Virtual Reality Systems for Exposure Therapy

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Abstract

Exposure therapy has proven to be an effective method for treating Fears, Post-traumatic stress disorder (PTSD), and anxiety but it quickly loses its effectiveness due to either little or too much patient participation in therapy. Because it generates imaginary, safe, and controllable environments that might heighten emotional engagement, virtual reality (VR) can aid in the improvement of extended exposure. Due to the fact that many industries have found a method to adapt this growing technology to meet their demands, demand for it has increased. This study will discuss research on how Virtual Reality Exposure Therapy (VRET) affects the accomplishment of its goals and objectives. To hasten the uptake of VR headsets, the manufacturers of goods like Head Mounted Displays (HMD) intend to keep creating more immersive content for these headsets at even better-quality levels.

Index Terms: psychiatric treatment, virtual reality (VR), exposure therapy, PTSD, anxiety disorders.

I. Introduction

Technology is now widely used in all aspects of modern life, including psychology and medical. Since the digital transformation of a lifestyle, the quality of medical care has been advancing at an ever-increasing rate. People tend to experience a wide range of mental health illnesses as a result of the modern lifestyle's constant frantic movements. Eventually, psychologists and psychiatrists created exposure therapy to address the problem, basing it on one of the most recent technological trends: virtual reality (VR) [1], [2]. The authors of [3] discovered that ID is crucial for choosing the right technology for the systems in the business to have better performance.

The American Psychological Association (APA) claims that virtual reality (VR) enables users to actively engage in a computer-generated, virtual environment in three dimensions that changes spontaneously in response to head and body movement. Despite the fact that the technology is still considered to be in its infancy, it has advanced significantly during the previous 50 years. VR has a big impact on a lot of different businesses, from marketing and entertainment to immersive breaking news and space missions. But it wasn't always going in this direction. A cinematographer named Morton Heilig introduced the first virtual reality technology in 1957 in the form of a theatre cabinet multimedia system that provided viewers with an interactive experience [4]. Therefore, looking back in time, the general population could only regard this creation as an instrument for enjoyment. The variables of decision support systems for better decision-making were explored by the authors

in [5].

The pleasant effects of VR's amusing component, which is also known as its most prevalent component, last just briefly. The goal of exposure therapy is to permanently eliminate the fears' unsettling effects, such as negative predictions, catastrophizing, or ruminative thinking. An uncomfortable environment could be entered by a client without risk thanks to the use of VR-based treatment [6]. More realistic and vivid sensations are delivered by the VR presentation of necessary scenes than by the human imagination or recollection alone. It collaborates to recognize and confront a person's problematic thinking in an effort to uncover more nimble behaviors.

II. Problem Background

As The rapid rate of lifestyle changes and the emergence of a highly judgemental and demanding culture have made 21st-century living difficult. Anxiety-related diseases are now among the most prevalent mental health conditions in the globe, according to [7], the Mental Health Foundation (2016). Specialized fears, posttraumatic stress disorder (PTSD), and general or specific anxiety disorders (public speaking or social anxiety disorders) were on the list of those conditions. It was shown that a lack of social connection brought on by fear results in social functioning impairments, which are linked to poorer educational attainment levels, a higher chance of unemployment, and challenges creating intimate relationships [2]. The World Health Organization (WHO) has reported that the illnesses described affect 1 in 13 people worldwide. As a result, those who disregard the appropriate treatment for their mental disease put themselves seriously at danger.
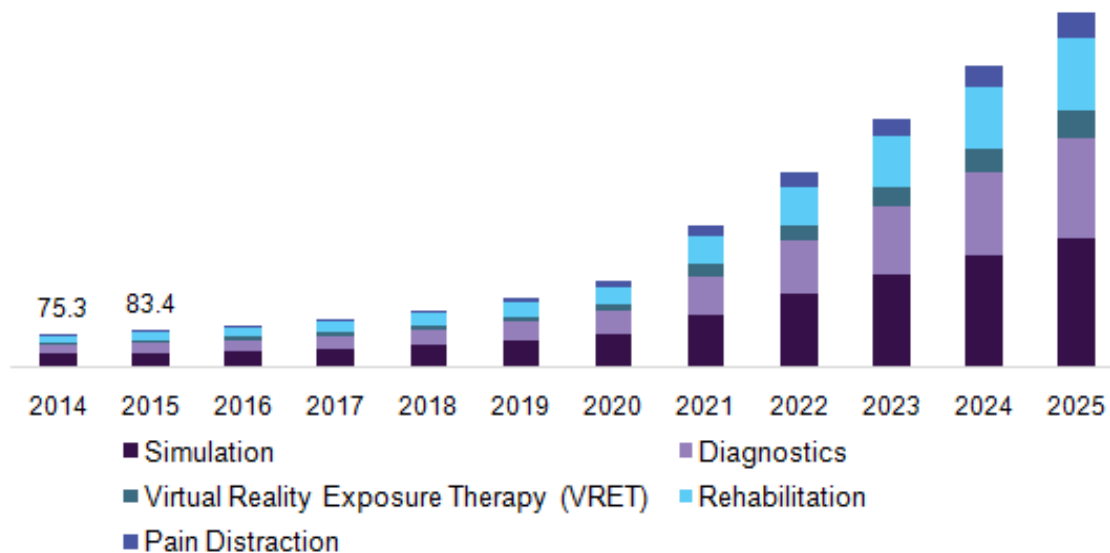
Figure 1. *North America VR in healthcare market by application, 2014 - 2025 (USD Million)*

The main therapy for social anxiety is cognitive behaviour therapy (CBT). Despite the fact that there are several CBT techniques, including exposure, relaxation training, social skills training, and cognitive restructuring, conventional treatment almost always involves the last one as a crucial element [2]. The DSM-5 states that post-traumatic stress disorder (PTSD) involves the emergence of defining symptoms, including distressing flashbacks, disturbing memories or nightmares about the traumatic incident, physiological reactions, avoiding triggers connected with the traumatic experience, and negative shifts in mood and cognition. One or

more traumatic experiences in real life, such as being in a car accident or fighting in a war, are assumed to be the cause of the symptoms [6].

Specific phobia, on the other hand, is a psychiatric disease that is characterized by a According to the American Psychiatric Association, persistent fear is a feeling that is either excessive or unfounded, and that is brought on by anticipating a certain thing or circumstance rather than by its actual occurrence [8]. Similarly, the authors [2] defined social anxiety as a fear of social interactions and events. People who have social anxiety usually avoid social interactions out of concern for criticism and public observation. Utilizing VR technology, Virtual Reality Exposure Therapy (VRET) mediates exposure therapy under the direction of a therapist [8].

Figure 2. *VR exposure to heights*

Figure 3. *VR exposure to public speaking*

Since VRET may be beneficial in resolving the disadvantages of conventional exposure techniques, particularly in terms of cost-effectiveness, ease, acceptance of therapy, and availability, as well as difficulties with clients visualising situations during imaginal exposure [6], [9], it is imperative that medicine adopt new, cutting-edge treatment modalities in conjunction with advancements in the information technology sector. Additionally, VRET offers a compelling and innovative therapy strategy and may be helpful for those who exhibit

resistance to taking part in real or imagined exposure.

III. Literature Review

The databases Research Gate, Google Scholar, and PsycINFO were utilised to carry out an extensive search of the prior literature for this paper. Studies must be in English, have full-text accessibility, have undergone peer review, and be published in an academic journal. The majority of studies used the Clinician Administered PTSD Scale and Hedges' g to measure and compare the effects of VRET and conventional ET.

The DSM-IV American Psychiatric Association's Clinician Administered PTSD Scale (CAPS) is an interview that was semi-structured and utilized to assess the key aspects of posttraumatic stress disorder [1].

The exam has five score ranges that can be used to estimate the overall severity of PTSD. The best score of 0 to 19 denotes a patient who is either asymptomatic or just has a few symptoms the following 20–39 point scale is considered mild PTSD/subthreshold and is still acceptable. The main symptoms begin to worsen between the ages of 40 and 59, which is considered the mild PTSD/threshold range. It reaches a tipping point as a severe PTSD symptomatology between the ages of 60 and 79. It signals the need for an urgent appointment with a therapist. At 80 or more, the harshness finally hits its peak. The phrase "severe PTSD symptomatology" speaks for itself. In this situation, it is advisable to seek a thorough, protracted treatment led by a licenced therapist. As a result, the length of the treatment increases with the CAPS range.

Some studies also employed Hedges' g, which suggests a minor influence with a g of 0.2, a medium effect with a g of 0.5, and a big effect with a g of 0.8.

In their study, Ready, [10], [11] interviewed nine military members who had previously served in war zones like Vietnam, Iraq, or Afghanistan and were now suffering from PTSD. Four of them received present-centered therapy, while the other five received VRET treatment. However, time and treatment condition did not interact in a statistically significant way at the 6-month follow-up and post-treatment measurements of mean improvement. In other words, the results did not change over time, demonstrating the VRET's durability. In contrast, the same pattern was noted in a study [11] that focused primarily on a combat engineer. The initial CAPS score of 106 has quickly fallen by 56% and is now below the mild level (49). Poor focus, mood irritation and furious outbursts, sleep disturbance with "cold sweats," a strong startle reaction, a difficulty to relax, and hypervigilance were among the patient's stated primary symptoms.

However, a counterargument has been presented in light of the research done by [7]. At the post-treatment assessment, the value of VRET did outweigh the value of traditional ET in the context of specific phobias, but not at the 6-month follow-up. Regarding social anxiety, the total effect size of VRET compared to no therapy took over g of 0.92, demonstrating remarkable improvements, according to the average figure obtained from 4 primary investigations on more than 150 participants reviewed by [2] and [6].

The aggregate effect across five investigations on 255 randomly assigned people was on the cusp of a tie with the g of 0.06; nevertheless, the use of VRET for social anxiety does not outperform traditional treatments in the same way. Another study that demonstrated no differences between extended exposure therapy (PE), one of the traditional therapies, and

VRET in the treatment of PTSD at the post-treatment stage was handled by [12]. What is more intriguing is that, in terms of the follow-up to three and six months, PE even accelerated VRET One of the goals of this paper, which is based on the literature evaluation, is to make VRET more effective. As a result, it is essential to take good care of the mental health diagnosis process since an increasing number of people are experiencing mental diseases as a result of real-life exposure to traumatic experiences that leave a lasting bad impression and cause disturbance.

IV. Problem Statement

Traditional exposure therapy may present challenges for patients who have trouble visualising or imagining, particularly when under pressure from outside sources. It is necessary to arrange a certain event in real life, such as flights or battles, in order to create a truly immersive experience using only the traditional technique [13]. There is no guarantee the treatment will produce beneficial outcomes in one go, even with a patient's vivid imagination and the availability of all the tools for a scenario. In addition, the psychiatrist has little influence over the method used to partially alter the behaviour of the variables. For instance, meteorological conditions, the behaviour of living things, and turbulence during flights [7].

However, a study by Garcia-Palacios et al. in 2001 [8] found that 80% of participants with a particular phobia preferred VRET to conventional ET. The therapist's level of control over the process, which includes the ability to manage unpredictable elements that may impede overall therapy and to do the task an endless number of times, is the first factor influencing the decision to choose patience in favour of VRET [10], [7]. The patient can be exposed to an infinite variety of stimuli and environments, which saves a significant amount of resources, time, and effort (such as using a plane). In addition, VRET provides a patient with privacy because most traditional ET sessions are inevitably held in public, which has the unfavourable effect of impairing the expected outcome. The ability to tailor therapy, the ability to bring therapies to market more quickly, and enhanced patient participation are the three main drivers of the current wave of innovation.

V. Aims and Objectives

This essay's primary goal is to evaluate how well a Virtual Reality Exposure Therapy (VRET) achieves its goals and objectives. The accomplishment of the following research goals would make this goal more feasible. To start, examine how virtual reality software is used. The second goal is to determine what influences the VRET. Thirdly, to evaluate the effects of VRET that have been found to have on patient wellbeing. Last but not least, to offer advice to VRET users and distributors regarding how to raise the effectiveness of VRET.

VI. Contributions

The study's conclusions, which show how important a role virtual reality plays in both the technology and medical industries, will benefit society as a whole. The necessity for more potent, paradigm-shifting treatment modalities is justified by the rising desire for cutting-edge technology tools like virtual reality. Hospitals will therefore be able to select the most efficient treatment strategy based on the collection of prior research offered if they implement the suggested therapy obtained from the results of this investigation. Therapists will be given

instructions on what should be shown on the screen and what bodily sensations it should elicit to improve patients' psychological functioning in social situations. The study will help identify important steps in the exposure therapy process, especially for the researcher who has not yet explored the burgeoning technology.

VII. Proposed System

Figure 4 shows how the three main components of VR are envisioned. These elements, which the model view controller architecture and the user interface system architecture both had an impact on [14], [15], respectively, are the application, the interface, and dialogue control. One type of VR experience might give the user a convincing impression of being somewhere else. A helmet mounted display and specialised interface devices transmit sensory data. To provide a sense of immersion, these gadgets capture head motions so that movements and pictures adjust naturally with head motion. For instance, the individual is practically placed in a forest, standing beneath a canopy of tree limbs. Depth perception, or the capacity to generally disparity allows one to estimate the distance to an object in the field of view and/or the distance between objects in the field of view (e.g., shifts in position) of the objects as the user turns his or her head in various directions. The sound of running water allows the user to readily detect the river behind him.
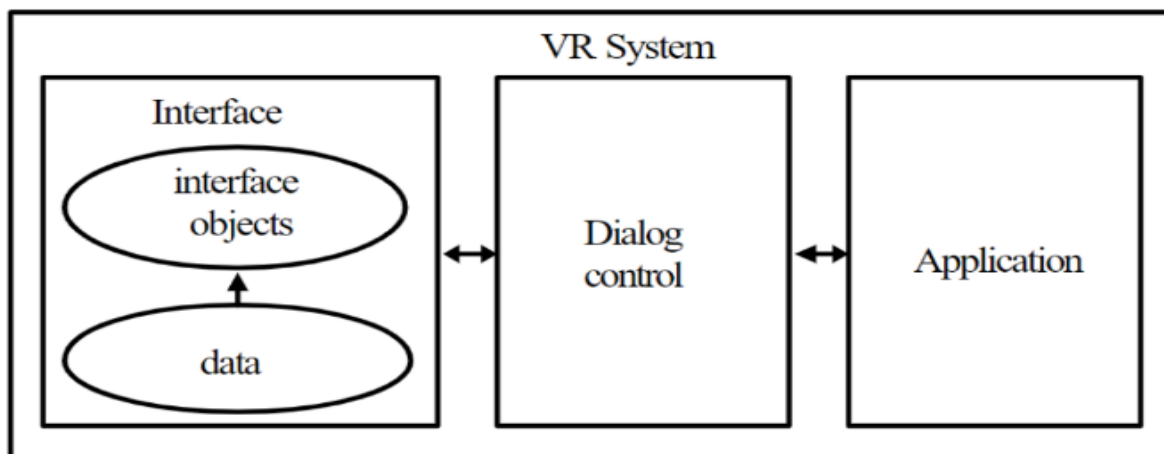
Figure 4. *VR System*

The scene vision and sound volume vary depending on the proximity to the items. The item is clearer and the sound more distinct the closer the user gets to the river. Turning around, the user finds a deer standing only 10 feet away. The user's depth perception detects that the deer is approaching them as it begins to run in their direction. The user may be able to detect that a deer is approaching them quickly based on their depth perception and the relative positions of objects around the deer.

Current VR solutions make use of numerous spatially separated cameras to realistically replicate the scene. 3D audio and video integrated, as well as a camera or microphone array, an aggregation system, a viewing setup, etc. Both a graphic design of the scenario and a recording of it using a camera and microphone array are both possible. In order for the camera array to record enough view disparity for producing stereoscopic images, camera modules included in the array may have lenses fitted around spherical housings that are orientated differently and have adequate diameters and fields of view. The microphone array can pick up sounds coming from different angles. Both send the recorded data to the aggregation system in

comparable directions or directionalities.

The aggregation system may include a server or client with a storage device for the raw video and audio data. A set of gigabit Ethernet switches for gathering the unprocessed audio and video data may also be a part of the aggregation system [16].

VIII. Evaluating Proposed System

We shall assess the suggested system under consideration in this section. Numerous research carried out a long time ago were employed in the course of a systematic investigation into the use of virtual reality in psychiatry, even though the technology is still regarded as new and emergent.

The lack of research on data security-related issues is one of the study's weaknesses as proposed in this paper. The reason is due to a system limitation: the haste with which the system was released onto the worldwide market resulted in the right attitude toward proper privacy and security issues. The relevant IT specialists must become familiar with the information that the virtual reality suppliers track and use in order to prevent potential hazards.

The mimicked scenarios shown should be taken as seriously as reality, as the technology's name implies. High-end multimedia computing is crucial in this situation. Buying a headset that is seriously concerned with user experience is vital to give comfort and prevent any physical disturbances.

Conclusion

Finally, we evaluated how a Virtual Reality Exposure Therapy (VRET) affected the accomplishment of its goals and objectives. The factors that have been investigated and determined to have an impact on the VRET are described. From a "small entertainment booth" all the way to mental therapy, virtual reality has come a long way to get to where it is now. Even if it may not be as widely used or available in hospitals today, this innovative technology continues to catch the attention of millennials, who are particularly prone to mental illnesses brought on by a busy lifestyle and the high expectations of contemporary society.

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