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Winter 12-4-2016

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Recommended Citation

Chang, Hsin-Lu; Hu, Hui-Chen; and Shih, YungChi, "The Effectiveness of Applying Virtual Reality to Educational Purpose" (2016). *ICEB 2016 Proceedings*. 67.

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The Effectiveness of Applying Virtual Reality to Educational Purpose

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ABSTRACT

Research Motivation

The purpose of this thesis is to build a model to examine the impacts of subjects who experienced the virtual reality system made by Taiwan's National Palace Museum and make a proof that apply virtual reality on museum exhibition will achieve the expected benefits. The beginning of research on virtual reality is starting from psychological therapy. For the purpose of knowing what effects virtual reality has and why virtual reality is effective, many researchers devoted to this subject related to the concept of presence [1].

In the past decades, the researches on presence are adequate and covers many dimensions: the cause of presence, the category of presence, measuring presence, the outcome of presence, experimental design about understanding or measuring the presence, questionnaire design. However, what other fields that virtual reality can be applied in? what are the details about actual utilizing virtual reality in a specific field? The researches on this subjects are insufficient. For example, there was a research talking about applying virtual reality to learning purpose is potential if the system can generate a high presence virtual environment, but it did not actually prove it for real world. This paper, with Taiwan's National Palace Museum's virtual reality system, we will develop a model to examine the impacts of technical and task factors on presence in virtual reality museum exhibitions and through the questionnaire to evaluate the subject's performances.

For knowing using virtual reality in museum exhibitions was valuable or not, we listed the three main targets. These targets means after subjects experienced the virtual reality, it would be achieved at least one of the following benefits. the first one, enhance the subjects' willingness of joining the exhibitions, the second, increase the interests of the exhibitions and the last, improve the knowledge of artifacts in the exhibitions. Overall, we would know whether the virtual reality of museum exhibitions could produce the expected outcomes. If not, how to adjust the technical and task factors and improve the system is the question we try to answer.

Research Objective

Based on the past experiences, the visitors of museums could be divided into two types. The persons have been very interested in the artifacts or the experts had related professional background knowledge. Another type was the persons who just went for fun or felt curiosity but did not really interested in the contents. For giving the first type visitors a better experience and enhancing the interests of second type visitors, Taiwan's National Palace Museum had been starting its digital plan. The plan has been executed for several years and there have been many positive results and feedbacks. In recent years, the potential of virtual reality took the museum's fancy and the museum tried to develop a museum exhibition virtual reality.

Taiwan's National Palace Museum developed a virtual reality system for its digital plan. The virtual environment includes artifacts like jade cabbage, paintings and script of ancient poetry. The subjects wear head-mounted display(HMD), hands with the controllers and broadcast the introduction of artifacts continuously. There is a little space subjects can walk around and the scenes in the virtual environment is just like visiting an exhibition in the museum. In the virtual environment with the viewpoint of the subject, the subject can see that their right hand with white gloves and left hand with a flashlight. There are two ways that the subject can control the virtual environment and every action represents the different interactions. Controller on the right hand corresponds to the virtual environment is the right hand wearing the white gloves. The controller has a button, when press the button direct to the specific artifacts, it means "grab" the artifacts if the thing can be picked up. If the artifacts in the virtual environment cannot be picked up, such as painting and script of poetry, pressing the button will not give any response. A subject can use right hand to pick up the jade cabbage and watch it in full view. The controller on the left hand corresponds to the virtual environment is the left hand with the flashlight. A subject can use the flashlight to scan the paintings or scripts, and it represents the subject press the button on the left hand controller. The artifacts scanned will become full-screen in front of the subjects, so subject can see the details.

In order to know the outcomes of the museum exhibition virtual reality, we are going to build a model to figure it out. Therefore, we are going to find out the key factors that contributed to the presence and relationship between these variables and presence. Through the decades, the researches on finding out the factors that affects to presence was sufficient and many researchers tried to categorize these factors. Thus, there were so many taxonomies but some of them still had commonality. We use the Sheridan's (1992) taxonomy to categorized these variables into three groups, technological, task- or context-based and user characteristics or individual. Technological and task-based view are focus on the system level. Technological view focus on how the virtual reality design affects the presence. Task-based view emphasize what contexts or tasks will contribute to presence. Except the technological and task-based variables mentioned above, individual differences are important to presence. The variances between individuals are huge and complex, including differences of personal characteristics, attitude toward to the technology, tendencies of paying attention or engaging in the virtual environment. it is difficult to take these views all. Thus, this paper will concentrate on system level, point in technological and task-based factors and examine the impacts of these factors.

Presence is classified into personal presence, environmental presence, and social presence [2]. For the contexts of Taiwan's National Palace Museum virtual reality, there did not include the element of social presence. For the reason that this paper just separated the presence into personal and environmental presence.

We have three expected outcomes of this museum exhibition virtual reality, increasing the visitors' interests, improving the experience and learn more about the artifacts than before. Through the model, we want to know whether the system achieve these targets. The measurement is according to questionnaires fulfilled by subjects after they experienced the virtual reality. The measurement not only valid the model but also evaluate subjects' performance and the virtual reality can fulfill the expected outcomes or not. The details of the model will discuss in research framework paragraph. Model see the following Figure 1.

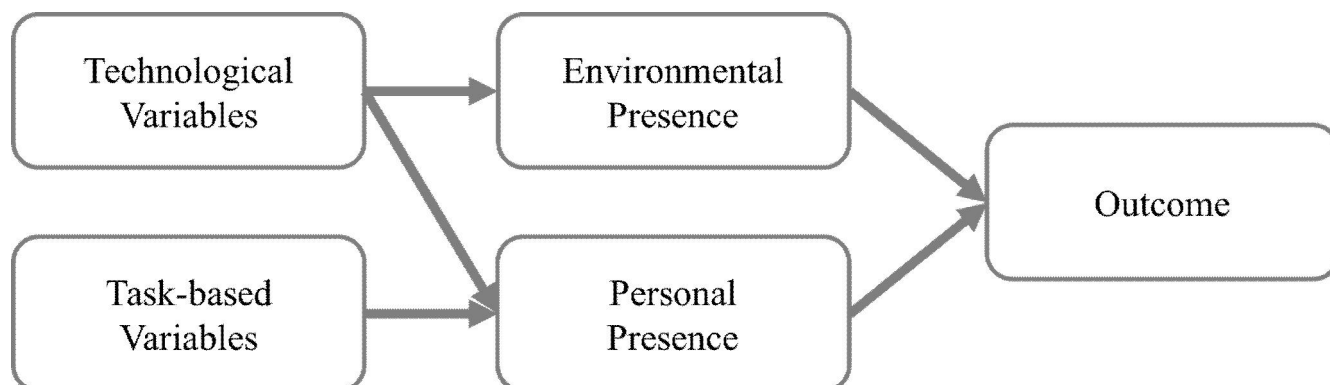


Figure 1

Literature Review

In the past researches, there were so many factors contribute to presence, and many researchers try to categorize these factors. Sheridan (1992) identifies five factors contribute to presence [3]. Steuer, J. (1992) categorized three of them as technological factors: the extent of sensory information, control of sensors relative to environment, and the ability to modify the physical environment [4]. The other two are task-, or context-based: task difficulty, and degree of automation [3]. Zeltner (1992) also provides three technological variables: autonomy (a qualitative measure of the ability of a computational model to act and react to simulated events and stimuli), interaction (the degree of access to model parameters at runtime), and presence (bandwidth of sensation) [5]. Naimark (1992) provides a six-category factors for realspace imaging and the taxonomy also from a technological view [6].

The definition of term "presence" is related to wide fields of researches. Lombard and Ditton identified six different explanations of presence: social richness, realism, transportation, immersion, social actor within medium, medium as actor [7]. Schloerb separated the presence into subjective presence and objective presence [8]. Heeter distinguishes between three different types of presence: personal presence, a measure of the extent to which the person feels like he or she is part of the virtual environment; social presence, refers to the extent to which other beings (living or synthetic) also exist in the virtual environment; environmental presence, refers to the extent to which the environment itself acknowledges and reacts to the person in the virtual environment [2]. There are still existing other researches about defining the nature of presence. Although these theories do not conflict, we have to pick one or converge approach some theories together when it is necessary to measuring presence. This paper uses the Heeter's definition, differentiate personal presence, social presence and environmental presence.

The measurement of presence in this paper is questionnaire. The presence questionnaire has been developed for several years and many of them were passed the validity test. So far we sort out the presence questionnaire and classified the questions to personal or environmental presence. The following are the presence questions we are going to use it to our questionnaire [12] [13] [14].

- Personal Presence
- (1) I was aware of the world.
 - (2) I felt I knew what was going to happen next
 - (3) How involved were you in the virtual environment experience?
 - (4) When you think back about your experience, do you think of the field more as images that you saw, or more as somewhere that you visited?
 - (5) During the time of the experience, did you often think to yourself that you were actually just standing in an office wearing a helmet or did the field overwhelm you?
- Environmental Presence
- (1) How well could you move or manipulate objects in the virtual environment?

- (2) How responsive was the environment to actions that you initiated (or performed)?
- (3) The temperature of the real world distracted me.
- (4) I wanted to see more of the space in the displayed environment than I was able to.
- (5) I could not do some of the things I needed to do in the virtual environment.

The questionnaire of antecedents is also developing. There is a limitation of space and the final questions are not confirmed, thus we do not list all the questions we sorted up until now here.

Research Framework

Based on the model (Figure 1), There are two groups of antecedents which affect the presence. The technological and task-based groups. The technological variables refer to the variables related to the system design. All factors which will affect the presence and the factors relate to the virtual reality system design are the technological variables. For examples, how the virtual environment interacts and reacts with the subjects, what subjects can do in the virtual environment and how many sensory of the subjects used when experiencing. These questions are technical factors' issues. Giving the last question as instance, in the museum virtual reality, the subjects can grab the jade cabbage to watch all details and zoom in the paintings on the wall. The sensory breadth of this system is covered the visual, auditory, and basic orienting system.

The factors in the technical group also have three subgroups: interaction, vividness and realism. These factors were defined by many researchers. In the paper, the fundamental definitions of interactivity and vividness we chose the Steuer, J. (1992) definitions and used the definition to extent to other similar concepts. Interactivity refers to the degree to which users of a medium can influence the form or content of the mediated environment [4]. Vividness refers to The ability of a technology to produce a sensorially rich mediate environment [4]. Vividness is stimulus driven, depending entirely upon technical characteristics of a medium. Media artist Michael Naimark (1990) refers to these same properties as realness and interactivity [9]. Besides the interactivity and vividness factors, the last factor of technological is realism. The realism refers to a person can be fooled into believing that the experienced situation is real if his mind cannot detect any discrepancy between the expected and the mediated outcome of their actions [11]. In a review of the concept of presence in virtual environments and associated literature (Sanchez-Vives & Slater, 2005) it was reported that experimental studies have found that factors that contribute to high reported presence are mainly concerned with the form of: how data is displayed to participants and how they are able to interact, rather than with the level of realism of the displays [10]. The realism discussed in this paper emphasizes the level of realism, and images in the virtual environment must be statistically plausible in relation to the probability distribution of images over natural scenes [10]. A constraint on this plausibility is the level of immersion not the level of realism. Thus, the realism is also a factor contributes to the presence and it belongs to the technological variables. The technological variables will affect both personal and environmental presence.

The task-based variables group refer to any factor which related to the context of the virtual reality. The differentiation of tasks difficulty is the main factors we will discuss. In the museum virtual reality, the different types of the artifacts mean the different tasks. The different tasks have its task difficulty. For an example, the artifacts in the virtual reality can be separated in to three type: the utensils like jade cabbage, the paintings and the words in manuscript. Each type of task will lead to different degree of presence. For the reason that the factor tends to the individual, the task-based variables only affect the personal presence. The higher no matter the personal presence or the environmental presence, higher the total presence. The degree of the total presence represents the performance of this virtual reality. We make an assumption that the better performance can have more chance to achieve the outcomes we defined at the first.

Research Plan and Expected Contribution

With the virtual reality of Taiwan's National Palace Museum, we will design the experiments to verify the relationships in the model and further valid it. For measuring all the factors, the presence and outcome, we will develop a questionnaire to measure all the factors. We designed the questionnaire based on the past literatures. In the last, we want to know is the virtual reality of Taiwan's National Palace Museum can achieve the outcomes we expected including enhancing the subjects' willingness of joining the exhibitions, increasing the interests of the exhibitions and improving the knowledge of artifacts in the exhibitions when the subjects experienced the exhibition in simulated environment rather than being in the actually museum. If the final answer is positive, there is a big encouragement to museum to keep working on its digital plan and utilizing the virtual reality to more artifacts. It will give visitors a better experience when visiting the museum.

Through this paper, we build a model and verify it then we prove that using virtual reality in museum exhibition will give the visitors a better experience or not. For the future, we hope the model will not only use on this case. The case is just an instance and the model can be used in another case and on the other situation according to this model can give others advices to design the virtual reality across the technological and task-based view.

Keywords: Presence, virtual reality, virtual environment, presence measurement, user experiences, exhibition, museum.

REFERENCES

- [1] Schuemie, M. J., Van Der Straaten, P., Krijn, M., & Van Der Mast, C. A. (2001). Research on presence in virtual reality: A survey. *CyberPsychology & Behavior*, 4(2), 183-201.
- [2] Heeter, C. (1992). Being there: The subjective experience of presence. *Presence*, 1: 262–271.
- [3] Sheridan, T. B. (1992). Musings on telepresence and virtual presence. *Presence: Teleoperators and Virtual Environments*, 1 (1), 120-126.
- [4] Steuer, J. (1992). Defining virtual reality: Dimensions determining telepresence. *Journal of communication*, 42(4), 73-93.
- [5] Zeltzer, D. (1992). Autonomy, interaction, and presence. *Presence: Teleoperators and Virtual Environments*, 1(1), 127-132.
- [6] Naimark, M. (1992). Elements of realspace imaging. Apple Multimedia Lab Technical Report. Cupertino, CA: Apple Computer.
- [7] Lombard, M., & Ditton, T. (1997). At the heart of it all: The concept of presence. *Journal of Computer – Mediated Communication*, 3(2), 0-0.
- [8] Schloerb, D. W. (1995). A quantitative measure of telepresence. *Presence: Teleoperators & Virtual Environments*, 4(1), 64-80.
- [9] Naimark, M. (1990). Realness and interactivity. *The art of human-computer interface design*, 455-459.
- [10] Slater, M., Lotto, B., Arnold, M. M., & Sanchez-Vives, M. V. (2009). How we experience immersive virtual environments: the concept of presence and its measurement. *Anuario de psicología/The UB Journal of psychology*, 40(2), 193-210.
- [11] Herbelin, B., Salomon, R., Serino, A., & Blanke, O. (2016) 5 Neural Mechanisms of Bodily Self-Consciousness and the Experience of Presence in Virtual Reality
- [12] Slater, M., & Steed, A. (2000). A virtual presence counter. *Presence*, 9(5), 413-434
- [13] Keogh, E., & Davidoff, J. (2001). A Cross-Media Presence Questionnaire: The ITC-Sense of Presence Inventory.
- [14] Witmer, B. G., & Singer, M. F. (1994). Measuring presence in virtual environments (No. ARI-TR-1014). ARMY RESEARCH INST FOR THE BEHAVIORAL AND SOCIAL SCIENCES ALEXANDRIA VA.