

COMPARING SOUND TYPES FOR STRESS THERAPY IN A VIRTUAL-REALITY ENVIRONMENT

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Article history

Received

15 May 2015

Received in revised form

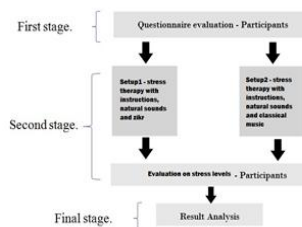
1 July 2015

Accepted

11 August 2015

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Graphical abstract



Abstract

This paper discusses about comparing different sound types 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 sessions were conducted at different timings; each session using different sound type, (zikr and classical music). By the end of each session, comparisons of stress level were made. Stress therapy with zikr as background sound produced better impact on reducing stress level among participants. This paper focuses on the effect of sound towards reducing stress.

Keywords: Stress therapy, virtual reality, sound, audio

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1.0 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. Cognitive behavioural therapy (CBT) is a technique normally used to treat stress problems effectively. CBT refers to a process or method where our thought, ideas, mental images and beliefs are synchronously work together. During this process, the therapist helps the patients to understand their current thought to identify any harmful, unhelpful, and false ideas or thoughts that can trigger health problem. In Malaysia, typical methods to treat stress effectively are known as counselling or imaginary techniques.

CBT stress treatment can be potentially improved to increase the level of effectiveness of such treatment by implementing the advancement of technology, i.e. virtual reality. 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. With this system, patients or users are exposed to an immersive 3D experience with the hope of better management of stress level.

This paper is organized as follows. Section 2 explains the background studies of this research. The detailed descriptions of the research methodology are discussed in Section 3 and in Section 4, the results and analysis of this research is presented. Finally, Section 6 concludes the paper and highlights the potential of this study.

2.0 EXPERIMENTAL

In this section, definition of relevant words or terms will be discussed in detail which includes type of stress, the causes and effects of stress, current stress treatment, virtual reality and sound therapy.

2.1 Stress: Causes and Effects

In general, stress has a direct impact to patients' health state. A mental state of humans mind that

faces stress problems often lead them toward negative emotional responses. 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) [1], stress is defined as a state of psychological pressure influenced by three main sources or domains and these three domains are 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 [2] 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 [3].

2.2 Stress Treatment: Imaginary Therapy

Imagination is a term that includes inner pictures, fantasies and ideas that revolve within our mind. There are three common methods of using imagination as therapy treatments techniques to treat neurological disorders such as depression and stress. These 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 [4].

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 [5, 6].

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 [7].

2.3 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 [8]:

a) 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.

b) 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).

c) 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 terms of software and hardware need to be considered. There are three important factors that must be considered in developing a VR application, viz.: type of display, audio and interaction. These factors are directly related to human being that have five basic senses such as visual, audio, taste, smell and touch [8]. In general, the level of realism in virtual world will increase if VR application covers more senses.

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 [8].

Currently, an on-going research has been done on developing a different technique for treating stress using virtual reality. This technique allows patient to immerse in a 3D world rather than forcing them to apply their imaginary capabilities. This technique combines immersion of realistic viewing together with audio as part and parcel of the stress therapy sessions. It is believed that by combining realistic visual and audio into the technique, it will overcome the problem of voice interruption, users' poor imagination ability, and in synchronization of imagination. It is predicted that the ability to immerse in a desired world by seeing and experiencing with open eyes, together with audio being played as background music and sound effects may improve the outcome of stress treatment better than a current technique of pure imagination (i.e. close eye). The system has been developed, and is currently tested within Malaysian context [9].

2.4 Sound Therapy

In the past, sound has been used as healing practices by many indigenous tribes and ancient healers. 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. This is realised by toning, singing, chanting, or using different instruments of sound: tuning forks, tibetan or crystal bowls, gongs and drums. It is believed that if part of our body is unwell or we have a 'dis-ease', 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 [10]. The 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 therapy, occupational therapy and speech therapy) [11].

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.

3.0 OBJECTIVES OF STUDY

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 [9]. The current 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. However, the study did not look 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 [10, 11, 12]. Thus, specifically for this study, the aim is to identify whether audio works better in eliminating or reducing stress among patients.

4.0 RESEARCH METHODOLOGY

To compare the effectiveness of audio with in controlling stress (reducing/eliminating), a controlled experiment was conducted with two setups (i.e. setup1–stress therapy with zikr played as background

music and setup2–stress therapy with classical music as background music). With setup1, participants will be placed with head mount display and headset to view the VR environment and surround audio features (combinations of instructions, natural sound–sound of birds chirping, sound of wind, sound of the beach and zikr). Meanwhile, with setup2, participants will be given the same equipments as setup1 (but with different combinations of sound–instructions, natural sounds and classical music).

We adopted the imaginary therapy developed by Benson and some modification was done to suit with the scene [13] where the scene will be viewed by the participants in guided mode and non-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 comfortably and relax..You are safe ... You feel relaxed and peace..Exhale... Inhale... You feel the sunlight gives you energy.... You can hear the gentle wave... Take a deep breath ...Inhale ...Exhale...Inhale”

Based on the script above, we have developed the beach scene that includes audio elements such as the natural sound of birds chirping, sound of waves, sound of winds and relevant to its surrounding.

The experiments involved three different stages:

First stage: Participants were evaluated by questionnaire – a list of lifestyle assessment questions focusing on stress management. The questionnaire is to indicate participants' state of emotion.

Second stage: After answering the questionnaire, participants undergone with the treatment. Once the treatment was completed, the participants were asked to express their stress condition using interview method. This process was repeated another time but, with a different sound type used. Participants were asked to answer the questionnaire before attending to the stress therapy. And once completed, participants were asked to express their thoughts on the session – especially the impact of using different type of sound.

Final stage: Data collected were analyzed from the questionnaires. Comparisons were made between gender of the participants and impact towards their stress levels.

The flowchart of the process is presented in Figure 1.

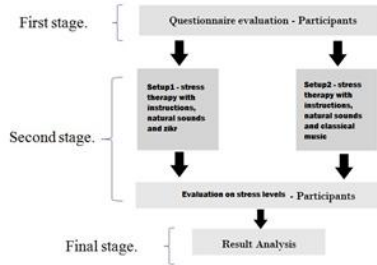


Figure 1 The flowchart of the experiment

The questionnaires that were used to evaluate the effectiveness of both therapy setups are based on SSHQ (Study Skills and Habits Questionnaire) ¹.

5.0 RESULT OF STUDY

Twenty eight participants took part in this experiment equally divided in gender (14 males, and 14 females with age of all participants ranging between 19 until 22.

The results showed how both genders have a slight different in thoughts. For female students, 64% identified that their stress level before each session at the lower range compared to male students, 71% mentioned that their stress levels were within the middle range. When asked on whether, there is any difference of stress when not in school, majority of both gender identified that their stress levels were at the lower range.

Majority of these students (both genders) identified their stress factors were final exam, mid-term exams, assignments, juggling courses workload. 35% of participants had also mentioned of socializing with people had made a negative impact towards their stress levels.

Figure 2 shows that after conducting both sessions, participants acknowledged the different impact made of each sound type used. Majority of participants mentioned that the session with zikr had better impact of relieving stress as compared to classical music. They mentioned that with zikr, they were calmer, more relax, and were able to relieve the anxiousness.

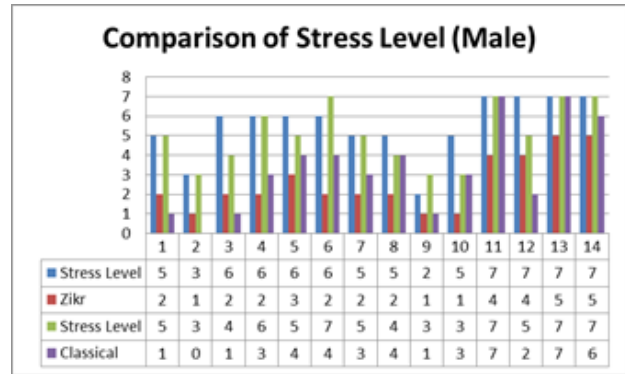


Figure 2 Comparison of Stress Level among male participants

Figure 3 shows the reactions taken among female participants after both sessions. The results showed that similarity with male participants that majority of the female participants shared that zikr had higher impact of reducing their stress level. They mentioned that with zikr, they felt more relaxed, and calmer. A few participants mentioned that with zikr, the sound made a plaintive effect thus, their thoughts and feeling immediately changes to a calmer and stress-free status.

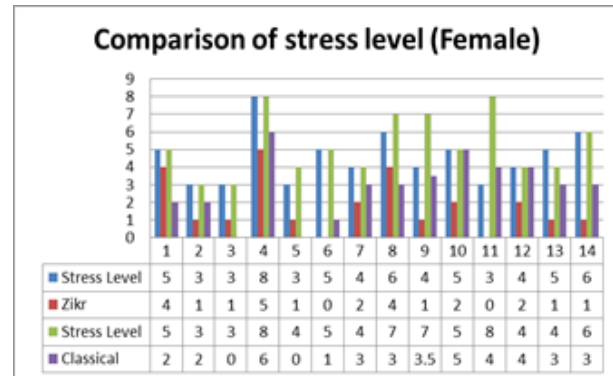


Figure 3 Comparison of Stress Level among female participants

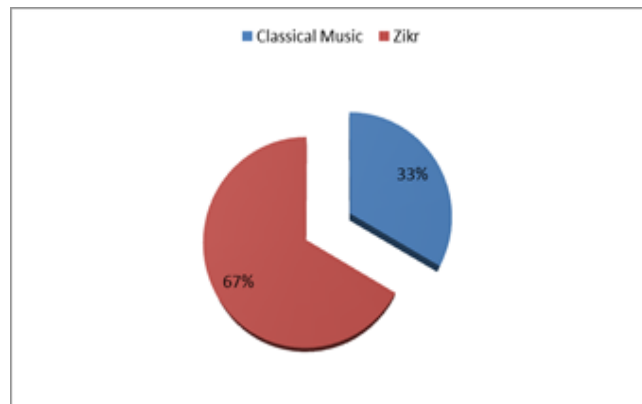


Figure 4 Male preferences

¹ Questionnaire was developed using the Healthy Lifestyle Assessment prepared by Queen's University, Canada. Access <http://www.queensu.ca/hcds/peermentors/handbook/Health%20Lifestyle%20Assessment%20%28complete%20assessment%20t%29.pdf>

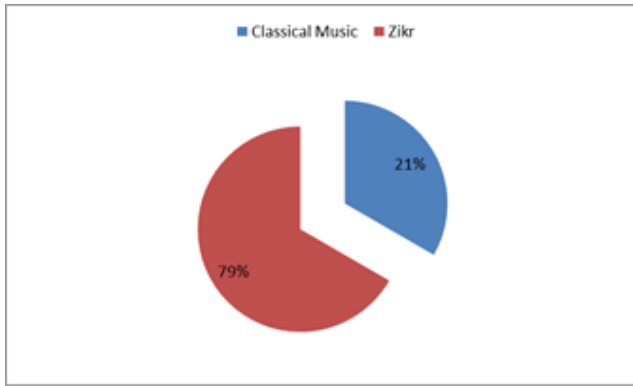


Figure 5 Female preference

As shown in Figure 4, The male participants were asked to choose the sound type preferred between both, and 67% chose zikr over classical music. Meanwhile, 79% of female participants chose zikr over classical music as shown in Figure 5.

6.0 CONCLUSION

The current controlled experiment conducted managed to project insights that with different types of sound used in the stress therapy environment, with realistic views and instructions given, participants' level of stress had reduced, thus improved the session. There is a difference in impact made between sound types used. Both genders had the same preferences of type of sound for relieving their stress; zikr.

However, the current experiment did not explicitly detail out whether it was directly due to the different sounds used. The experiment were able to show the positive impact made by sounds, but did not directly identified which sound type were supporting the session the most beneficial.

We plan to improve the experiment by separating the three sound types but combining each with instructions. Besides that, a different method of measurement for stress level will be used; rather than

questionnaire and interview, the participants' heart rates and changes in emotions will be monitored. By doing so, recognition of the most appropriate sound type could be made for the stress therapy within the virtual environment.

Acknowledgement

We would like to thank UNITEN for its Internal Grant Program which enables this study to be conducted.

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