Virtual Reality Approach in Acrophobia Treatment

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Abstract: - Acrophobia is a scientific term used to describe the fear of height. To some, this fear is tolerable, but to other, the fear could pose danger to their life if the fear is starting to interfere with their day to day activities. The conventional treatment for acrophobia is usually done through exposure therapy, where individuals suffering acrophobia will be gradually exposed (physically) to the height. The goal of the study was to develop a simple 3D virtual environment to perform exposure therapy for acrophobia. The system consist of a multimedia workstation, a Head Mounted Device (HMD) and a virtual scene of a busy city surrounded with tall buildings. The scenario consist of the user is being gradually lifted up and down on an open elevator hanging outside one of the building.

Key-Words: - Virtual Reality, Immersive, Acrophobia

1 Introduction

Acrophobia is characterized by marked anxiety upon exposure of heights, by avoidance of heights, and by interference in functioning as a result of this fear [1]. If left untreated, acrophobia could significantly reduce the quality of life of the sufferers. Current or traditional method of treating acrophobia is through method called graded exposure in-vivo, where the sufferers will be gradually expose to a hierarchy of feared stimuli, where the fear will first increase, and gradually diminished as the exposure being repeated [2]. Using the in-vivo treatment, the sufferers will be exposed to the real stimuli, such as climbing on the stairs of 10 storey building.

Another approach is to conduct the in-vivo exposure using Virtual Reality (VR) where the sufferers will be exposed to the stimuli created by the virtual environment. VR lets people act within and upon computer-generated environments, making it ideal for exposure therapy [3].

Lots of research have been carried out to test the effectiveness of treating acrophobia using VR environment [4] – [6] including the experiment to compare the effectiveness between exposure using VR and in-vivo therapy [7].

Our main objective is to find out whether it is possible to create the presence of height using a simple 3D computer generated environment. The term simple here refers to a system consisting of a multimedia workstation, HMD and the 3D environment. The environment was created using Autodesk Maya (a 3D modeling tool) and the VR interaction was achieved using Virtools (a tool for creating highly interactive 3D applications). We presume that if the presence of height could be created, then the treatment would be feasible. The effectiveness of the treatment and how the treatment should be done are out of the scope of this project.

2 Data Gathering

The research started with data gathering where sets of questionnaire were distributed to 150 random participants (Malaysian public ranging from students to professionals). The questionnaire was divided into three main categories: demographic information about the participants, types of phobia and a specific section focusing on sufferers of acrophobia. The last section on sufferers of acrophobia was designed to obtain information on: symptoms that they experience when exposed to high altitude environment and condition which made them feel safe being at high places.

Figure 1.0 shows the types of phobias suffered by the participants. The graphs depicts that 86% of the participants reported that they have problems with height.

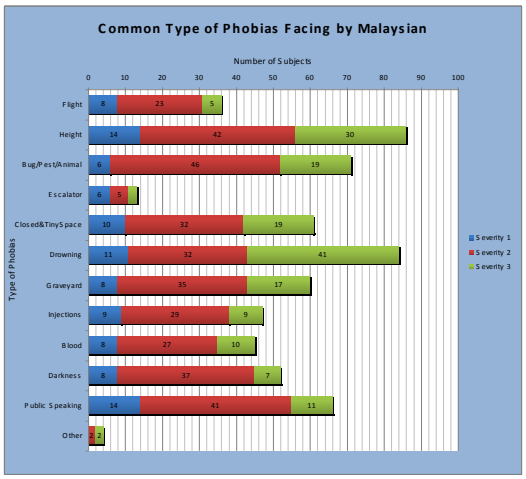

Figure 1.0: Types of phobia suffered by Malaysian.

Figure 2.0 shows the common symptoms felt by the sufferers when they are experiencing a high altitude environment. The result shows that majority (81%) of the sufferers experience fast heart beat rate, followed by knee/leg becomes weak (33%), feeling dizzy (31%) and sweating (30%).

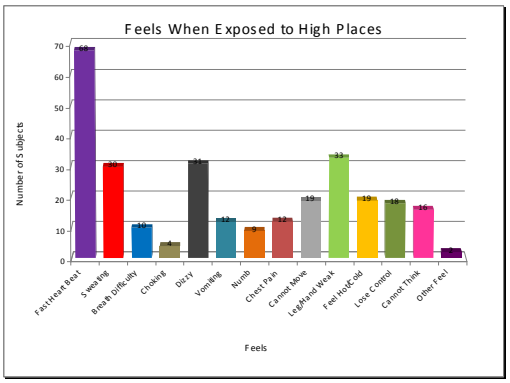

Figure 2.0: Symptoms felt by acrophobia when placed at high altitude environment.

Figure 3.0 shows the result of condition which made the sufferers feel safe being at high places. The result shows that most sufferers would feel safe if they have something to hold on to (67%) and if there is a barrier around them (66%). 50% of the sufferers also acknowledge that they would feel safe if they stand on a stable and sturdy surface.

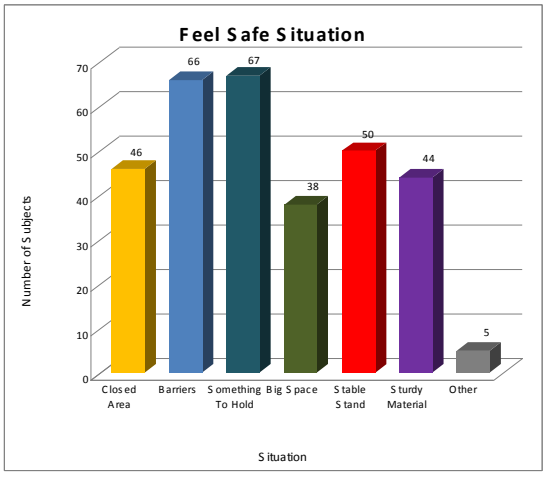

Figure 3.0: Condition that made the sufferers feel safe being at high places.

From the result, it could be concluded that even with a small sample of randomly selected participants, acrophobia is one of the most commonly suffered phobia among the participants.

Information on what made the sufferers feels safe will be used when modeling the environment, where all those factors will be eliminated in order to increase the fear among the sufferers.

3 The Environment Setup

The environment consists of a number of tall buildings. It was set up to demonstrate realism of a busy city with cars moving on the road. Apart from that, a helicopter is also included to enhance the immersion. Figure 4.0 shows a snapshot of the environment seen from the elevator at the 45th floor of the tallest (60 floors) building.

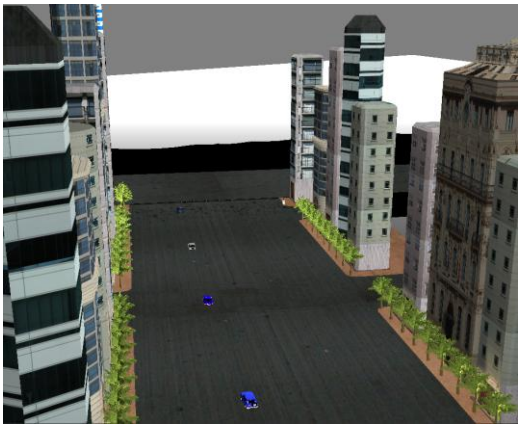

Figure 4.0: View seen by the 45th floor of the main building.

In this virtual environment, the user is standing on a shaft elevator hanging outside the 60 storey building. The user is expected to feel the height as s/he is lifted from the ground and then from one floor to another until s/he reached the highest level.

The user stands on an elevated panel. A mechanism is used to make the panel vibrate as the elevator moves up and down.

A fan is used to simulate the wind at higher levels. It is assumed that the higher levels should be more windy and cold compare to ground level.

Stereotype sound of helicopter and cars moving around is included as well as the sound of wind. Stereotype sound is used so that the sound is projected dynamically rather than static. For example, when the helicopter move to the left hand side of the user, the left speaker will be louder compared to the right speaker.

The user is required to wear the HMD. Since there was no data tracker being used, the user has no control over the movement of the elevator as well as the view (turning left and right) of the HMD. The movement of the elevator and view were controlled by therapist.

4 The Experiment

Around 50 participants took part in this experiment. The participants come from different backgrounds. 20 out of the 50 participants suffer from acrophobia. The participants were asked to put on the HMD and stand on the panel. Then, they were virtually lifted up to the highest level of the building and then quickly being

brought down to lower levels. During the experiment, the users' gestures and reactions were carefully observed.

Upon completing the experiment, each participant was asked the following questions:

i. How real is the environment?
ii. Can the presence of height being felt in the environment?
iii. Any suggestions to improve the current mechanism.
iv. Any other comment on the system.

Figure 5.0 shows the view seen by the participants when they are on the ground floor. Figure 6.0 and 7.0 shows the view seen by the participants when they are at the highest level of the building.

Figure 5.0: View seen by the participants on the ground floor.

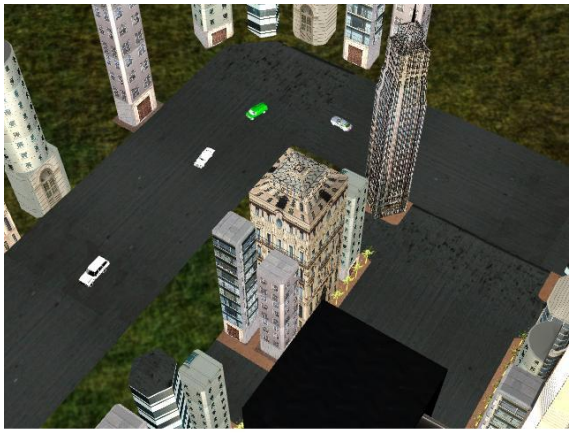

Figure 6.0: View seen by the participants on the highest level.

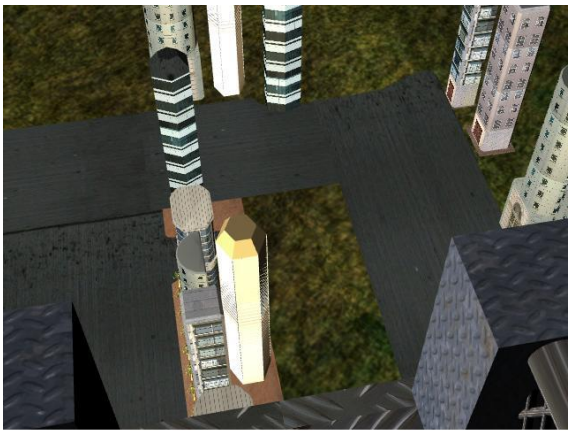

Figure 7.0: View seen by the participants on the highest level.

5 The Result

35 out of the 50 participants commented that the environment looked real. They could feel as if they are on a real elevator going up and down of a building. They commented that the vibration, the wind and the sound effects are vital elements in the experiment. It helps the participants to feel that the environment is real.

Out of these 35 participants, five of them are severe acrophobia sufferers. These five participants were observed to demonstrate the following behavior: clutching their hands, knee shaking, screaming as if they are going to fall from the elevator when they were lifted higher and lower suddenly. Two of them even asked to stop the simulation since they could not tolerate the fear that they were experiencing.

15 of these 35 participants were mild sufferers. They commented that they felt the presence of fear once they were on certain level. The rest of these 35 participants are non-sufferers. Anyway, even they commented that the presence of height could be experienced by them.

The remaining 15 out of 50 participants commented that they are unable to feel the presence of height since the environment does not seems to look real for them.

There are many factors contributing to this matter, among them are:

- The buildings size is the same for all hence it does not mimic reality.
- They can feel the weight of HMD that makes them realize that the environment is not real.
- The set up of the experiment (the HMD, the floor panel and the fan) gives no suspense to participants.
- The size of the cars is not proportional to the environment.
- They cannot control the view. Since the system does not include data tracker, they will see the

same view even if they turn their head to the left or to the right.

6 Conclusion

As a conclusion, the study confirms that it is possible to create the presence of height even when using a simple 3D environment. It is noted that severe acrophobia sufferers would have the similar reaction when they were exposed to height in virtual environment as to when they are exposed to height in reality.

From the observation during the experimentation, we have realized that we need to choose the view carefully. Some views do not generate the presence of height. We have noticed that in order to make the users to perceive height in this virtual environment, we need to focus on the view; which allow the users to realized the changes resulted from the changing of the altitude. For example, a view where the users can see the car size getting smaller as they see themselves is being lifted up.

The speed of virtually bringing the user up and down also plays an important role. We have observed that the presence of height could be achieved if the users being lifted and brought down at a higher speed.

Upon finalizing environment and the way the experiment should be done based on the feedback, we will proceed to examine the effectiveness of the end product.

References:

[1] Hodges, L.F. Kooper, R. Meyer, T.C. Rothbaum, B.O. Opdyke, D. de Graaff, J.J. Williford, J.S. North, M.M., "Virtual environments for treating the fear of heights", Magazine Computer, IEEE, Jul 1995, Volume: 28, Issue: 7,On page(s): 27-34,

[2] Bouman, K., Scholing, A., Emmelkamp, P.M.G, Anxiety Disorder, A Practitioners Guide, John Wiley & Sons, 1992.

[3] Lear, A.C.; "Virtual reality provides real therapy" Computer Graphics and Applications, IEEE Volume 17, Issue 4, July-Aug. 1997, pp.16 – 20.

[4] Hodges L.F. et al.; "Virtual environment for treating the fear of height", Computer, Vol. 28, No. 7, July 1995, pp. 27 – 34.

[5] Schuemie, M.J., et al.; "Treatment of Acrophobia in Virtual Reality: a Pilot Study", Conference Proceedings Euromedia 2000, Antwerp, Belgium, May 2000, pp.271-275.

[6] Jang, D.P., et al.; "The development of virtual reality therapy (VRT) system for the treatment of acrophobia and therapeutic case", IEEE Transaction on Information Technology in Biomedicine, Volume 6, Issue 3, Sept. 2002, pp. 213 – 217

[7] P.M.G. Emmelkamp., et al.; "Virtual Reality Treatment in Acrophobia: A Comparison with Exposure in Vivo", Journal Cyberpsychology and Behavior, Vol.4, No.3, June 2001, pp.335-341.