USING SOUND FOR STRESS THERAPY IN A VIRTUAL-REALITY ENVIRONMENT

Rubijesmin Abdul Latif[1], Rozita Ismail[2], and Ahmad Redza Razieff Zainudin [3]

[1]*Universiti Tenaga Nasional (UNITEN),Malaysia, rubi@uniten.edu.my*
[2]*Universiti Tenaga Nasional (UNITEN), Malaysia, irozita@uniten.edu.my*
[3]*Universiti Tenaga Malaysia (UNITEN), Malaysia, ahmadredzarazieff_redza@yahoo.com*

ABSTRACT. This paper discusses about comparing different sounds used in stress therapy among Malaysians. The aim of the stress therapy is to reduce stress among users, thus a virtual reality environment was used which replaces the traditional guided therapy sessions. Two groups were studied in the experiment; the first group - the therapies were guided by computer and sound types applied were instruction, natural sound and zikr. Meanwhile, the second group - sessions were also guided by computer but with different sound types (instructions, natural sound and instrumental music). The result of the experiment showed that the first group- guided with natural and zikr sound choice does have higher impact to positive emotions compared those exposed to natural and instrumental sound choice.

Keywords: stress therapy, virtual reality, sound, audio

INTRODUCTION

Stress is a condition that leads to mental, emotional, or physical resistance. Stress is often caused by heavy workloads, relationship difficulties, financial crisis, family related problems and many more. In such situations, people with stress problems tend to have a negative emotional response. In Malaysia, typical methods to treat stress effectively are known as counselling or imaginary techniques.

In this paper, a new approach of stress intervention therapy system based on virtual reality technology will be presented. By incorporating elements such as realistic 3D environment, stress treatment instructions and soothing background audio, patients or users are exposed to an immersive 3D experience with the hope of better management of stress level.

BACKGROUND STUDIES

In this section, terms used will be discussed in detail which includes type of stress, causes and effects, current stress treatment applied, virtual reality and sound therapy.

Stress: Causes and Effects

In general, stress has a direct negative impact to patients' emotional health state. This mental state may be caused by their personality traits, emotional responses, environmental

effects, and burnout in which, causes the negative emotional responses. According to Derogatis Stress Profile – DSP (Montgomery, 2005), stress is defined as a state of psychological pressure influenced by three main sources or domains; personality mediators, environmental factors, and emotional responses. Personality mediators refer to a situation where time pressure, driven behaviour, attitude posture, and role definition are constructed. Environmental factors, on the other hand, constructs vocational satisfaction, domestic satisfaction, and health posture. Finally, emotional response constructs hostility, anxiety, and depression.

There are two main causes that lead to stress among humans (Smith, 2001) and they are:

i) Medical Distress which creates high-energy response where this high levels of chronic arousal are not healthy. Also, chronic arousal suppresses the ability of the immune system to protect against and recover from illness when sick. (i.e. fever, headache and etc.).

ii) Emotional Distress where people often experience emotion in complex ways. Various emotions can be combined, for example, feeling angry, sad and depressed at the same time. The psychological distress is often associated negative emotions.

In this research, the VR-based stress therapy attempts to handle user or patients with Emotional Distress since this is type stress is more common to people and it is increasing.

Stress Treatment

There are three common methods of using imagination as therapy treatments techniques to treat neurological disorders such as depression and stress. The three methods are;

i) Expressive therapy which is a healing process by using an imagination through various forms of creative expression. The examples are music, art, drama and writing (Malchiodi, 2003).

ii) Psychotherapy (counselling) - Guided affective imagery (GAI; also known as katathym imaginative psychotherapy) often involves several or all senses, in the mind of the listener. In this method, the imagination plays an important role together with discussions with the therapist to patient. This method is an early traditional method of therapy being used (Leuner, 1969; Miller, 2006).

iii) Hypnosis is a technique which involves creating dubious images into our mind to relax. In this method, practitioner changes the brain activity through communication with the unconscious mind using vision or sound techniques. It is a useful tool for achieving deep relaxation ("About Hypnosis", 2013).

In this research, the VR-based stress therapy attempts to improve the psychotherapy methods with realistic 3D images and surround sound.

Virtual Reality

Virtual reality is a computer simulated 3D environment that makes object to virtually presence like in a real world. There three types of VR system according to Burdea and Coiffet (2003):

i) *Immersive*: user's real world view will be replaced with computer generated images and the view of these images change based on the position and orientation of the user's head.

ii) *Non-Immersive*: users are able to view the virtual world but they are still aware of the real world (i.e. viewing the virtual environment on a monitor).

iii) *Hybrid*: allows users to view the real world with virtual images superimposed over this view. This type is also known as augmented reality (AR).

In order to enable users to fully immerse in the virtual 3D world, various technologies in need to be considered: type of display, audio and interaction. Virtual reality applications are usually displayed using monitors, projectors or even head mounted display (HMD). The presence of surround audio systems will make the virtual environment become more realistic to the user. In terms of interaction components of the VR application, input devices such as keyboard, mouse and gloves are often used (Burdea & Coiffet, 2003).

Sound Therapy

Sound has been used as healing practices by many indigenous tribes and ancient healers in the past. Sound healing is a technique that uses music and sound as therapeutic tool; a simple, non-invasive process that can bring the mind, body and spirit into harmony and balance. It is believed that if part of our body is unwell or we have a 'disease', then the whole body responds and feels out of sync. We can bring the body back into alignment and to its natural harmonious state by using sympathetic vibrations and resonance (Heather, 2014). This ancient art of sound healing is re-emerging across the globe.

According to the American Music Therapy Association, music has been used in wide range therapy settings (in the hospitals, nursing and rehabilitation facilities, schools, prisons, private practices) in the USA as music can have therapeutic value when patients listen to music, write or improvise tune, and discuss lyrics. Music therapy transcends age, cultural differences or musical preferences. Music therapy has been used to alleviate anxiety, reduce pain in surgical and coronary care patients as well as gaining acceptance in all three types of post-stroke rehabilitation (physical, occupational and speech therapy) (Safranek, 2011).

Thus, it is evident to investigate whether different types of audio have different impact with relieving stress and identifying the best audio type to be applied for stress therapy sessions.

RESEARCH METHODOLOGY

This study is an extension of currently under-going research i.e. the development of a VR technique (an immersive system) focusing on treating stress among Malaysians. The study focuses on comparative benefits between self- imaginative therapy and VR technique. The results showed that VR technique decreased stress compared to self-imaginative therapy (Mahalil, Rusli, Mohd Yusof, Mohd Yusof & Zainuddin, 2014). However, the study did not look at the relationship between types of audio played with the level of stress reduced. There have been studies done that showed with audio and music used as a part of therapy, patients' conditions improved if not better, slightly better than before (Thaut, 2010; Safranek, 2011; Heather, 2014). Thus, specifically for this study, the aim is to identify whether audio works better in eliminating or reducing stress among patients.

To compare the effectiveness of audio in controlling stress (reducing/eliminating), a controlled experiment was conducted with two setups (i.e. audio type 1 – natural sound and zikr and the other audio type 2 – natural sound and instrumental music). All participants will be placed with head mount display and headset to view the VR environment and surround audio features.

We adopted the imaginary therapy developed by Benson, Beary & Carol (1974) and some modification was done to suit with the scene where the scene will be viewed by the participants in guided mode. During the experiment, participants would be listing similar instructional script that should bring them to relaxation mode (similar used in a normal imaginary therapy). The sample of the underwater script is shown below:

"You are safe.. Seat comfortable and relax.. You are safe.. You feel relaxed and peace.. Inhale.. Exhale.. You feel the sunlight gives you energy.. You can hear the gentle wave.. Take a deep breath.. Inhale.. Exhale.. "

Based on the script above, 3D VR representations were constructed (jungle and beach scenes) that include audio elements such as natural sound of the representation surrounding.

The experiments were conducted at three different stages;

First stage: Two groups evaluated by a standard stress management questionnaire. The questionnaire is to indicate participants' state of emotion.

Second stage: After answering the questionnaire, both groups undergone with the treatment. Once the treatment was completed, the participants were asked to express their stress condition with the same questionnaire.

Final stage: In this stage, we calculated the summation values of all positives and negatives emotions' scores before and after the participants have undergone the treatment session. Next, the changes value between before and after summation values will be calculated. Finally, Equation 1 will be used to calculate the mean value of the changes where *a* refers to total score value of positive or negative emotions and *n* refers number of participants respectively. This mean value can be used to compare the effectiveness between the two techniques.

$$D = \frac{\sum_1^n a_{(after)} - a_{(before)}}{n}$$

In addition, a statistical analysis was conducted by using T-test. The test was conducted to determine the p-value of VR-based and imaginary treatments in terms of the mean value of positives and negatives emotions.

The questionnaires that were used to evaluate the effectiveness of both therapy setups are based on Derogatis Stress Profile (DSP). The positive and negative emotions set in the questionnaires were randomly arranged so that the respondents can answer the questions without bias about their positive and negative emotions. These emotions were divided into eighteen human's state of emotions; nine were positive and the other nine were negative. The findings were evaluated using a Likert scale with a range of 1-5. The emotion states are listed in Table 1.

Table 1. Emotion States

Emotions/No	1	2	3	4	5	6	7	8	9
Positive	Excited	Confident	Happy	Joyful	Brave	Strong	Interested	Proud	Inspired
Negative	Afraid	Nervous	Annoyed	Stressed	Angry	Sad	Upset	Shy	Scared

RESULT OF STUDY

Twenty eight participants took part in this experiment and they were divided into two groups: guided with audio setting of natural sound and zikr (type 1) and the other is guided with audio setting of natural sound and instrumental music (type 2). Respondents were equally divided between male and female, and age of all participants ranging between 18 until 25.

The effects of undergoing VR-based therapy to the state of positive emotions of participants are shown in Figure 2. Basically, it can be observed that mean Likert scores for almost all positive emotions are higher after the participants have finished the therapy session. Figure 3 shows the result of negative emotions obtained from type 1 participants. The average of Likert score shows the difference between before and after therapy. This shows that their emotion levels have decreased.
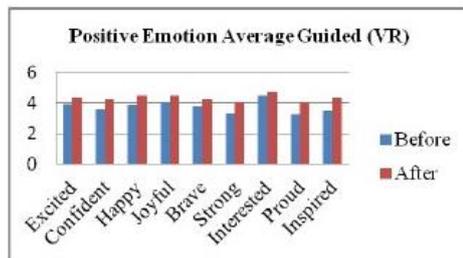

Figure 2. The mean Likert score of positive emotions for type 1 participants
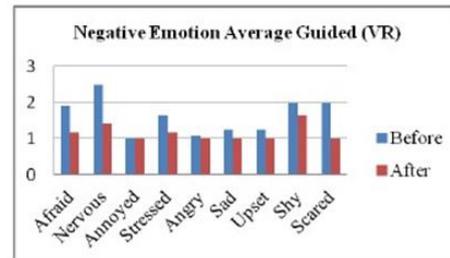

Figure 3. The mean likert score of negative emotions for type 1 participants

Figure 4 shows the positive emotions obtained from the type 2 group had increased and decreased level of emotions. Meanwhile, Figure 5 shows decreased level after type 2 participants completed their experiments.
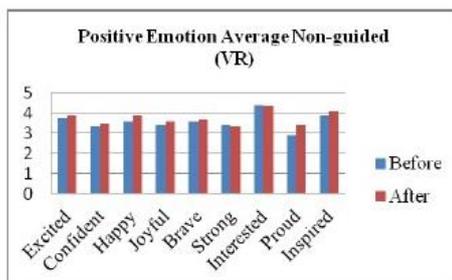

Figure 4. The mean Likert score of positive emotions for type 2 participants
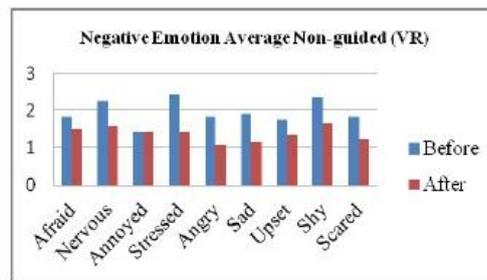

Figure 5. The mean Likert score of negative emotions for type 2 participants

Based on all scores collected, the results show that positive emotions improved using type 1 group compared to type 2 group. But, guided with natural and zikr sound choice does have higher impact to positive emotions compared to natural and instrumental sound choice. This is shown in Figure 6. Interestingly, Figure 7 shows some changes in participants' negative emotion levels. Type 2 participants have higher impact to their negative emotion compared to type 1 participants. We believe, with the different sound types do make an impact to the participants. Type 1 group was more focused from the very beginning as compared to Type 2

group. Thus, their positive emotions were increased sooner and made higher impact to reducing on negative emotions.
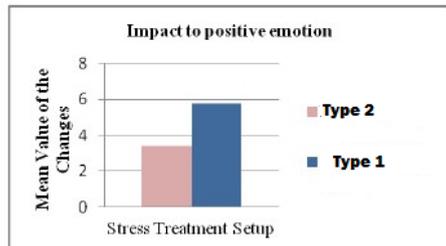

Figure 6. The Mean Value of Changes of Positive Emotions Between Type 1 And Type 2
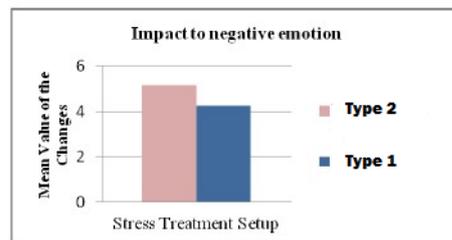
Figure 7. The Mean Value of Changes of negative emotions between type 1 and type 2

Table 2 shows the p-values for positive and negative emotions based on the t-test analysis. The P-value obtained from the experiment as shown in Table 2 are smaller than 0.05(95% confidence interval). In positive emotion, the mean value for type 2 is 3.4166 and type 1 is 5.7500. It shows that the mean for type 1 is higher than type 2. A P-value of 0.0176 indicates that the difference between sounds of positive emotion is significant. While in negative emotion, the mean value from type 2 is 5.1666 and type 1 is 4.2500. This shows that type 2 is higher and more significant than type 1 with the P-value of 0.042.

Table 2. Emotion P-Value (95% Confidence Interval)

Emotion	p-value
Positive	1.76E-02
Negative	4.24E-02

CONCLUSION

The current controlled experiment conducted managed to project insights that with guided environment, realistic views with the background sound (natural and zikr) and instruction given, participants' level of positive emotions have improved and reduced the negative emotions. However, the current experiment do not explicitly detailed out whether, it was directly due the sound had made an impact to that. Thus, in the future study, it is crucial to identify whether, with controlled guided environment, different type of sound have any different impact towards stress therapy sessions.

REFERENCES

About hypnosis (2013), Retrieved from http://www.abouthypnosis.com/

Benson, H., Beary, J. F. & Carol, M. P. (1974). Psychiatry, *Journal for the Study of Interpersonal Processes*, 37(1), 37-46.

Burdea, G. C. & Coiffet, P. (2003). *Virtual Reality Technology*, 2nd Ed., Wiley-IEEE Press.

Heather, S. (2014). Healing-Your Guide To The Oldest Form Of Healing Known To Humanity, *Physic News*.

Leuner, H. (1969). A Method of Intensive Psychotherapy. *American Journal of Psychotherapy*, Guided Affective Imagery, 23(1), 4–22.

Mahalil, I., Rusli, M. E., Mohd Yusof, A., Mohd Yusof, M.Z., Zainuddin, A.R. R. (2014). Virtual Reality Based Technique for Stress Therapy. *Proceedings of 4th International Conference on Engineering Technology and Technopreneuship (ICE2T 2014)*.

Malchiodi, C. A. (2003). *Expressive Therapies*. New York: Guilford ISBN 1-59385-379-3.

Miller, J. U. (2006), M: Guided imagery as an effective therapeutic technique: a brief review of its history and efficacy research, *Journal of Instructional Psychology*.

Montgomery, C. (2005). A Meta-analysis for Exploring the Diverse Causes and Effects of Stress in Teachers, *Canadian Journal of Education*, 28, 458-486.

Safranek, R. (2011). The Use of Music Therapy In Stroke Rehabilitation, *Proquest Discovery Guides*.

Smith, J.C. (2001). *Stress Management - A comprehensive book of Techniques and strategies*, Springer.

Thaut, M. H. (2010). Neurologic Music Therapy in Cognitive Rehabilitation. Neurologic Music Therapy in Cognitive Rehabilitation. *Music Perception*, 27(4), 281–285.