Challenges in Using Virtual Environment in Education

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Abstract - Virtual environment (VE) is a system used to create and enhance communication between human and computers/machines. As such human-related principles and issues need to be examined and accomplished to make VE well received by its users. This paper will generally delve into the human-related challenges faced by VE. The four challenges identified are students' characteristics; educators' and guardians' characteristics; students' health and social consequences from misuse and abuse of VE. These challenges will present to a more effective design of VE that will encompass the nature of the challenges as well.

I. INTRODUCTION

Today's technology enables human to create myriads of images and pictures that given the right conditions, can effectively enrich education [1]. Computer graphics which are real-time in nature are an essential component of the multi-sensory VE. The potential of VE is still being explored. A lot of efforts are currently underway to apply VE to make advancement in the fields of medicine, engineering, education, entertainment, design, training etc. Of the many application areas, education is clearly worth immediate investigation.

VE faces many forms of challenges. Some of the challenges are cost, system usability and the fear of technology [2]. Cost-related challenges are considered as economic form of challenge while system usability challenges can be seen as the technical form of challenge. Meanwhile the fear of technology can be deemed as human-related challenge.

So this paper attempts to take a deeper look into the human-related challenges that VE faces. The rationale behind this choice of delving into human-related challenges is that humans or users are the ones who will actually interact with the VE at the end of the day. In this respect, four primary human-related challenges have been identified and they are: students’ characteristics; educators’ and guardians’ characteristics; students’ health and social consequences from misuse and abuse of VE. Some of these topics have been looked at rather briefly in the past [3]. In the following sections, the four primary challenges will be addressed.

II. THE FOUR HUMAN-RELATED CHALLENGES

A. Students’ Characteristics

An important aspect in challenges that VE faces is the differences of students’ characteristics. The differences in such characteristics influence the VE. In fact user differences have already been reported to influence the VE e.g. the sense of presence achieved by different users [4].

One of the primary students’ characteristics is the level of experience. Students who have experienced VE before have diverse capabilities and requirements that may not be compatible with students who have never experienced VE before. Experience level influences the skills of the students, the abilities to predict performance and the manner in which students comprehend and organise task information. Almost similar approaches to this matter have also been explored using the expert-versus-novice paradigm [5,6,7]. Such differences could affect the design of a VE and the performance of students. Thus, VE needs to be adaptable to these diverse needs.

Another students’ characteristics that may pose challenge to VE is personality. Personality may become more important during more-complex interactions particularly if VE is modeled after human-to-human communication [6]. Perhaps another form of personality that poses challenge to VE comes in the form of a student’s history of illness. What is a VE to do when it is faced with students who suffer from autistic or dyslexia? It must be pointed out that patients who suffer from autistic generally exhibit some kind and to a certain degree of withdrawal symptom. This means an autistic child rarely communicates with the outside world, especially with other people. If an autistic child exhibits such behaviour, will VE be able to cope with such situation since it demands interaction with its user? The same is true for students who have difficulty in learning i.e. will they be able to follow closely the instructions given in VE? What about students who are physically disabled e.g. blind, mute, deaf, handicapped etc? These many forms of challenges need to be addressed. A VE project for the blind, called ENORASI was developed by Tzovaras [8].
B. Educators’ and Guardians’ Characteristics

Educators are concerned that more technology that they are not trained to use will be put into the classroom and that won’t really help them to teach more effectively [2].

On the other hand, there is anxiety about the misuse of VE and fear by the parents that this technology may have some negative attributes. These fears, addressed by Bricken [2] are applied at a broader and more general level of society i.e. the fears are not limited to parents only but to society at large. The fear encompasses the fear of students losing control to others, denied access, confusion among students and abandonment.

C. Students’ Health

Maximising human performance in VE is essential to the success of this technology. Of equal importance is ensuring the health and welfare of users who interact with these environments. If the human element in these systems is ignored or minimised, it could result in discomfort, harm, or even injury. It is essential that VE developers ensure that advances in VE technology do not come at the expense of human well being. There are several health and safety issues that may affect users of VE. These issues include both direct and indirect effects.

There are several direct effects that could affect the students using VE. The eyes have the potential of being harmed. The eyes may be affected by electromagnetic field through prolonged exposure to the use of HMD [9]. In addition, eye strain could be caused by poor adjustment of HMD displays, as well as flicker, glare, and other visual distortions [10, 11, 12, 22]. Phobic effects may result from VE use, such as claustrophobia (e.g. HMD enclosure) and anxiety (e.g. falling off a cliff in a virtual world). Viirre [9] suggests, but has yet to prove, that no long-term phobic effects should result from VE, except potential avoidance of VE exposure. What about students who are suffering from short-sightedness? Will their condition be aggravated through the use of HMD in VE? These are some of the questions that need to be answered.

The risk of physical injury or trauma from VE interaction is of real concern. VE equipment is complex and interferes with normal sensory perception and body movements. Limited or eliminated vision of natural surroundings when wearing HMD could lead to falls or trips that result in bumps and bruises. Sound cues may distract students causing them to fall while viewing virtual scenes. Imbalance of body position may occur due to the weight of VE equipment or wires that link equipment to computers causing students to fall [3].

One of the most important health and safety issues that may influence the advancement of VE technology is cyber sickness. Cyber sickness is a form of motion sickness that occurs as a result of exposure to VE. Cyber sickness poses a serious threat to the usability of VR systems. Users of VE systems may experience various levels of sickness ranging from a slight headache to an emetic response.

There are several factors that cause cyber sickness. One of them is vector, which is the illusion of self-movement in a VE. When the body senses that there is no actual physical movement, a conflict occurs between the visual and systems which is believed to lead to sickness [13].

Another factor is lag. In VE, lag occurs when the user perceives a delay between the time a physical action is made and the time the VE responds to the physical action made. Such delays are often connected with cyber sickness but empirical data to support such claim are too little [14].

A less-known yet equally or even more important indirect consequence of VE is the potential harmful physiological after effects from VE exposure. The use of VE by students may produce disturbing after effects such as head spinning, reduced eye-hand coordination and/or sickness. These physiological after effects may make individuals less adapted (i.e. at risk of injury) for the return to the real world once VE interaction ends. Some of the most disturbing after effects include flashbacks and reduced motor control [15, 16].

If negative VE incidents occur, the technology could be perceived as unsafe and future use of the technology could be severely hampered, especially in the educational field. The VE technology community should thus collaboratively establish health and safety standards that can direct and guide future developments.

D. Social Consequences from Misuse and Abuse of VE

An often neglected effect of new technologies is their potential social consequences. Virtual reality is a new technology which like the television, computers and video games, has the potential for negative social consequences through misuse and abuse [17]. Already there is a high level of concern over the negative influences of much less interactive media (television and video games). VE applications that are presented as harmless
form of entertainment but which actually represent violence may become available at video game rooms in the near future. Such animated violence is already a known favourite over the portrayal of morally-encouraged emotions such as cooperation, friendship, or love [18]. There are many open issues [19, 20] such as: How will interaction in VE modify behaviour? Will individuals transfer violent virtual worlds to the real worlds? How will VE influence young students who are particularly liable to psychological and moral influence?

However, in the educational world, one might argue that there is no possibility that violent VE will make their ways into schools and other educational institutions. Consider this: What if the introduction of VE in learning institutions actually acts as a catalyst that eventually will arouse and deepen a student’s curiosity to learn more about VE? From here, is it not possible that in the end the student will somehow be introduced to a more violent form of VE as opposed to that of VE found in school? A survey conducted by Loong, Teng & Yuen [21] showed that 75% of respondents from five schools in Kuala Lumpur, Malaysia have never experienced VR before and do not know what VR is. If VE is introduced to these students, then this will probably accelerate the growth in the number of users in VE hence a more exposure to VE. The problem of students exposed to violent VE will also be aggravated further. This issue needs to be taken into account when using VE in the education sector.

III. CONCLUSION

The needs and abilities of VE users have not been amply addressed in the design of virtual world. As VE applications are growing very fast, human-related issues should also be considered before improper design and practices of VE become commonplace. This paper only provides a general picture of human-related challenges from a theoretical point of view and is an indication of the number of factors that need to be considered when studying human-related challenges in VE. As such a quantitative research can be carried out in future studies to determine variables that have the greatest effect on VE and can subsequently be studied in more detail. Since VE will involve the interaction of people and machines, we need to apply human-related principles to their design and use.

REFERENCES


