Effects of user operation on the sense of reality in virtual reality with Roomscaling

Haalyn Choi
Chonnam National University
rynn1008@gmail.com

Heesu Yoon
Chonnam National University
gmltn0027@naver.com

Museok Jeong
Chonnam National University
splashwjd@gmail.com

Abstract: The purpose of this study is to identify the user's experience depends on how the conditions of user operation in the virtual reality of applying with Roomscaling, and what will affect the user's experience. Room-scale is a design paradigm for virtual reality (VR) experiences which allows users to freely walk around a play area, with their real-life motion reflected in the VR environment. This allows the user to perform tasks, such as walking across a room and picking up a key from a table, using natural movements. Being able to physically move within the space helps to replicate real-world movement for the user and make the virtual environment seem more real. To achieve the research objectives, a study was conducted to compare the differences in user experience in two conditions of virtual reality. In the first condition, the controller was used to operate observations implemented in virtual reality. In the second condition, users moved to observe an object implemented in virtual reality. Under all conditions, a statue of general and a picture were provided as an object of observation. Studies show that a group of controlled condition got the higher score in usability than the group of experimental condition. There was no difference between the two groups in virtual reality and learning engagement.

Keywords: Virtual Reality, Roomcaling, User Experience,

INTRODUCTION

Virtual Reality is a new learning media that can promote learning activities because it offers a perception which is not real but as if it exists. In comparison to several prior traditional platform, VR provides an experience in 3D spaces, which can offer a new learning environment. In addition, in a VR environment, Interactions occur in which users are likely to perceive a greater sense of immersion when providing a hands-on experience. Few studies had attempted to verify user experiences under spatial mobility is unrequired in immersive VR. Therefore, the user experience needs to be verified, even in situations where dynamic space movement is unnecessary, such as museum observations. In particular, observations in static environment are the conditions that are used a lot in educational situations, such as in physical laboratories or museums. Therefore, this exploratory will identify how the user experience differs under the conditions that can and cannot support spatial mobility.

METHOD

Participants

50 adults (27 males and 23 females) participated in this study. The average age of participants was about 23 years with a range of 18 through 30(SD=2.95). According to the pre-survey in the study, 29 out of 50 participants had experience with VR. They were recruited via the university website as paid participants. This study assigned participants to two conditions (VR condition=25/Control=25)

Materials

We used in this study is Oculus Rift. Oculus Rift is a head mounted display that implements VR. This equipment includes the controller called Oculus touch, which enables users to rotate and move objects. We also used Oculus room-scaled VR setup in a 1.8*1.8m calibrated space.

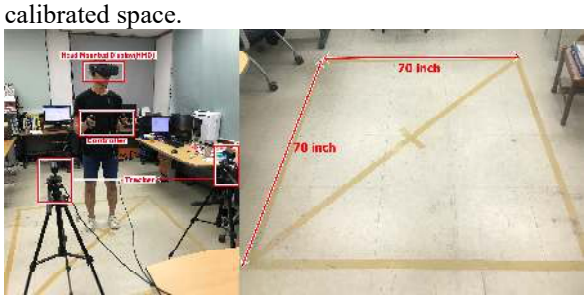

Figure 1. Room-scale setup

Design

Two conditions were applied in this study. Under the experimental condition, the user can not only take their position by manipulating the controller, but also move body directly to observe objects. A status of general and a picture were presented as objects for users to observe in virtual reality. Under the controlled condition, the user observed 3D objects by manipulating the VR controller without any movement. The user was supposed to manipulate the controller to move or rotate the objects.

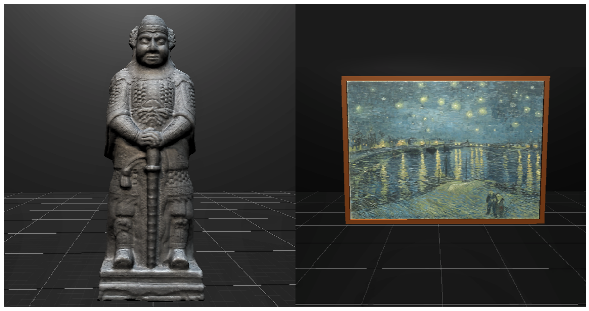

Figure 2. (A) A statue of a general (B) A picture.

Procedure

The procedure was the same as the experimental and controlled conditions. First, participants were informed of the purpose of the experiment, procedures and precautions. Users then were instructed to operate the device and took short operating training. After that, they were required to wear the device and entered the virtual reality space to observe. When a user observed an object, they were given three tasks and they had to act and respond accordingly. The tasks consisted of instructions to guide observation. Finally, Users were asked to complete a questionnaire each time they observed each object.

Task 1	observe and describe the whole of the general
	explain the structure of the armor.
	express the texture of the general.
Task 2	Describe the whole picture.
	Pick five objects in the picture.
	Describe atmosphere of two people at the bottom right.

Data collection

The measure usability, learning engagement, and VR presence, this study implemented a survey instrument. The instrument consisted of 25 questions. A questionnaire measuring Usability consisted of five questions and it assessed how easy and efficient the user is perceived to perform the task(α=.84). in regard to usability, we just fully modifie3d Kim(2010)'s survey. In terms of learning engagement, the survey consists of five questions, which estimate how users exert their efforts in tasks, We sampled 5 of 18 questions in the inSitu questionnaire (Larkken et al, 2012)(α=.92). Lastly, to capture users' virtual presence, we used 15 questions assessing how much users are aware of being existed in nonexistent circumstance(Ryu and Yu, 2016)(α=.97).

RESULTS

Through this study, there are two findings. As shown in Figure3, first, the group of the controlled condition significantly obtained the higher score(F=13.57, P<0.01) in usability than those of the experimental condition. Second, there was no difference between the two groups on virtual presence and learning engagement.

As shown in the study of finding, there is no statistical significance between two groups on virtual presence and learning engagement. We assume a potential reason why it happened. We assumed a potential reason why it happened. We assumed that the interaction in the intervention did not encourage the users to undergo spatial mobility.

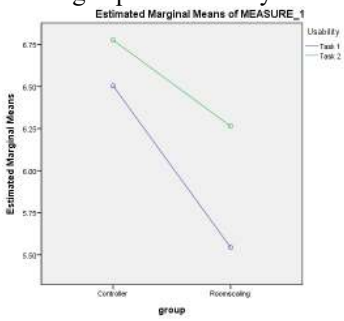

Figure 3. a graph showing the difference between controlled and experimental conditions

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