SIDE EFFECTS OF VIRTUAL REALITY EXPOSURE THERAPY (VRET)

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ETHICAL DILEMMA

Working as a computer engineer, I often have to make difficult choices on the technical aspects of projects. These decisions are carefully made after weighing all options and consulting any available resources. Occasionally situations arise concerning the ethical implications of a project and a decision must be made. To eliminate bias and make the best choice, I consider all viewpoints and review the ethical standards of engineering, but I can't help acknowledging my personal opinion of the effects of a project.

Currently, I work as a software engineer at CleVR, an extension of the Virtual Reality Exposure Therapy (VRET) research group of the Delft University of Technology and the University of Amsterdam. My job includes developing custom virtual reality software and programs for use in treatment of anxiety and impulse control disorders.

VRET has been shown to have many advantages over traditional exposure therapy, including increased treatment efficiency, security, and control. I know that the programs I have developed have helped many people overcome personal fears and anxieties. However, I am beginning to question the possible side effects appearing as a result of this treatment program.

My employer plans to launch a campaign making VRET technology more readily available, but I do not think the programs have been developed enough for such widespread use. Many people still experience uncomfortable side effects that could be mostly eliminated with the incorporation of improvements that are still in development. I do not think this campaign should move forward when the product is still problematic for many users and could be extensively improved.

Concerns with VRET

In 2011, 88 participants, 35 females and 53 males, participated in a Delft University of Technology experiment on simulation sickness. Only 14 participants reported experiencing no symptoms of cybersickness during the two VRET programs they completed [1].

A side effect of using virtual reality technology, cybersickness is a form of motion sickness with reported symptoms including nausea, vomiting, eyestrain, disorientation, ataxia, and vertigo [2]. However, unlike traditional motion sickness, cybersickness has been caused simply as a result of visual stimulation, rather than the vestibular stimulation that is cited as the source of most cases of motion sickness [3]. That being said, there is no particular definitive cause for cybersickness.

Although the feelings of nausea, disorientation, and other uncomfortable symptoms of cybersickness will pass after a period of time, regular and continued usage may result in more serious, long lasting effects. Such aftereffects may include changes in postural control, disturbed locomotion, perceptual-motor disturbances, flashbacks, drowsiness, and fatigue [2]. Any instabilities regarding movement are most likely caused by the user’s adaptation to the sensorimotor requirements of the virtual reality program, which are similar but often not exact to realistic conditions [2]. Symptoms of aftereffects may last for hours or, in some cases, days.

COMBATING CYBERSICKNESS

As a professional, I feel that it is my responsibility to formulate an optimal design that will produce the most efficient product. Particularly, I feel that improvements could be made on the VRET technology produced here at CleVR. I will take initiative to propose and offer to lead a research and development team. This team will work to discover effective methods of reducing cybersickness by modifying elements of current VRET technology without degrading the quality of the company’s product.

Proposed Ideas

Combining my knowledge as a computer engineer with extensive research and experience with virtual reality technology, I propose several options for improving the VRET product by improving components that may induce cybersickness.

Cybersickness seems to be caused by a strong perception of one’s self-motion, or visual stimulation of motion. In other words, one in a virtual reality environment is not physically moving but because their range of vision is focused on the changing screen, they feel a sensation of movement.

Several issues involving display and technology contribute to cybersickness. Wide fields of view induce the strongest sense of self-motion, but narrowing the user’s field of vision can detract from the effects of VRET [4]. Screen resolution is also a factor in virtual reality use. Improving screen resolution can make the virtual environment appear more realistic and comfortable for a user, but may also induce strong self-motion perception [4]. System time delays, including conflict between interacting physical sensations and visual lag, can also contribute to cybersickness [4].

All of these issues contribute the main cause of cybersickness: discontinuity between actual motion and perceived motion in a virtual environment.
Stereoscopic Viewing

Stereoscopy, or stereoscopic imaging, is a technique used to produce a three dimensional effect by adding an illusion of depth to a flat image [5]. By adding stereoscopic viewing to any virtual reality viewing device, particularly head-mounted displays, the user’s depth perception is improved due to the inclusion of visual cues [5]. For example, if one object partially obscures another, we understand that the one in front is closer. Objects and patterns grow smaller as our distance from them increases. These further away objects tend to look hazier and less brightly colored, than if we would see them up close.

This technique has proven effective to increase a user’s presence, or their feeling that they are actually “inside” the virtual world. A study conducted by a group of Delft University of Technology researchers, previously mentioned in connection to experiments with cybersickness, tested the effectiveness of stereoscopic viewing [5]. They concluded that although the inclusion of stereoscopic increased subjects’ presence, it was not definitively linked to results of a cybersickness test [5]. I believe that we should not discount the value of incorporating stereoscopy into virtual reality programs and continue to test and expand its use.

Advantages of Augmented Reality

The application of augmented reality is quite similar to virtual reality. The differing feature of augmented reality is that virtual elements are superimposed into the real world. Thus, the user views a visualization of the real world with virtual elements added [6]. The type of augmented reality in exposure therapy is limited, as its use can only be applied in some specific scenarios.

Augmented reality is beneficial because it may seem substantially more real to the user. In addition, creation of augmented reality is less expensive than virtual reality because the real world can be used as a blueprint for the generated scene.

Motion Platforms

As cybersickness is instigated by the lack of vestibular stimulation, adding motion to virtual reality programs may reduce the conflict of sensations.

Dr. Young Youn Kim and several colleagues at the Korea Institute of Science and Technology, studied the use of biosignal feedback as a real-time cybersickness detection system [7]. By constantly monitoring the feedback from an artificial neural network, the system was able to identify states of cybersickness. Upon recognizing a user’s discomfort, the field of view was automatically narrowed and perceived motion was decelerated [7].

This idea is step beyond previous methods of using gloves containing sensors to record the movements of a user’s hands and providing an according tactile response. It is more comparable to the incorporation of electrorheological fluids. These fluids alter thickness when exposed to electric fields of different strengths. An advanced virtual reality computer would be able to read and interpret these electrical signals and send responsive signals back to the user [8].

There have also been motion incorporation adapted from systems used by flight-simulators [9]. Many of these systems create virtual obstacles by altering the motion of a treadmill [9]. Although this system eliminates causes of cybersickness, it brings up many safety concerns; any testing of such a system requires the user to wear a harness [9].

ETHICAL ANALYSIS

Before arriving at my conclusion that the technology I work to develop needs to be improved before further availability, I also consulted several engineering codes of ethics and past ethical cases.

At the broadest but most inclusive level, the National Society of Professional Engineers’ Code of Ethics for Engineers details the standards and responsibilities of those in the engineering profession. The preamble of this document states that, “Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare” [10]. Knowing that this is what is expected of me as a professional, I cannot allow the release of a VRET program that may have a negative health impact on a user, when it could be developed further to eliminate any causes of side effects.

Although this product has been shown to improve the quality of life of participants, I cannot adequately assure anyone that the positive benefits outweigh the possible negative impact. As a result of this uncertainty, I am adhering to the Code of Ethics for Engineers guideline that, “engineers shall advise their clients or employers when they believe a project will not be successful,” [10].

Furthermore, as a software engineer, I must “ensure that [my] products and related modifications meet the highest professional standards possible,” as stated in the Software Engineering Code of Ethics and Professional Practice [11].

Related Ethical Cases

An ethical case presented on the Online Ethics Center for Engineering and Science gave me helpful insight on how to think about my decision.

As a professional, one does not want to show disloyalty to one’s employer but also must maintain an obligation to clients. Despite the differing details of the case from my situation, I found myself in a similar position to the engineer involved. I did not want to object to my employer’s plans, but I could not let such plans be implemented due to my obligation to clients.
Michael Davis’s commentary on the case reinforced my interpretation of the code of ethics [12]. Thinking about the implications involved in my ethical dilemma, I was able to clearly determine what was truly important in the VRET development process.

STUDYING THE IMPLICATIONS

I believe my decision to oppose the release of underdeveloped VRET technology emphasizes the research and development that is needed to make advancements. By testing the aforementioned solutions that may improve virtual reality, we can learn more about its capabilities and applications.

With enough focus and attention, virtual reality could soon reach a level of capacity shown in fictional novels, such as “Divergent” by Veronica Roth. The film adaptation of Roth’s book, released in 2014, presents a visual representation of the possibility of virtual reality technology in the future.

Roth’s conceptualization of society’s future involves a faction system, in which those charged with the task of security and protection must be fearless. To achieve such a level of fearlessness, they must face scenarios symbolic of their fears in a simulation, known as a fear landscape [13]. This fear landscape simulation seems to combine augmented reality with a highly independent motion platform.

With continuing research and development, this seemingly impossible technology could move forward at a similar rate to the integration of computers and mobile devices.

REFERENCES


ADDITIONAL SOURCES

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