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A Study on Shamanistic Expression Method of Performances Using VR Technology: Body Ownership and Gaze

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Abstract

Virtual reality (VR) technology has been increasingly more frequently used day by day in industries, entertainment and performances due to the development of AR and MR technologies. Performance arts also actively utilize 360 ° VR technology due to the free expression of stage settings and auditoriums. However, technologies for systems in which performers wear VR devices firsthand rather than being in the sandpoint of bystanders while audiences wear VR head mounted displays(HMDs) to see performance stages have been rarely studied yet. This study investigated the technical possibilities of possible methods of expression that will enable performers to appear on the stage wearing VR devices. Since VR can maximize the sense of immersion with its closed HMD structure unlike augmented reality (AR), VR was judged to be suitable for studies centered on the mental interactions in the inner side of humans. Among them, to implement shamanistic expression methods with the phantoms of the body and soul, a motion capture technology linked with VR display devices and real-time cameras was realized on the stage. In this process, the importance of body ownership experienced by the performers (participants), reactions when they lost it, and the mental phenomena of the desire to possess the subjects of gaze could be seen. In addition, high possibility of development of this technology hereafter could be expected because this technology includes the technical openness that enables the audience to appear on the stage firsthand to become performers.

Keywords: *Virtual reality, shamanism, performance, body ownership, subject of gaze, hand gesture, interactivity*

1. Introduction

Stage performances through virtual reality technology have been utilized as a tool to give a sense of immersion and wow effects to the audience. Studies that attempted grafting of virtual reality technology on the field of performances have been continued from long ago together with the development of the technology. It is natural that virtual reality technology is studies on the stage because stage spaces are reality while enabling virtual experience [1].

Recently, cases where dances were combined with virtual reality technology such as a study that presented the possibility of expansion of dance performances applied with 3D hologram techniques [2] , and the range

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of expression of ballet motions using 3D projection mapping [3] have been presented to further enhance the possibility of the fusion of technology and arts. Furthermore, 360 ° virtual reality (VR) technology is an approach on a different dimension from existing studies in spatial expandability and can be regarded to be worthy of research in terms of mental research on space and movement. An art-tech content case analysis study utilizing VR technology in performing arts [4] also shows the results of study utilizing good technologies on the possibility of development as such.

However, given that the possibility of expression is limited due to audience -oriented VR studies, more scalable study results are judged necessary. When worn, VR head mounted displays (HMDs) have the closure to isolate the user from external environments. VR HMDs are used to maximize immersion effects, and the immersion environments as such can be regarded to be similar to the spiritual property of shamanism.

In this respect, this study is intended to investigate the possibility of shamanistic expression as a characteristic of ritualistic performances using VR technology. In addition, this study will examine what kinds of technologies should be grafted on ritualistic performances for ritualistic expressions as such to be become effective and realistic. This study focused on the psychological tendency [5] in which the sense of body ownership to perceive the body and regard it as being owned by the relevant person and hand gestures are used differently from reality.

2. Loss of Body Ownership and Embodiment

2.1 Performances and spaces using VR

Existing VR spaces are operated so that the user feels reality by matching changes in the tilt sensor of the HMD worn by the user with the viewpoint of the virtual camera in the computer space. Cases where there is no such interaction are live action based 360 ° image environments, which are divided into tendencies to pursue descriptive environments.

Virtual reality contents containing interactions can lead to immediate reactions of virtual reality objects when the user has taken actions in virtual reality thereby increasing the user's sense of immersion [6].

On the other hand, in general 360 ° image environments, interactions are not possible because there is no device that will enable the user to affect virtual objects so that the user remains as a bystander who watches multifaceted videos.

However, studies to apply diverse interactions to 360 ° image environments are in progress through studies of 360 degree images synthesis and stitching processes such as studies to synthesize 360 degree images and virtual 3D objects [7-8], and studies to insert actions in the process of stitching 360 degree images [9-10].

Performances applied with VR technology have been produced by filming general stage spaces with 360 degree cameras and stitching the images thereafter so that users can view 360° images. [11]

Performers just exists in the VR spaces and were not those who change VR spaces. In recent performances, as additional interfaces became utilizable, interactive spaces were enabled. The methods of expressing the hand in virtual spaces match the locations and movements of user's hand in virtual spaces with those in physical spaces one-to-one mainly using devices such as Fingo and Leap Motion to increase user's sense of immersion[12]

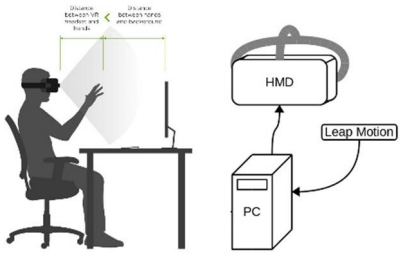

Figure.1 HMD user with Leap motion sensor

```
#include "Leap.h"

using namespace Leap;
class SampleListener : public Listener {
public:
      virtual void onInit(const Controller&);
      virtual void onConnect(const Controller&);
      virtual void onDisconnect(const Controller&);
      virtual void onExit(const Controller&);
      virtual void onFrame(const Controller&);
      virtual void onFocusGained(const Controller&);
      virtual void onFocusLost(const Controller&);
      virtual void onDeviceChange(const Controller&);
      virtual void onServiceConnect(const Controller&);
      virtual void onServiceDisconnect(const Controller&);

private:
};

void SampleListener::onFrame(const Controller& controller) {
      // Get the most recent frame and report fingertip information
      const Frame frame = controller.frame();
      HandList hands = frame.hands();
      for (HandList::const_iterator hl = hands.begin(); hl != hands.end(); ++hl) {
            // Get the first tracked hand (in most of the cases is the only one)
            const Hand hand = *hl;
            // Get fingers
            const FingerList fingers = hand.fingers();
            // Get index fingertip
            index_fingertip = hand.fingers()[1].tipPosition();
            // Get middle fingertip
            index_fingertip = hand.fingers()[2].tipPosition();
            // Get ring fingertip
            index_fingertip = hand.fingers()[3].tipPosition();
            // Get pinky fingertip
            index_fingertip = hand.fingers()[4].tipPosition();
            // Get thumb fingertip
            index_fingertip = hand.fingers()[0].tipPosition();
      }
}
```

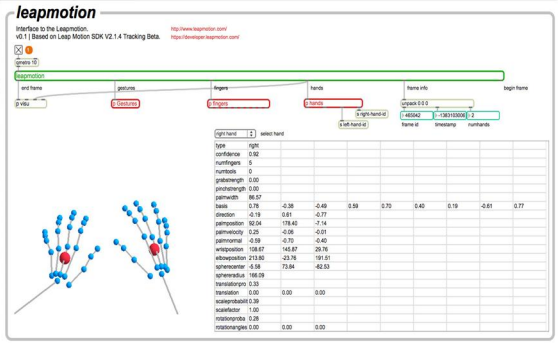

Figure.2 Leap motion code and Max patch

2.2 Desire for body ownership and the subject of gaze

The use of the hand gestures in VR performances brings about the effect of actually having two different realities because the hand made with computer graphics that actually exists on the virtual space is made like an avatar. In addition, the sense of immersion is increased further because body ownership [13] is added in that when the user's body is used, the body in the virtual space moves identically with the user's body. One thing important in body ownership is that one reality is felt as a reality in which the user is standing on his/her feet and another reality is the reproduced one seen in VR, which is appears as the reality seen through the camera in real time is duplicated.

Another factor for feeling the user's presence in VR is the gaze [14] of the user because the gaze defines

the subject of the gaze so that the user can feel "I am looking at there I am and standing at the starting point". In this study, the object that makes the gaze of the VR space was expressed with the user's live camera to show the perspective to see reality and virtual reality as two different realities instead of seeing VR spaces as CG and reality with a dichotomy.

Existing VR spaces are operated so that the user feels reality by matching changes in the tilt sensor of the HMD worn by the user with the viewpoint of the virtual camera in the computer space. Cases where there is no such interaction are live action based 360 ° image environments, which are divided into tendencies to pursue descriptive environments.

2.3 Closed spaces and shamanistic elements of VR

In this study, leap motions were used to implement real-time cameras instead of VR computer data, and users were enabled to use their hands while utilizing an infrared camera as a gaze so that they can experience two realities while giving performances at the same time. In addition, the gazes of performers were exchanged so that they cannot select gazes as active subjects. That is, they experience environments where they cannot see their own figures by themselves as they can see their own figures only when others show their figures to them. Through the foregoing, the removal of body ownership was expressed.

The reason why the body ownership as such was set is that the structure of HMD that enables the user to experience VR spaces makes closed spaces disconnected from the outside and this fact was considered to be associated with the shamanistic environments intended in shamanism [15] Therefore, gazes were exchanged to set passive body ownership with an intention to show the mental actions appearing in shamanistic acts. The mental actions as such means shamanistic methodology to separate the soul from the body.

2.4 Process through which two realities are mixed with each other- shamanistic expressiveness

In this study, because performances are given through the experience of the user's body that belongs to the other's gaze, a real-time camera is inserted into the VR space to show the reality as it is. This is to have the user experience his body that belongs to the other's gaze. Since the user's body is recognized as the other's body, information on the other's body is received but the user mistakes the other's body for his body. That is, although his body is perceived as his own, the body cannot be controlled because it is a replaced body so that he experiences the resultant incongruity and irrational situation. [16]

The incongruity as such occurs as he loses his subjective gaze and the incongruity becomes more effective as the space where his actual body is standing and the virtual space consisting of real-time camera information are inconsistent with each other. These moments were expressed as a process of embodiment [17] and for the expression, a simulation through which the body is possessed by the soul was expressed through largely three sections. How the real-time camera and the replace gaze, which is passive in the VR space, are combined and separated was shown through three sections.

3. VR Experimental Method for Shamanistic Expressions, and Result

The participants were divided into three parts consisting of one male dancer and one female dancer to express different subjects. First, the illusion experienced by those who have been deprived of their gazes as <bodies controlled by others> was shown. Second, the spiritual experience of being able to see one's figure

due to the <separation of the soul and the body> was shown. Third, the process through which two gazes separated from each other are combined with each other through <a game for combination of the soul and the body> was shown.

To this end, two performers participated in the experiment. Each of them wore an HMD(Oculus Rift DK2) connected to two different computers and leap motion was installed on the top of the HMD with a real time camera that would play the role of a gaze. The leap motions provided to the participants for the gaze and the manpower function of hand gestures were exchanged so that the other's camera was installed. Therefore, the first person and the third person were mixed with each other because the participants would see themselves from the third person's viewpoint.

Figure.3 Leap motion with HMD PC setting and Max Patch

3.1 My body controlled by others

One participant (B) observes the other's body (A) through the gaze. Through the screen, the audience can observe the incongruity of the exchanged gazes. Whereas A takes passive postures as his body is controlled by the gaze of the other, B conducts active behaviors. According to B's behavior, A mistakes B's behavior for his behavior and follows the behavior. B is deprived of his gaze and loses his body ownership. As the third party appears, the body controlled by A further becomes another's body. A can not control his body. As soon as his body is controlled by the other, the participant goes beyond the loss of physical functions and follows the other.

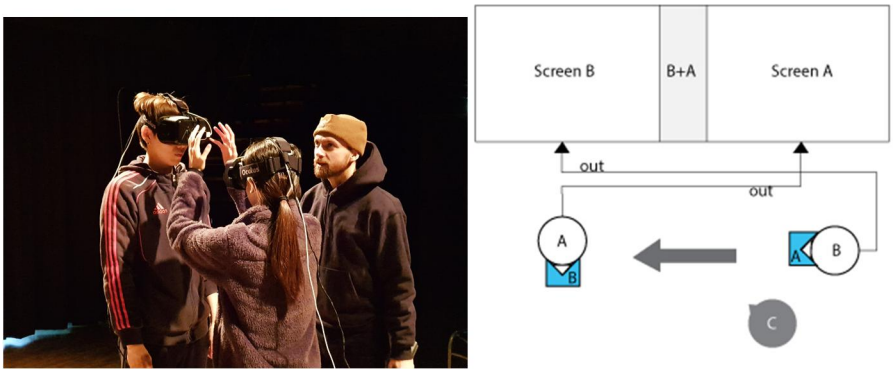

Figure.4 stage<1> structure and practice

3.2 Separation of the soul and the body

As with the first stage, A is in a passive and B is in an active position. Whereas A's body was controlled by B's body in the first stage, the second stage follows A's body while showing the outside of the visual area (posterior view) that A cannot see.

B takes off the HMD machine per se and uses it as his detached gaze tool. B reflects the posterior view of A's body with the HMD and delivers the information to A. In daily life, A gets out of the restricted environment where he can not see himself and sees his posterior view with simultaneity so that he feels the separation of his soul from his body. As B follows A's motions as they are while maintaining the coincidence of gazes, A feels that the gaze of B is the same as his gaze while becoming an observer who can see himself. The second stage refers to the homogeneity of the soul to the body that makes the person follow the posterior view of the other.

The illusion of seeing the soul separated from his body shows the possibility that the media can act as a transcendental being that can separate us from one reality thereby acting as two realities. [18]

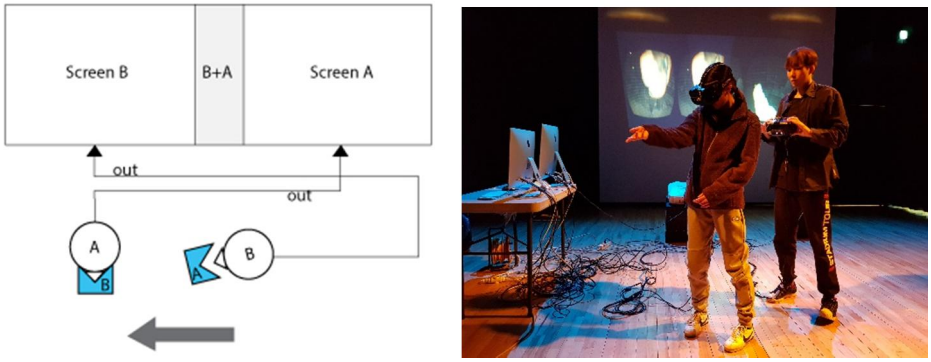

Figure.5 stage<2> structure and practice

3.3 Combination of the soul and the body _ The game

In the third stage, the process through which the body and the soul are combined after under going opposition and conflicts and the collision of gazes was composed like a game. A and B are standing face to face. They compete and fight over the views of them seen through the other's gazes and thereafter achieves the unity of actions step by step. The dispute looks like competition to win something first. Unlike the first and second stages, which were treated with the dichotomy of active and passive behaviors, they are at equal positions in the third stage. The process through which the separated soul and body are combined with each other is expressed with gestures that are like a sort of games. Particles are created repeatedly as the results of interactions to sense hand gestures in real time and react to the gestures.

The interface using hand gestures has more intuitive effects compared to other material based interfaces such as keyboards and mouses in that it has no substance and uses the body [19]. This is a visual representation of an invisible shamanistic role as augmented reality is added to the realities reproduced in VR on the screen. The sound used was made by mixing the praise of the medieval choir and the sound of Korean traditional gut. Finally, the gaze coincidence of pupils being combined with each other was shown by the

performance to match HMD cameras with each other.

Figure.6 stage<3> structure and practice

4. Conclusion

Through the performance combined with VR technology as shown above, the body controlled by the other, the separation of the body and the soul, and the combination of them were shown in three different forms of stages applied with the shamanistic methodology.

In the first stage, since one of the two participants was given the right to select camera gazes, the other participant behaviors to passively follow the former participant. A change in which the body ownership was lost appeared because the gazes of the participants exchanged with each other caused illusions. In the second stage, the participants were allowed to take off the HMD so that the gaze was separated from the body, thereby allowing the participants to see the area of themselves which are invisible and have an omniscient viewpoint. The participants experienced the separation of the soul from the body and transplanted the movement of the soul that follows the behavior of the body into the gaze of the other participants. In the third stage, the two participants were equally positioned to play a game attempting to occupy each other's gaze. A performance that means a process through which the body and the soul opposed with each other and were united thereafter through the same behaviors and interactions was implemented. In addition, the expression of particles that interact with hand gestures was shown on the real time camera to apply the technology to add augmented reality to virtual reality.

Shamanism cannot be sufficiently expressed by technologies because it irrational area is huge. However, the study on the technical method that can express the body and the soul through the performance using VR technology is regarded to have suggested a possibility expanded compared to existing the environment studies in which 360 ° images and interactions were combined. In addition, the implementation of a mechanism that can influence body ownership in the artistic expression of VR performances can be regarded to be meaningful in that it can be used as an immersive technology that can more obscurely show two different realities that divide real and virtual in the future.

In addition, unlike existing 360 ° images that have been viewed by the audience from the viewpoint of bystanders, the openness that will enable the audience to participate in the stage is included. Therefore, the degree of participation of the audience in performing arts is expected to improve quite a lot.

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