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A PATH FOR HORIZING YOUR INNOVATIVE WORK

APPLICATION OF VIRTUAL REALITY IN MODERN SOCIETY

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Abstract

In this article, we provide the nontechnical reader with a fundamental understanding of the components of virtual reality (VR) and a thorough discussion of the role VR has played in social science. First, we provide a brief overview of the hardware and equipment used to create VR and review common elements found within the virtual environment that may be of interest to social scientists, such as virtual humans and interactive, multisensory feedback. Then, we discuss the role of VR in existing social scientific research. Specifically, we review the literature on the study of VR as an *object*, wherein we discuss the effects of the technology on human users; VR as an *application*, wherein we consider real-world applications in areas such as medicine and education; and VR as a *method*, wherein we provide a comprehensive outline of studies in which VR technologies are used to study phenomena that have traditionally been studied in physical settings, such as nonverbal behavior and social interaction

INTRODUCTION

Virtual reality (VR) was originally conceived as a digitally created space that humans could access by donning sophisticated computer equipment (Lanier, 1992; Rheingold, 1991; Sutherland, 1968). Once inside that space, people could be transported to a different world, a substitute reality in which one could interact with objects, people, and environments, the appearance of which were bound only by the limits of the human imagination. Images of people in bulky headgear, heavily wired gloves, and space age clothing became symbolic of the emergent technological revolution of computing and the possibilities of transforming the capabilities of the human mind and body. Futurists heralded VR as an imminent transition in the ways humans would experience media, communicate with one another, and even perform mundane tasks. In the early nineties, pioneering scientists began considering new ways this groundbreaking technology could be used to study social interaction and other psychological phenomena (Bente, 1989; Biocca 1992a, b; Loomis, 1992). In subsequent years, VR has continued to capture the imagination of scientists, philosophers, and artists for its ability to substitute our physical environment and our sensory experiences – what we understand as reality – with digital creations.

1. What Is a Virtual Environment?

A *virtual environment* (VE) is a digital space in which a user's movements are *tracked* and his or her surroundings *rendered*, or digitally composed and displayed to the senses, in accordance with those movements. For example, in a computer game, a user's joystick motions can be tracked and his or her character moves forward, rendering a new environment. Or, a Nintendo Wii player can physically swing the Wii remote, and the screen shows a bowling ball rolling down the lane. The goal of a virtual environment isto replace the cues of the real world environment with digital ones. According to Biocca and Levy (1995), "The blocking of sensory impressions from physical reality is a crucial part of the most compelling VR experiences. These are immersed in the virtual world;

the body is entrusted to a reality engine" (p. 135). The psychological ex-perience of losing oneself in the digital environment and shutting out cues from the physical world is known as *immersion* (Witmer&Singer, 1998).A VE can be implemented on any number of computer-based platforms, from a cellular telephone screen to a desktop monitor to a fully immersive virtual environment (IVE) in which a user can move around a physical space while wearing computer equipment. See Figure 1 for an example of a virtual environment .The tracking and rendering process allows a much greater level of interactivity than traditional media. Unlike other media, a user in a virtual environment has a role within the medium, and his or her actions have an immediate and observable impact on the content of the medium. This inter activity may augment the effects of virtual environments because the user is typically active and cognitively engaged throughout the experience, in contrast to more passive media activities such as television viewing. Indeed, inter activity is one feature which contributes to making virtual reality so perceptually realistic because it reacts to our natural behaviors. Because of the claims of many futurists in the early 1990s, when people hear the words "virtual reality," it is often with a dose of skepticism and technological trepidation: What happened to that bizarre world where everyone sits at home and experiences life in a funky helmet? The fact is that much of the high-end virtual reality technology featured in these futuristic fantasies has not diffused as quickly as other emergent technologies (e.g., cellular phones) because it remains too costly and cumbersome for everyday use. In the meantime, more simple virtual environments have become increasingly prevalent. People are generally unaware that low-end virtual reality using the cycle of tracking and rendering is a daily experience for many via computers, videogame consoles, and cellular phones. Considering that almost one of every four people worldwide(nearly 1.6 billion) uses the Internet (Internet World Stats, 2009), three of every five people use cellular phones(Jordan's, 2009), and over 400 million videogames were sold last year (NPD Group, 2009), it is clear that low-immersive virtual environments are becoming a significant part of human existence around the world. The prevalence of exposure to VEs, and particularly their increasingly common use for social interaction, suggests that they are a necessary topic of social scientific study.

2. Hardware Setups

Virtual environments come in many forms, and often these are determined by the capabilities of the platform or hardware with which one is experiencing the VE. Virtual environment hardware may be something as simple as a cellular phone or as complex as a fully immersive virtual reality setup, which incorporates wearable equipment that allows the user to move in the physical environment. The most rudimentary VEs are those available on desktop computers, mobile devices such as cellular telephones and handheld gaming devices, and traditional videogame consoles. These environments may be two- or three-dimensional. Typically, key presses and mouse or joystick movements\ are employed by the user to move a viewpoint or a representation, thus providing a simple form of tracking. The monitor then reflects these changes via appropriate rendering. For example, a user may press the right arrow key or tilt a joystick to the right to move a videogame character from left to right on the screen and progress through a depicted virtual environment. New technologies have increased the tracking ability and movement veridicality in desktop setups via webcams and remotes (e.g., the Nintendo Wii). More immersive VEs often use a *head-mounted display* (HMD) to render virtual environments. An HMD is comprised of a helmet or headpiece with LCD screens affixed in front of the eyes to provide a wide, stereoscopic view of the computer-generated environment (Chung et al., 1989; Furness, 1987; Sutherland, 1968).An HMD may be used in a simple, non mobile setup, wherein the user's body remains stationary and only head movements are tracked. Head orientation is typically tracked through a device, such as an *accelerometer,* which provides feedback regarding the pitch, yaw, and roll of the user's head. If the user is in a fully immersive virtual environment and permitted to move around in the physical space, *optical* (light-based) or *magnetic trackers* may be attached to the user to send information about the user's x, y, and z position (Meyer, Apple white, &Biocca, 1992; also see Welch, 2009, for a history of tracking technologies). Some recent developments, such as the HIVE (huge immersive virtual environment; Waller, Bachmann, Hodgson, &Beall, 2007), feature portable, UN tethered equipment that enables users to move around in much larger spaces. Another type of fully immersive environment, such as the CAVE® (computer-assisted virtual environment; Cruz- Neira, Sandin, DeFanti, Kenyon, & Hart, 1992; Sutcliffe, Gault, Fernando,&Tan, 2006), involves the use of multiple cameras and projection screens in an enclosed room to give users the impression that they are surrounded by the VE. More complex VEs employ hardware that addresses different sensory modalities beyond visual stimuli (Turk & Robertson, 2000). For example, auditory aspects of a virtual environment can be transmitted through headphones or speakers. Sound is interpreted by the brain three-dimensionally, so the ability for a virtual environment to create specialized sound (e.g., a virtual human's voice coming from the direction of the speaker and growing louder as the speaker approaches) enhances the realism of the VE experience (Kalawsky, 1993; Loomis, Hebert, &Cicinelli, 1990; Zahorik, 2002). Matching appropriate auditory cueswith visual cues also enhances realism; for example, the sound of a door slamming should coincide with the visual depiction of the slamming door. The sense of touch has also been incorporated in VEs through the use of sensory gloves and other hap tic devices (Lanier, 1992, 1997; Salisbury &Srinivasan, 1997; Tan &Pentland, 1997). Some hap tic devices may be employed to allow a user to exert touch and grasp or move a virtual object. Other hap tic devices enable the user to feel the texture of a surface or receive *force feedback*, a felt reaction that can occur, for example, when trying to depress an object and having it bounce back (Basdogan, Ho, Srinivasan, & Slater, 2000; Tan &Pentland, 1997).

3. Application of virtual reality in modern world

1. Virtual Reality in Data Visualization

1. Intranet File Usage Visualization

[1]Our current application prototype visualizes the Intranet file usage of a global engineering consulting company which comprises approximately 7000 employees. This firm has created internal communities of practice, so-called *skill networks*, which consist of staff members who are specialized in a specific field of expertise, such a structural engineering, fire engineering, acoustics, etc., or have a professional interest in being a member of that community. Although these experts share a common corporate identity, they are often spread out geographically throughout the various international offices. To enable an effective communication of project experience and specialized knowledge, each skill network is represented by a website that is posted on the corporate Intranet, with the primary goal to geographically distribute the knowledge that is embedded in its content. All IP-numbers have been categorized in seven different regions, containing an approximate equal number of employees. The Intranet files are divided in three categories, each represented by a different color: orange document files (e.g. Word, PDF), purple structural files (e.g. HTML, ASP), and red image files (e.g. JPEG, GIF). This particular categorization has been chosen to analyze the differences between the web page functionalities and the specific knowledge documents they give access to. Figure 1,2 demonstrates that the whole interface is built up in human proportions and uses no space occluding menu widgets, resulting in a full physical immersion of users within the visualization Space.

Figure 1: A user immersed in a virtual reality cave

Each unique Intranet file is represented by a single infoticle. All infoticles initially swirl around the center of the scene. Seven forces, depicting the different geographic regions, are placed around this center and are represented by simple circular icons. A status console, placed at the bottom of the screen, reveals the timeline state and the database timeframe that is currently being loaded by the visualization system (see Fig.5). The system retrieves all the file access log entries that are present within a certain database timeframe (e.g. 1 hour: 2002-07-02, from 9:00 until 10:00). If the same data value (e.g. "USA") for a certain file (e.g. "index.html") appears more than once within this timeframe, they become accumulated for the average force calculation and the total number is mappedunto the width of the pathline ribbon.

Fig2: powerwall virtual reality environment

At first glance, the use of relatively sophisticated virtual reality technology for visualizing this kind of dataset might seem disproportionate. Yet, this dataset is implemented primarily as a manageable, real-world source for experimentation, with the goal to explore the infoticle metaphor effectiveness and detect its potential features for information display in immersive environments. In the following descriptions, a data entry found within the web logs is considered as a single 'use' of the corresponding document, although theoretically this relationship does not always hold: users might have just clicked on the document, or looked at it so briefly that assuming this data entry as an effective usage would be an overestimation. Also, the following infoticle scenario should not be confused with network visualizations, in which typically the physical transmission of unique electronic packets is represented. Instead, these infoticles denote the time-varying and geographical sharing of centrally stored knowledge documents.

2.Virtual Reality in Military Operation other than War

The application and value of virtual reality for the treatment of cognitive, emotional, psychological, and physical disorders has been well [2] specified (Glantz, Rizzo, & Graap, 2003; Rizzo et al., 2004), and a number of controlled studies over the last

10 years have documented its clinical efficacy as an exposure therapy treatment for anxiety disorders (Wiederhold&Wiederhold, 2004). The first use of VR for a Vietnam veteran with PTSD was reported in a case study of a 50-year-old, Caucasian male veteran meeting DSM-IV criteria for PTSD (Rothbaum et al., 1999). Results indicated post treatment improvement on all measures of PTSD and maintenance of these gains at 6-month follow-up. Examples of stimuli from these environments are included in Figures 3, 4. This case study was followed by an open clinical trial of VR for Vietnam veterans (Rothbaum et al., 2001). In this study, 16 male PTSD clients were exposed to two HMD-delivered virtual environments, a virtual clearing surrounded by jungle scenery, and a virtual Huey helicopter, in which the therapist controlled various visual and auditory effects (e.g., rockets, explosions, day/night, yelling). After an average of 13 exposure therapy sessions over 5 to 7 weeks, there was a significant reduction in PTSD and related symptoms.

Figures 3.1 and 3.2 The landing zone clearing in the Virtual Vietnam Scenario.

Figures 4.1 and 4.2 The view inside the virtual helicopter in Virtual Vietnam.

After VRET, the majority of clients' ratings of their global improvement indicated improvement. At 6 months, 6 of 8 reported improvement. Clinician's ratings of clients' global improvement as measured by the Clinical Global Improvement Scale indicated that 5 of 6 showed improvement immediately after the study while one appeared unchanged. At 6 months, 7 of 8 were rated as demonstrating some improvement. Clinician-rated PTSD symptoms as measured by the Clinician Administered PTSD Scale, the primary outcome measure, at 6-month follow-up indicated an overall statistically significant reduction from baseline in symptoms associated with specific reported traumatic experiences. Eight of 8 participants at the 6-month follow-up reported reductions in PTSD symptoms ranging from 15% to 67%. Significant decreases were seen in all three symptom clusters. Client self-reported intrusion and avoidance symptoms as measured by the Impact of Events Scale were significantly lower at 3 months than at baseline but not at 6 months, although there was a clear trend toward fewer intrusive thoughts and somewhat less avoidance. he authors concluded that VRET led to significant reductions in PTSD and related symptoms and was well tolerated. No person decompensated due to exposure to the VREs. No participant was hospitalized during the study for complications related to the treatment. Most of those who dropped out of the study were provided opportunities for other treatment within the PTSD Clinical Team clinic at the Atlanta VA Medical Center and did not appear to suffer any long-term problems attributable to their participation. This preliminary evidence suggested that VRET was a promising component of a comprehensive treatment approach for veterans with combat-related PTSD. Positive findings in the study of Vietnam veterans has led other groups to propose VR environments to facilitate PTSD treatment in civilians. For example, subsequent to the September 11, 2001 terrorist attacks on the World Trade Center in New York, Difede and Hoffman (2002) constructed a scenario in which civilians, firefighters, and police officers with PTSD could be exposed to relevant events in VR.

3.Virtual Reality in Surgical Education

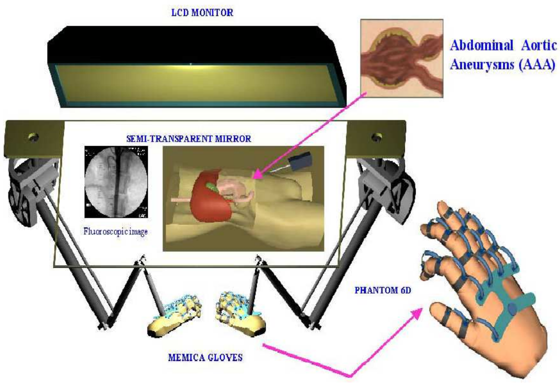

Figure 5. Virtual Reality for Surgical Training.

Virtual Reality systems present a computer-generated visual and auditory experience that allows a user to be immersed within a computer generated "world" for various purposes. Used in conjunction with traditional computer input systems this can be used, for example, as a powerful design tool allowing a user to see objects that he or she is designing.[3] The application to entertainment or training simulation systems is equally useful as it allows for the creation of an infinite number of immersive environments to suit any need. The addition of haptic systems to virtual reality will greatly increase its effectiveness at simulating real-world situations. One example can potentially include a medical training system using a simulator and virtual reality where a haptic system provides doctors with the "feel" of virtual patients. Figure 5. shows the schematic of such a medical simulation system, the visual display and the haptic gloves are combined to simulate, in this example, an abdominal aortic aneurysm surgery.

4.Virtual reality by using Haptic technology.

Haptic interfaces are devices that stimulate the sense of touch such as the sensory capabilities within our hands. The surge of computer capability and the desire for better ways to connect to computer-generated worlds has driven the creation and development of practical devices for haptic interaction. Until recently haptic systems only existed as demonstrations in research facilities. However, while research is still continuing, consumer-level haptic systems have been introduced. For example, force feedback gaming devices, such as joysticks and computer mice, have become available, while in the medical field, telesurgery or surgeon directed robotic surgery has been gaining recognition. [4] Burdea and co-workers have pioneered a concept whereby pneumatic, force-producing elements act on discrete areas inside a user's hand. Portability makes the design adequate for use in conjunction with virtual reality gloves (Figure 6) (Burdea *et al.*, 1992. Performance modeling is described in Gomez *et al.* (1995).

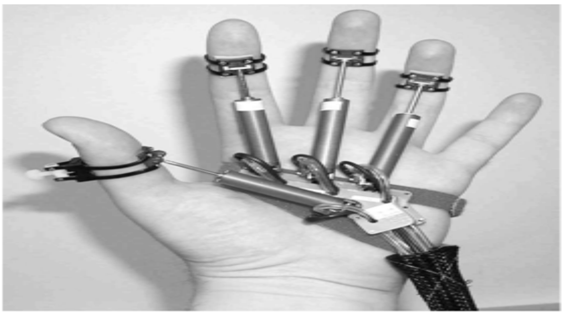

Figure 6

The pneumatic piston make it possible to achieve a low weight and hence portable device to simulate the grasping of virtual objet.

5.Virtual reality in telexistence.

Telexistence technology was adapted in the national five year Humanoid Robotics Project (HRP) sponsored by the Ministry of Economy, Trade and Industry (METI) to develop a new type of cockpit system to control a humanoid bipedal robot, as shown in Figure 7. [5] The telexistence cockpit was completed for this project in March 2000 (Fig 8). It consists of three main subsystems: an audio/visual display subsystem, a teleoperation master subsystem, and a communication subsystem between the cockpit and the humanoid robot

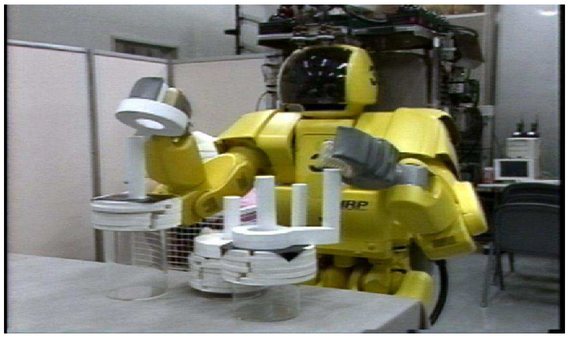

Fig.7 HRP Humanoid Robot at Work (2000).

Various teleoperation experiments using the developed telexistence master system confirmed that kinesthetic presentation through the master system with visual imagery greatly improves both the operator's sensation of walking, and dexterity at manipulating objects. If the operator issued a command to move the robot, the robot actually walked to the goal. As the robot walked around, real images captured by a wide field of view multi camera system were displayed on four screens of the surrounded visual display. This made the operator feel as if he or she was inside the robot, walking around the robot site. A CG model of the robot in the virtual environment was represented and updated according to the current location and orientation received from sensors on the real robot. The model was displayed on the bottom-right screen of the surround visual display, and by

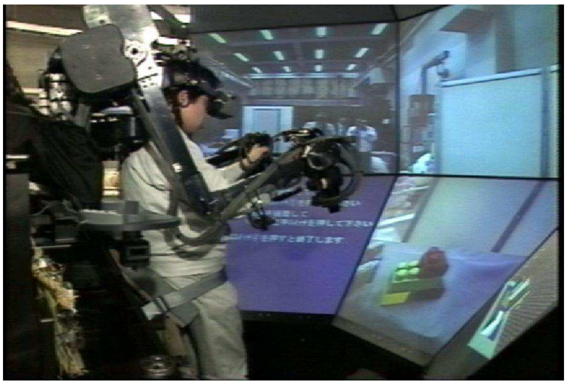

Fig.8.Telexistence Cockpit for Humanoid Control (2000).

Augmenting real images captured by the camera system, it supported the operator's navigation of the robot. Since the series of real images presented on the visual display are integrated with the movement of the motion base, the operator feels the real-time sensation of stepping up and down. Persons can control the robot by just moving their bodies naturally, without using verbal commands. The robot conforms to the person's motion, and through sensors on board the robot the human can see, hear and feel as if they sensed the remote environment directly. Persons can virtually exist in the remote environment without actually being there.

4. CONCLUSION:

As our society inventing new technology day by day, where virtual reality is a technology which changed whole world , this technology not only develop as individual technology but also it helping other technology to develop in totally different way, purpose of this paper is to give introduction to application of virtual reality with different technology. These technologies not only changing the way of work in different fields but also changing the way of living of human being. These technologies are minimizing the distance, as well as saving the time. Use of robotics making it more easier and error free environment.

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