



Application of virtual reality technology in the treatment of depression

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Abstract. Virtual reality is a comprehensive technology that allows users to immerse themselves in a three-dimensional realistic image through computer simulation and to interact with the virtual scene through some special equipment. With the help of computer programming, virtual reality technology can create an interactive scenario suitable for the rehabilitation of depression patients, which has unique advantages over traditional treatment methods. Based on the review of previous studies, this paper summarizes the current situation of the application of virtual reality technology in the intervention treatment of depression symptoms, the design of interactive scenarios and their mechanisms. Finally, combining the limitations of virtual reality technology and its advantageous characteristics, it is argued that the future development of this technology should consider interactive scene diversification, cost reduction and industry treatment standardization.

Keywords: Virtual reality , Depressive disorder, Psychology , PCT-vr , Interactive Virtual Reality Scenarios

1 Introduction

As virtual reality technology continues to be updated and iterated, it is also being used in clinical psychotherapy, including for patients with depression. It is a drug-free therapy, which means that patients can use it together with other therapies without fear of interference with medication. Depression is a mood disorder that affects about 3.8% of people worldwide, affecting their ability to work, study and perform daily activities. Among other symptoms, people with depression may experience persistent low mood, loss of interest in enjoyable activities, sleep problems and poor concentration. Virtual reality technology is one of the therapeutic approaches that has shown efficacy for mental health disorders such as depression. Although some VR is still in the exploratory stage for depression treatment, they are expected to be an effective form of treatment in the future.

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G. Guan et al. (eds.), *Proceedings of the 2023 3rd International Conference on Education, Information Management and Service Science (EIMSS 2023)*, Atlantis Highlights in Computer Sciences 16, https://doi.org/10.2991/978-94-6463-264-4_60

2 Virtual Reality Technology

Virtual reality technology is the use of computer simulation to generate a three-dimensional space virtual world, providing the user about the visual and other sensory simulation, so that the user feels immersive, can instantly and without restrictions to observe things in three-dimensional space. [1] It does this by creating a virtual reality that humans can access and immerse themselves in through all of their senses, even interacting through verbal language, body language, or other means. In user-computer interaction, The more common easy-to-use tools are the keyboard and mouse. In three-dimensional space because of the six degrees of freedom, So the flat motion of the mouse does not lend itself to feedback on three-dimensional space. There are already some mainstream products for the mapping of three-dimensional space, such as digitizers, space balls, data gloves and data suits.

3 Depression and traditional treatment methods

Depression is a mood disorder characterized by significant and persistent depression, with a high recurrence rate and a high risk of suicide. In addition to common mood symptoms, cognitive dysfunction is another prominent symptom of depression, with varying degrees of impairment in cognitive functions including memory, visuospatial structure, psychomotor speed, and executive functions, resulting in reduced quality of life. According to the 2017 WHO Depression and Other Common Mental Disorders: Global Health Estimates report, 322 million people worldwide suffer from depression, accounting for 4.4% of the global population in 2015. (See table 1) Half of the population lives in Southeast Asia and the Western Pacific, and the number of depressed people worldwide increased by 18.4% in the decade from 2005 to 2015. Africa accounts for 9%, East and Central Asia for 16%, Europe for 12%, America for 15%, South Asia for 27%, and the Western Pacific for 21%. [2]

The more common treatments for depressed patients include pharmacotherapy and psychotherapy, as well as repetitive transcranial magnetic stimulation therapy, which has emerged in recent years. However, the general treatment process takes a mixed approach, i.e., a combination of pharmacotherapy and psychotherapy.

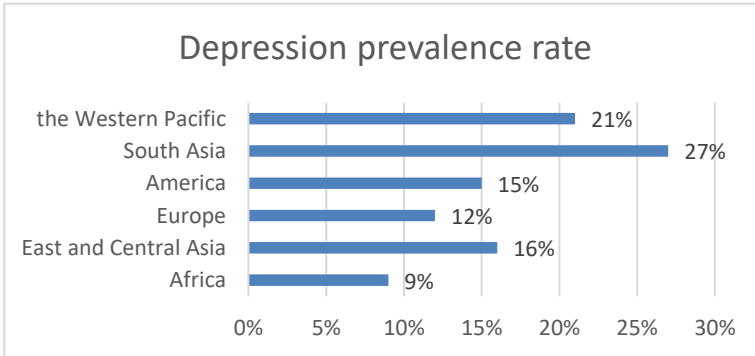


Table 1. Global epidemiological survey of depression (authors' handout)

4 Comparison of traditional therapy and virtual reality technology

Features of depression include depressed mood, slowed thinking, reduced volitional activity, and cognitive deficits. The main clinical manifestations are persistent depressed mood, including depressed mood and reduced interest or lack of pleasure. VR technology has the advantage of treating depressed patients, it allows depressed patients in an immersive space, through the virtual reality environment on the patient's mental interference, affecting the patient's psychological state, into the fake "real" world to become the real world. The "real" world becomes possible. VR-based therapies are becoming increasingly common in healthcare as virtual reality exposure therapy (VRET), which can be used to reduce the stress response that patients may experience as a result of traumatic experiences, alleviate depression, anxiety, and isolation, and improve general well-being. [3] Although virtual reality technology has not been explicitly applied to the treatment of depressed patients in clinical settings, there are considerable empirical studies showing that virtual reality technology can improve the symptoms and enhance the quality of life of depressed patients.

4.1 Virtual Reality Exposure Therapy

Exposure therapy is a treatment method that exposes the patient directly to an irritating environment to create some resistance. Virtual exposure therapy is highly controllable, safe, and simple to administer. The quality, intensity, and frequency of exposure are easier to control, and the therapist can choose to terminate the treatment in a timely manner to prevent harm to the patient based on the patient's course of treatment. This advantage avoids the poor reproducibility and ease of implementation of traditional exposure therapy, and is also more realistic; when Zainal et al. used virtual reality exposure therapy with patients suffering from severe social anxiety, it was effective in alleviating their depressive symptoms. [4] Although virtual exposure therapy is not explicitly used clinically as a primary treatment for depression, it does have a signifi-

cant effect on symptom relief and reduction of depression. In conclusion, virtual reality exposure therapy, as an efficient, safe and flexible treatment method, can effectively improve patients' symptoms of depression.

4.2 Virtual reality technology intervention group compared to drug treatment

The use of medication for depression is often accompanied by a number of side effects. Examples include nausea, vomiting, manic symptoms and sexual dysfunction, among others. minJea Kim's team recruited 36 depressed patients and 22 healthy controls through online advertising for a controlled trial of virtual reality technology treatment versus medication. The patients' initially high depressive symptoms, high suicidal tendencies, and low resilience improved after VR treatment, with no significant difference in treatment effects compared to the medication group. [5] This not only demonstrates that VR therapy has a good effect on improving negative mood and suicidal thoughts in depressed patients, but also further demonstrates the clinical potential of VR therapy in depression.

4.3 Interactive Virtual Reality Scenarios

Compared with traditional product interaction design, virtual scene interaction design has greater advantages and characteristics. Interaction in virtual reality scenes has a higher degree of realism, that is, it can restore almost the same user perception, such as visual, tactile, auditory and a series of perceptual activities. Users can participate in the interaction process in a realistic environment, and can experience not only the physiological restoration, but also the complete restoration of psychological feelings. The virtual scene interaction process is shown in Figure 1.

Research has been conducted to design environments with restorative VR, including natural environments [6,7] and interactive spaces [8,9]. Natural environments include the restoration of ecological nature, such as forests, birdsong, flowers, and wind sounds, which can make people feel safe and relaxed. Interactive spaces refer to a number of VR devices that allow patients to perform indoor aerobic exercises and rehabilitation training, among others. These restorative VR environments make patients feel relaxed and improve their high pressure psychology by promoting their parasympathetic activity, further paving the way for some rehabilitation efforts. Wang et al. further did an experiment on depression relief and intervention treatment based on interactive virtual reality scenario study. The study designed a 2 (anxiety-depression state) \times 4 (interactive VR scenario) experiment, where the interactive VR scenario design included two environments, city and park, while the interactive design included four activities: automatic viewing, free roaming, fishing and watering flowers. The results truly showed that such interactive VR scenes with restorative properties were effective in improving depressive symptoms in depressed patients, while the experiment showed the great potential of VR therapy for depressive symptom intervention.

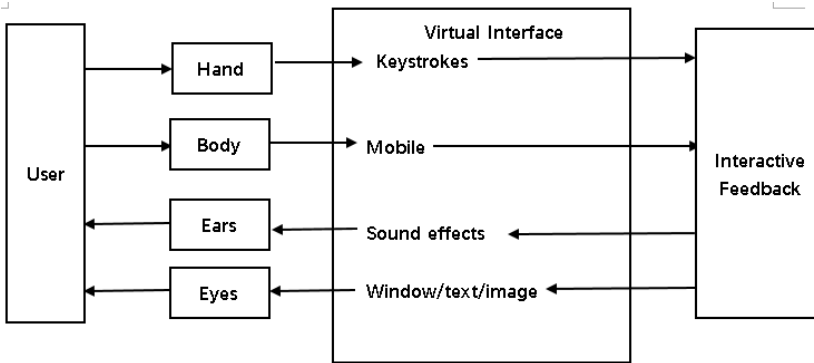


Fig. 1. Virtual scene interaction diagram (Hand-drawn by the author)

4.4 virtual reality-enhanced personal construct therapy (PCT-VR)

Cognitive-behavioral therapy, based on cognitive therapy techniques and founded by the American psychologist Beck in 1976, is a systematic treatment approach based on the complementary and mutual absorption of behavioral therapy and cognitive theory. In the course of its continuous development, Beck's "cognitive structure" has been applied to practice, and personal construct therapy is a developmental branch of it.

Adrián Montesano's team research design comparing traditional personal construct therapy and virtual reality augmented personal construct therapy while introducing standard cognitive behavioral therapy as a control group found that the therapeutic effect of personal construct therapy augmented by VR was higher than traditional personal construct therapy. In contrast to cognitive behavioral therapy, PCT-VR does not require activities such as educating patients about symptoms and changing cognition, and the treatment focuses on the process of meaning making rather than on the improvement of outcomes. It directly allows the patient to enter the mental world through the virtual environment created by VR, and then to start from the mental world and think about the conflicting or consistent behaviors of behavior and mental thoughts. [10]

5 Application of virtual reality technology in the treatment mechanism of depression

Although virtual reality technology is the same as drug therapy as the physiological mechanism of action, but the impact of drug therapy on the human body environment is often accompanied by some harmful side effects, virtual reality technology can not only effectively prevent such side effects but also flexibly control the treatment process to bring the patient discomfort reactions. In addition, it can be used as an assessment tool to collect data directly through hardware devices. Unlike traditional means of psychotherapy, such as reluctance and concealment in counseling, virtual reality technology can perform the tasks of data collection and individual psychological assess-

ment very well. Virtual reality interactive devices provide wearable devices for subjects to experience virtual reality scenarios, including somatic interactive devices, visual interactive devices, and auditory interactive devices. It emphasizes on exploring users' needs from multiple perspectives, understanding their feelings, analyzing their internal and behavioral characteristics, predicting how the product affects the relationship between the product and the user, and exploring the dialogue between the user, the product and the environment as a cross-loop process between the user, the product and the environment. Interactive virtual reality establishes different scenarios according to the needs, which can be relaxing, soothing, etc., to achieve a good interactive experience of human-computer environment. The HCI system relationship is shown in Figure 2.

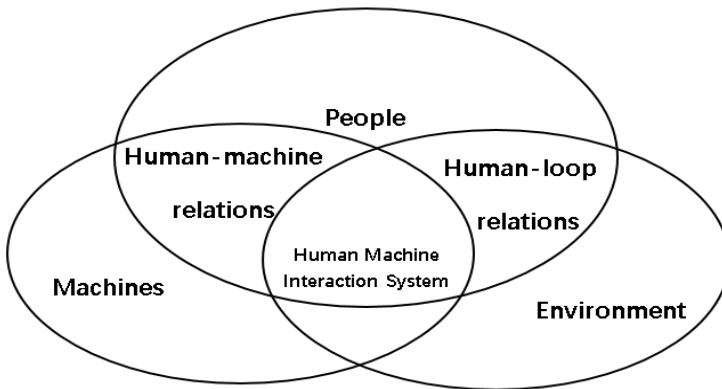


Fig. 2. Human-computer interaction system relationship diagram (Hand-drawn by the author)

6 The limitations and prospects of virtual reality technology

Compared with people who know about virtual reality technology, new users have questionable and fearful attitudes towards the acceptance of virtual reality technology. For example, it is more difficult to study the interaction design of products for the elderly than for young people who like new technologies. In the future, with the continuous development and improvement of virtual reality technology, the application of this technology will have a broad prospect and wider acceptance. Secondly, the familiarity of virtual scenes and product interaction varies from person to person, and different users will have different reactions in different scenes, so it is difficult to simulate various scenes and set diverse interaction tasks when conducting interaction design research. Future research can consider ergonomically designed interesting and appropriate VR interaction scenarios that track the physical and mental mechanisms of the virtual and real world to create quality human-computer interaction experiences to improve public mental health and well-being. Although the current application of virtual reality technology in psychotherapy is limited, facing such difficulties as expensive virtual reality therapy equipment, incomplete psychotherapy industry norms,

and lack of virtual reality content development talents, it is foreseeable that with the comprehensive political, economic, social and technological assistance, the application of virtual reality in psychotherapy will show a different The application of virtual reality in psychotherapy is expected to show a different kind of vitality with the help of political, economic, social and technological aspects.

7 Conclusion

The psychological applications of VR have been very active and have been usefully explored by many scholars. In recent years, especially the theories of systematic desensitization therapy and exposure therapy have been introduced into VR applications, and new results have been achieved in the treatment of phobias, anxiety disorders, PTSD, etc. Although its application in the field of depression treatment is still immature, still in the experimental stage, and has not been promoted on a large scale, however, there has been much empirical evidence that it can effectively alleviate depression symptoms. Some scholars have also developed an interactive virtual scene system suitable for depression patients, which can effectively act on the relief of depression symptoms. This shows that virtual reality technology has great prospects for the treatment of depression.

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