REVIEWS OF VIRTUAL REALITY AND VIRTUAL ENVIRONMENT AND ITS APPLICATIONS PARTICULARLY IN EDUCATION

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Penulis

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Abstract

Tulisan ini membahas tentang teknologi realitas maya (*virtual reality*) atau lingkungan maya (*virtual environment*) serta penggunaannya terutama dalam bidang pendidikan. Realitas maya menjadi teknologi yang berkembang pesat dan terjangkau dengan potensi luas dalam berbagai aplikasi termasuk pendidikan, kedokteran dan industri. Realitas maya memungkinkan pengguna untuk berinteraksi dengan lingkungan yang disimulasikan oleh komputer. Peneliti yang dikutip dalam tulisan ini menyimpulkan bahwa teknologi realitas dan lingkungan maya dapat diaplikasikan dalam pendidikan dengan memperhatikan 3 hal sebelum menjalankannya, yaitu biaya yang dikeluarkan dan keahlian pengajar dan responden dalam hal ini siswa terkait pengoperasian teknologi tersebut, kedua, aksesibilitas yang memudahkan pengajar dan responden untuk mengakses teknologi ini dimanapun berada dan terakhir yang paling penting adalah dalam menyiapkan lingkungan maya (*virtual environment*) agar responden mendapatkan pengalaman belajar yang efektif.

Keywords

Virtual Reality (VR), Virtual Environment, Education.

INTRODUCTION

Virtual Reality (VR) is fast becoming an affordable technology with potentially wide-ranging applications in many professions including education, medicine and industry (Cobb et al, 1995). Its advantages over existing technology are primarily that users can visualize, feel involvement and interact with virtual representations of real world activities in real time. The last three years have seen rising interest in virtual reality (VR) technology. The numerous published articles, both in academic press and general media, VR is described in terms of technical descriptions of system hardware and software (for example see Ellis, 1994; Kalawsky, 1993), futuristic scenarios of how it will influence our everyday activities (Walser, 1990) and discussion of the potential impact this may have on society (Beardon, 1992). This script reviews the recent research of 3D perspective within Virtual Reality on Virtual Environment.

The structure of this script is as follows. First, basic conceptualizations and empirical findings on 3D or Virtual Environment are reviewed. Second, information on 3D or Virtual Environment that is specific used in education aspect. Finally some suggestions for future research are offered.

The Differences between Virtual Reality and Virtual Environment

It is useful at this point to make a distinction between the terms virtual reality and virtual environment (Cobb, D'Cruz & Wilson, 1995): virtual reality (VR) may be taken to denote the technology and its system elements; virtual environment (VE) denotes the 'worlds' or models built in VR and experienced by the user (or more precisely, the participant). In another view, VEs might be built within a variety of technologies, from sketches to CD to simulators; it is those built in VR systems we are concerned with here.

VR comprises different system elements which divide into:

- The architecture and software to produce visual and other images and to interface with input devices,
- Interface systems including sensors, effectors and input devices,
- Communications systems for networking and other purposes.

A virtual environment is not a single entity; it is a combination of multiple features (Wickens & Backer, 1995). As each feature is added, the experience of a real environment – and therefore the sense of presence – becomes more compelling. Six features of a virtual environment:

1. Three-dimensional viewing. Since space is three dimensional, a display representation that preserves that characteristic is more realistic than a two-dimensional representation.
2. Dynamic. Perceptually, we experience time as continuous; thus, we perceive a video or movie as more realistic than a set of static images. Hence, a virtual display should allow the user to view (and control) events dynamically in real time.
3. Closed-loop interaction. When we act upon objects in the real world, there is typically very little delay from the time the action is initiated until motion occurs. The virtual world should also respond quickly to control inputs (hand, mouse, joystick movements) so that there is little lag.
4. Ego-centered frame of reference.
5. Multimodal interaction. In real-world interaction, we do not simply view stimuli, but can localize objects by their sound, pick them up, move them, and feel weight and texture. Therefore, virtual environments may also include auditory feedback using 3-D localized sound techniques, and proprioceptive, kinesthetic, force, and tactile feedback using a dataglove, 3-D mouse, or joystick (e.g., Dede, Salzman, & Loftin, 1996).
6. Head-mounted display and tracking. Many VE systems incorporate a head-mounted display (HMD) and motion sensors. These allow changes in head position to control the view on the head-mounted display of the virtual environment in the same way that changes in head position change the visual scene in the real world. The HMD also typically provides a wide field of view, which helps to produce a sense of presence (Barfield, Zeltzer, Sheridan, & Slater, 1995; Snow & Williges, 1997). Some systems also track and update the visual scene based on an observer's eye movements (Kocian & Task, 1995).

Advantages and Disadvantages of Virtual Environments

Virtual environments appear to have three fundamental benefits. The first is the potential advantage of the ego-centered frame of reference for many guidance tasks such as remotely controlling a remote vehicle or the space shuttle arm (McKinnon & Kruk, 1993). The second benefit of a virtual environment is its usefulness for training because it is often safer or less expensive than training in the real environment. Exploring a virtual environment simulating a large multistory building transfers well to the physical building, for example (Wilson, Foreman, & Tlauka, 1997), which

could be useful for navigating in a strange environment (as in military reconnaissance). The third potential benefit of a virtual environment is in terms of on-line comprehension (Wickens & Baker, 1995). The intent here is to assist the user in gaining insight about the structure of an environment. An architech may "walk" through a 3-D virtual building wearing an HMD, gaining insight into the arrangement of rooms.

Although the increased sense of immersion that occurs with an ego-centered frame of reference and a dynamic, three-dimensional environment can be beneficial, there are associated costs. First, the technology tends to be expensive. One way to deal with the problems of expense is to reduce the number of virtual environment elements, attempting to optimize the remaining elements for the task at hand. Second, rendering 3-D graphics in real time is computationally intensive and can lead to serious lag problems, making interactivity impossible.

Virtual Reality in Education

Virtual worlds/virtual reality have featured prominently in educational research since the 1990s (Taxen & Naeve, 2002). The urge to use virtual worlds/virtual reality in education draws on the idea of digital natives; where students of today are considered familiar with gaming technologies that keep them motivated to meet set goals (Prensky, 2001). The same technology that allows an immersive experience presented in a game context can be harnessed to present learning environments to an ever-growing population of learners that have computers with built-in 3-dimensional graphics capability (Jones, Morales & Knezek, 2005). Taxen & Naeve (2002) see this as a major advantage. They claim that such learners (especially younger ones) who are familiar with the gaming environment require much less training and hence 'master the controls' in a shorter time.

Teachers are adapting this model in the formal education system where they assume using environments and technologies similar to that used in gaming will help students understand key concepts in different areas of study and equip them to deal more effectively with the real world (Shaffer, 2006 cited in Albion, 2008b). It is also assumed that such an approach would encourage student motivation and goal orientation which would in turn assist them to achieve their learning objectives.

These are the principles underlying the constructivist approach to learning and teaching and the importance of interaction. The argument is

that constructivism is the best basis for building theory of learning in virtual environments (Winn, 1993, p.1) and that people construct knowledge through a psychological process prompted by their interaction with objects and events (Winn, 1993). This is termed the "fourth generation" of computer-based education where the focus is shifted from prescribing interactions or transactions (Merill, 1993 cited in Winn, 1993) to designing learning environments that enable any kind of interaction, limited only by the capability of the system it is designed with. Such interactions are possible through most, if not all 3D online learning environments. According to Jones et al. (2005), irrespective of the type, all 3D online learning environments create a context/scaffolding for interaction using 3-dimensional presentations to engage and/or immerse the student in a situation for learning (situated learning) or entertainment (p.221). They go on to claim that such engagement is a "natural outcome from the user interface" (p.223).

Probably the most well documented use of the interactive features of Web 3D/virtual environments are in distance education where it is considered an aid to reducing the transactional distance but as Albion (2008a) indicates, it is necessary to identify the most appropriate forms of interaction to be included in learning environments using such spaces (p.1). Johnson (1995) also contends that it is imperative to select an appropriate style of interpersonal interaction.

With its support of multiple modes of interaction (e.g. audio, video, text chat), Web 3D/virtual worlds can create a stronger sense of social presence (Albion, 2008a). In his bid to prove that there is a value in exploring the potential of 3D online spaces for hosting forms of interaction that support learning, Albion (2008a, p4-5), goes on to describe a tool for mapping such opportunities. He suggests that there is no reason to presume that 3D online spaces used for education would not manifest the same three dimensions of interaction as other learning environments, with content, instructor and peers (Albion, 2008a, p. 3). Hence, given below are a number of ways in which Web 3D/virtual worlds can be used to facilitate educational interaction as identified using the mapping tool of Albion (2008a & b):

1. High interaction with content
    a. accessing information by browsing in the 3D space
    b. observational field experiences
2. High interaction with instructor and content
    a. presentations providing a sense of occasion
    b. 'performance coaching' for participating in activities in world or in real world with reporting and feedback occurring in the 3D space

3. High interaction with instructor and peers
    a. 'Socratic questioning' with one to one communication
    b. substantive conversation with peers for 'action learning' or 'problem based learning'
4. High interaction with peers
    a. sharing information through presentations
    b. group work
    c. synchronous communication in appropriate virtual venue
5. High interaction with peers and content
    a. 'experiential learning' with engagement enabled by in world activities and events
    b. virtual field studies and group work

Despite the recent hype in the use of 3D/virtual reality, there are a number of issues that need to be given due consideration. Firstly, large scale implementation of such virtual reality in education require a consideration of the return on investment in terms of the technology, many of which are proprietary, and the accompanying expertise/skills set needed in establishing and maintaining such an environment. Furthermore, what types of training is required by (1), staff taking on such initiatives and (2), students expected to learn in these environments and more importantly, who provides this training and when. Brna & Aspin (1998) share similar sentiments by questioning how a user can be expected to write codes for a system they are yet to fully understand.

Dickey (2005) quite rightly points out that in order for educators to adopt and integrate a technology, it must be accessible both in terms of cost and technical skills required (for both teachers and students). Secondly, the accessibility issue needs attention. Do all the staff and students involved in a course taught using Web 3D/virtual worlds have access to this technology at home or at the university? Although Jones et al. (2005) suggest that a 3-dimensional rendered environment is highly bandwidth efficient; many researchers still caution users on this issue. Taxen & Naeve (2002) express concern that the current systems are expensive, fragile and can be cumbersome to making them hard to utilize for larger groups of learner and harder to integrate into existing school environments where resources are limited.

Finally and perhaps most importantly, there has to be a reason for setting up such a system and using it effectively to enhance the learning experience. One has to consider whether the environment has been developed for use at a superficial level or is it developed to truly engage the learner. And irrespective of the subject matter or the level at which it is taught, the use of virtual reality needs to be justified because it may not be

the best alternative available for use with an intention to enhance the educational experience of learners.

CONCLUSION

The potential of the virtual reality in education is enormous. They can facilitate educational interaction and give effective learning experience. Points need to concern before applying virtual reality in education are cost and technical skills required (for both teachers and students). Secondly, the accessibility issue needs an attention. 3D/virtual worlds should be accessible at home or at the university. Finally, setting up the virtual environment might be the important one, such a system and using it effectively to enhance a good learning experience.

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