HIERARCHY	Clearly showing the level of important content	Yes	
CONTRAST	Elements used to show contrast and avoid visibility	Yes	
BALANCES	Suitable content arrangement		No
HARMONY	Functional and appropriate text, visual and others technical item	Yes	

Table 1 shows the identified problems sorted from the usability assessment checklist. There is only one principle that has not complied with the design principle, which is the principle of Balances. This is justified by some of the system displays, which show blank screens before certain options, while other options do not even work. The displayed error messages are not understandable and led to broken links. Additionally, almost all screens do not have the 'help' option for the user. The details of the outcome in regards to the Balances principle are shown in Table 2.

Table 2. Ranking of the Interface design principles usability evaluation checklist

Interface Design Principle: CONTRAST	**YES**	**NO**

1	The visual used is clear and attractive	/	
2	Button return to the previous screen function well		/
3	The screen goes blank on the log-off		/
4	The system is slow in loading		/
5	Text is easy to read	/	
6	The screen goes blank by selecting the "option" button		/
7	Broken links		/

4.3 Interactive digital exhibitions performance

Through observation, it is understood that the museum is designed in such a way that the audience can see what effect does the bomb had on the city, the reconstruction and development of the city, and the lasting effect of the atomic bomb. The museum's first section is a room that depicts the old city as it was just before the bomb decimated Nagasaki. A clock that stopped at 11:02, which was the precise time when the bomb hit the city, is also on display to demonstrate the catastrophic event where too many people were killed at an instant. In the next section of this room, visitors can enter a space that shows Nagasaki just after the bombings. Included in the room is a water tank with contorted legs which was located at Keiko Middle School, approximately 800 meters away from the hypocentre of the bombing area. The permanent exhibition in this room, displaying large materials that are exposed to the blast, including a replica of a sidewall of the Urakami Cathedral which was hit by the bomb. Photographs and facts are shown alongside the artifacts left by the deceased (Fig. 3).

Fig. 3: The first exhibition room in the Nagasaki Atomic Bomb Museum

In addition, the second room contains a timeline of events that show moments right before the bomb being dropped in Nagasaki. This room also exhibits leaflets conveying the information that the American forces were stationed in Japan during the early part of 1945. Also included are melted bottles, the bones of a human hand stuck to a clump of melted glass, burnt clothing, a lunchbox with its contents still charred inside of it, and a helmet with the remains of a victim's skull in it. Section B of the second room shows the damage caused by the radiation, damage caused by the blast, appeals of the atomic bomb survivors, and the rescue and relief activities that were carried out (Fig. 4). In this section, visitors are presented with facts on modern nuclear weapons alongside the facts relating to the victims of the atomic bombing. And the final room in the museum contains videos and documents related to the Nagasaki bombing. Visitors can also find answers to their questions and documents like Nagasaki's Peace Declaration.

Fig. 4: The damage exhibited in the second room of the Nagasaki Atomic Bomb Museum

The first interactive digital exhibition that is observed at Nagasaki Atomic Bomb Museum resides in the first museum's room. The exhibition in this room features a physical three-dimensional model and a video display consisting of two stations, each of which consists

of a set of monitors (see Fig. 5). The three-dimensional models come with text displays as a helpful guide describing the model. The video display is complementing the three-dimensional model.

Fig. 5: A video display in the first room at the Nagasaki Atomic Bomb Museum

From the observation, it is discovered that the length of the video brings bad emotion to the visitors but does not necessarily contain bad content. In this case, however, there is no physical play, stop pause or playback button where the interfaces for controlling the length of the video do not appear on the screen. At the very least, the visitors should be allowed to either stop or change the video. Therefore, this shortcoming contributes to low interaction between the content of the presentation and the visitors, where most of them spent a very short time watching the video. As the Nagasaki Atomic Bomb Museum is designed for information-based exhibitions, more effective digital presentation methods are needed for better communication with the visitors.

Museums' function is not only to preserve and display things but also to preserve and display values through things. Due to the limitations of space and time, museums are not able to exhibit everything or most facts and knowledge. The most popular and conventional method of presenting information in exhibitions is to display text or images on display boards or panels at the eye level of visitors who view them in a standstill position. At the Nagasaki Atomic Bomb Museum, the observation in the second room of the museum found out that most of the visitors can access and interact with the historical texts and images of Nagasaki. It was also observed that the concept of the whole wall works well to the extent that people walk up to and interact with all the objects being exhibited (Fig. 6).

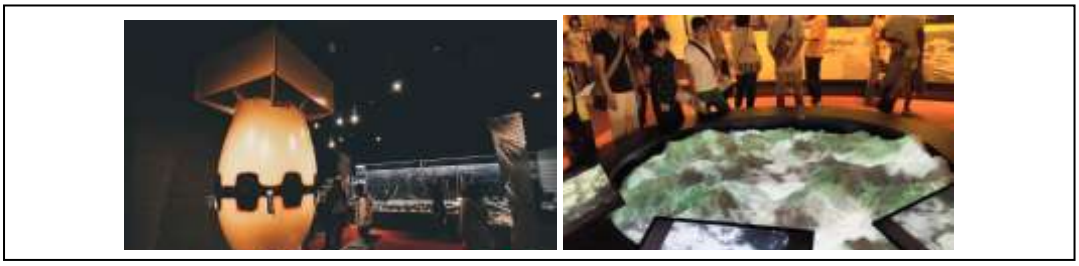

Fig. 6: The concept of the whole wall works at the Nagasaki Atomic Bomb Museum

When people visit museums that exhibit stories of the past, they are persuaded to think of the non-existing things. This condition reflects the ability of museum exhibitions to communicate to the visitors what they should remember and what they should forget. This capacity enables museums to have the authority to reconstruct, redefine, and interpret history and events. On a qualitative note, many visitors at the Nagasaki Atomic Bomb Museum gave positive reactions towards the interface design of the interactive digital exhibition in the second room where most of them show positive responses through facial expression and body gestures (in the sense of frustration towards the bombing).

The observation was also conducted at the third room of the museum which contained more information on the movement after the war, including the beginning of nuclear development, the people involved, a petition submitted by scientists to the American President against the use of the atomic bomb, a world map indicating countries that have nuclear weapons, and an exhibition on atomic bomb survivors. In particular, for this third room, the Nagasaki Atomic Bomb Museum provides a chronology of the warfare to enhance visitors' understanding of Japan's involvement in the war. The information displayed on the panel is in the Japanese language. While the topic line is written in English. The English explanations are also made available through audio voices at a small multimedia corner. This corner, even though important and provides significant information, but fails to catch the visitor's eye.

Fig. 7: The multimedia corner at the Nagasaki Atomic Bomb Museum

5.0 Conclusion

To understand the position of effective museum exhibitions, museum curators must first understand the characteristics of their visitors and what the visitors will see, learn, and perceive. Besides, museum visitors can be divided into three main categories: visitors who only look at the exhibition headlines; visitors who read about only the topics they are interested in; and visitors who read everything. Museums, therefore, have to organize their exhibitions in a way that the three main groups of visitors can fulfill their needs within a period of 45 minutes to 1.5 hours (the average amount of time that visitors spend in museums). For those reasons, it is concluded that the two methods of usability evaluation which are heuristic evaluations and usability interface design evaluation, are suitable and complement each other. When they are used together, they provide a better focus to the user in doing diagnosis and analyses of the object being studied. This will also increase better feedback, among other advantages.

Moreover, through observations, this action research also found out certain issues with the interactive digital exhibitions at Nagasaki Atomic Bomb Museum are plagued by some weaknesses in the interface designs, dysfunctional video, and discordance in coupling information being displayed. All these led to visitors' frustration and therefore, affects visitor experiences. In conclusion, this research does suggest to which extent that the interface design principles can be generalized across media platforms and what should be considered when working with interaction design and user experiences in general. As a whole, this research reveals that the design of the user interface is a very important element to be considered by museum curators.

Acknowledgement

This research is a collaboration study between Universiti Teknologi MARA (UiTM) and The Department of Museums Malaysia in determining the roles of interface design in museum exhibition.

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