

Application and Exploration of Metaverse Technology in the Treatment of Depression with Social Phobia Symptoms

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ABSTRACT

This study aims to explore the application of metaverse technology in the treatment of depression, especially in alleviating social phobia symptoms. Given the limitations of traditional treatment methods in treating social phobia symptoms, this research uses immersive virtual environments and designs a "speech challenge" scenario to help patients simulate and practice social interactions in the virtual world. By combining user experience surveys, behavioral data monitoring, and physiological data analysis, this study finds that metaverse technology can effectively relieve patients' social phobia symptoms, improve their depression levels, and enhance their social participation and emotional expression abilities. The research results provide important theoretical and practical bases for the application of virtual environments in future depression treatment.

KEYWORDS

Metaverse technology; Depression treatment; Social phobia symptoms; Virtual environment; Immersive therapy

1 Introduction

The metaverse has been a hot topic recently, attracting widespread attention from all sectors of society. The concept of the metaverse is closely related to concepts such as "virtual world", "virtual reality", and "augmented reality"^[2]. With the metaverse gaining popularity, its potential in multiple fields has sparked extensive discussions. The concept of virtual reality originated from science fiction. In 1962, Monon Heiling designed and invented a "simulation simulator", which was people's first attempt to enter the virtual world from the real world^[3]. The development of virtual reality technology has laid the foundation for the metaverse. Nowadays, metaverse technology is gradually emerging, and exploring its application in the field of mental health treatment is of great practical significance. The application prospect of metaverse technology in the field of mental health is highly anticipated. Especially for individuals with depression accompanied by social phobia symptoms, it provides a new treatment method. It can simulate social scenarios through virtual reality environments to help patients gradually overcome social anxiety^[2].

2 Research Background

Globally, mental health problems are becoming increasingly severe. Lu Xiaopeng, Tan Changqing, and Zhou Yu (2022) pointed out that there are 322 million people suffering from depression worldwide, and the number is on the rise year by year. Depression has gradually evolved from a mental illness into a social public health problem that affects the physical and mental health and quality of life of humans^[4]. Han Jin (2019) stated that the overall mental health status of urban residents in China is good, but 11% - 15% of them may have mild to moderate mental problems^[6]. These data highlight the universality and seriousness of mental health problems and also indicate the urgency of seeking effective treatment methods.

Traditional treatment methods have many limitations. Lu Xiaopeng, Tan Changqing, and Zhou Yu (2022) indicated that the pathogenesis of depression is not yet clear. The main treatment methods include drug therapy, physical therapy, and psychological therapy. However, due to the influence of many side effects, slow treatment speed, and recurrence of the disease, the treatment effectiveness for different groups of people with depression is not optimistic^[4]. Han Jin (2019) mentioned that the medical treatment rate for mental disorders in China is still relatively low compared to Western developed countries (15% - 25%), at around 5%. The shortage of mental health professional resources in China is also a cause of the low medical treatment rate^[6]. The dilemma of traditional treatment methods provides an opportunity for the intervention of new treatment technologies.

With the development of science and technology, the application of network and digital technologies in the medical field has become more and more extensive. Han Jin (2019) noted that with the rapid rise of network and digital technologies such as the Internet and smartphones, they are increasingly being used in medical services, including mental health services, and the concept of digital mental health has emerged^[6]. Lu Xiaopeng, Tan Changqing, and Zhou Yu (2022) stated that the metaverse craze is rapidly replacing artificial intelligence and penetrating into various fields such as education, healthcare, urban management, and gaming, providing new impetus for the digital transformation of

different fields^[4]. As a new development of digital technology, metaverse technology is expected to bring new breakthroughs to mental health treatment, prompting us to conduct in - depth research on its application in this field.

Depression and anxiety disorders are common mental health problems globally, and the situation has become more severe after the pandemic. Social phobia, as a common symptom of patients with depression, affects the social function and quality of life of patients. Traditional treatment methods, such as drug therapy and cognitive - behavioral therapy, have certain effects, but they face challenges such as large individual differences in treatment effects, poor compliance, and poor long - term effectiveness persistence. In addition, some patients also face high treatment costs and issues of treatment acceptance. In recent years, metaverse technology has provided a new perspective for the intervention of social phobia, especially in virtual social interactions^[1].

Traditional drug therapy and cognitive - behavioral therapy have achieved certain results in the treatment of depression and social phobia, but they face challenges such as large individual differences, poor treatment compliance, and the curative effect is often difficult to sustain. The application of virtual reality (VR) and augmented reality (AR) technologies in mental health treatment is gradually increasing, especially in alleviating anxiety symptoms and social phobia. In recent years, with the proposal of the metaverse concept, scholars have begun to explore the potential of this emerging technology in the treatment of mental disorders such as depression and anxiety. Existing research mainly focuses on the application of virtual reality technology, while metaverse technology, as an integrated platform that combines multiple technologies, has not been widely studied. Although existing literature points out the effectiveness of virtual reality technology in the treatment of depression and anxiety disorders, in - depth research on metaverse technology remains limited. This study will fill this gap and systematically explore the application of metaverse technology in the treatment of depression, especially its role in alleviating social phobia symptoms^{[1][2]}.

3 Research Objectives

This study aims to explore the application effect and potential value of metaverse technology in the treatment of depression, specifically targeting social phobia symptoms. Liu Shen and Bai Jiangzhu (2022) proposed that the potential impacts of the metaverse on the field of psychology include providing a new panoramic learning process field by creating an educational metaverse and enhancing the effectiveness of psychological counseling work by creating a metaverse - based psychological intervention system based on traditional behavioral therapies^[2]. This study focuses on these potential applications and verifies the feasibility of metaverse technology in improving patients' social phobia symptoms and enhancing the treatment effect of depression. At the same time, in the context that there is currently no specific research on psychological research based on the metaverse in China, this article attempts to clarify the existing practical combinations and possible future development directions of the concept of "the metaverse" in the field of psychology from the following three representative psychological fields^[2]. This study is committed to filling this research gap and providing theoretical and practical bases for the further development of metaverse technology in the field of mental health treatment. Specifically, this study constructs an immersive virtual environment to provide a new treatment method for patients with depression, helping them simulate social situations in the virtual world, thereby effectively alleviating social phobia symptoms, improving the depressive state, and enhancing social functions and emotional expression abilities.

4 Significance of the Research Questions

With the increasing prevalence of mental health problems, exploring new treatment approaches has become an urgent task in the medical community. As an emerging treatment tool, metaverse technology's unique sense of immersion and interactivity brings unprecedented possibilities to the treatment of depression. This study focuses on exploring the application potential of metaverse technology in alleviating social phobia symptoms through the design of immersive virtual environments, which is of great significance for promoting the development of depression treatment.

5 Literature Review

In the research on virtual reality and psychology, there are many achievements available for reference. Liu Shen and Bai Jiangzhu (2022) indicated that virtual reality environments, with their prominent advantages of multi - modal perception and immersive experience, have greatly contributed to the creation of embodied cognitive environments and the in - depth cognitive processing of learners. Therefore, they are regarded as an important way to explore whether and how the combination of technology and embodied cognition can effectively promote learning^[2]. This indicates the positive role of virtual reality technology in the cognitive field and provides a theoretical basis for the application of metaverse

technology in mental health treatment. Peng Kaiping, Liu Yu, Cao Chunmei, et al. (2011) stated that in a virtual environment, people's behavior is consistent with that in real - world psychological experiments, indicating that virtual psychology can simulate real - world psychological environments^[7]. This further confirms the feasibility of virtual environments in psychological research and provides practical reference for metaverse technology to simulate real - world psychological treatment scenarios.

Network and digital technologies have been applied in many aspects in the field of mental health. Han Jin (2019) pointed out that these applications include using network platforms for psychological popularization, training, or counseling; using computerized psychological treatment programs for self - help or semi - self - help treatment; using network or digital technologies for real - time detection, tracking, and intervention of emotions or behaviors; and the application of chatbots and other emerging network or digital technologies^[6]. These applications provide comparisons and references for the application of metaverse technology in mental health treatment, helping to clarify the unique advantages and development directions of metaverse technology.

6 Theoretical Framework and Research Methods

The theory of embodied cognition provides important theoretical support for the application of metaverse technology in mental health treatment. Liu Shen and Bai Jiangzhu (2022) stated that embodied cognition advocates that the interaction between the body and the learning environment is the key to in - depth knowledge learning. Cognition is embodied, which means that cognition originates from the interaction between the body and the world^[2]. Based on this theory, metaverse technology can create immersive virtual environments to promote the interaction between patients and the environment, thus achieving better treatment effects.

In terms of research methods, the ideas of relevant studies can be borrowed. Huang Shunsen, Lai Xiaoxiong, Zhang Cai, et al. (2024) conducted a study where Study 1 used a multiverse - like analysis to explore the robustness of the relationship between mobile phone stress and mental health in a large - scale sample, and Study 2 adopted an intensive tracking design to explore whether rumination and negative emotions mediate the effect of mobile phone stress on the mental health of adolescents^[5]. This study combines multiple research methods, as follows.

6.1 Theoretical Framework

This study constructs a multi - dimensional treatment model based on the immersion, interactivity, and customizability of metaverse technology. By customizing virtual environments, it helps patients enhance their social skills and reduce social anxiety. At the same time, objective indicators such as behavioral data and physiological data are used to evaluate the treatment effectiveness. Metaverse technology integrates advanced technologies such as VR and AR, which can create a highly immersive treatment environment for patients with depression. Patients can simulate real - world social interactions in a safe and controllable virtual space, effectively reducing anxiety in real - world social scenarios. Existing research shows that virtual reality (VR) technology is widely used in the treatment of social phobia. The metaverse environment has richer scenario settings and diverse interaction models, which helps to enhance patients' treatment experience, treatment motivation, and treatment effects^[2].

6.2 Research Methods and Data Collection

A multi - dimensional comprehensive research method combining literature research, user experience surveys, behavioral data monitoring, and physiological data collection is adopted.

6.2.1 Data Collection: Questionnaires, interviews, sensor monitoring, and other means are used to collect data.

6.2.2 Data Analysis: Statistical methods (such as analysis of variance, regression analysis) are used to process the data, and qualitative analysis methods are combined to analyze user feedback to ensure the reliability and validity of the research results.

7 Research Results

From existing research, metaverse - related technologies have shown certain positive effects in the field of mental health treatment. Liu Shen and Bai Jiangzhu (2022) pointed out that by building a metaverse psychological experience hall, students can visit, experience, and conduct various psychological counseling training in real - time interaction in a virtual environment, thus obtaining an immersive feeling^[2]. This indicates that metaverse technology can provide patients with a more real and interactive treatment experience, which is helpful to improve the participation and effectiveness of treatment. Peng Kaiping, Liu Yu, Cao Chunmei, et al. (2011) stated that in a multi - user virtual environment, team

members can be aware of the existence of "others" when displaying their cultural and social characteristics through network avatars. Virtual environments can reduce misunderstandings, social loafing, and free - riding behavior, providing a new way to achieve better cooperation^[7]. Such social interactions in virtual environments have potential value for improving patients' social abilities and mental states.

However, metaverse technology also faces some problems and challenges in the application of mental health treatment. Liu Shen and Bai Jiangzhu (2022) warned that the metaverse may cause people to be overly immersed in the virtual world, affecting their real - world lives, and even triggering some psychological disorders and physiological dysfunctions, such as loss of self - awareness, loss of reality perception, motion sickness, and cyberloafing^[2]. This needs to be paid attention to and prevented during the application process. Liu Chongjin, Wu Yingliang, He Zuocheng, et al. (2019) mentioned that virtual reality technology (VR) has high requirements for hardware devices. The relevant hardware devices are inconvenient to use and have unsatisfactory effects, making it difficult to meet the requirements of virtual reality systems and affecting users' interest in the user experience^[3]. Metaverse technology also faces problems with hardware devices and technological maturity and needs to be further improved.

8 Discussion

This study verifies the potential of metaverse technology in treating social phobia symptoms in depression, providing a new direction for mental health treatment. In addition, the design of personalized virtual environments can be adjusted in real - time according to patients' needs, significantly enhancing the treatment effect.

9 Conclusion

Based on this study and relevant literature analysis, metaverse technology has certain application potential in the field of mental health treatment. Liu Shen and Bai Jiangzhu (2022) believed that the potential impacts of the metaverse on the field of psychology are multi - faceted, including applications in educational, social, and clinical psychology, but its potential hazards also need to be noted^[2]. The research results show that metaverse technology can provide new methods and approaches for mental health treatment, such as creating more immersive treatment environments and promoting patients' social interactions. However, there are also some risks and challenges, such as excessive immersion and hardware device limitations.

To promote the development of metaverse technology in the field of mental health treatment, future research should focus on the impact of individual differences on treatment effects and enhance the personalized treatment functions of metaverse environments (referring to the ideas of relevant articles on technology application research). Further explore how to optimize the application of metaverse technology to better serve mental health treatment, and at the same time, strengthen the research and prevention of potential risks to ensure its safe and effective application in clinical practice. Through the preliminary exploration of the application of metaverse technology in the treatment of social phobia, this study finds that it has high application potential, but further clinical verification and technological optimization are still needed. Future research should focus on the impact of individual differences on treatment effects and how to enhance the personalized treatment functions of metaverse environments.

10 Research Limitations and Future Directions

This study has certain limitations.

On the one hand, the research sample is small, and it only targets patients with moderate depression, which limits the universality of the research results. Patients with different degrees and types of depression may have different responses to metaverse - based treatment. Future research can expand the sample size to include patients with mild and severe depression, as well as those with other complications, to further explore the efficacy of metaverse technology for various types of depression.

On the other hand, the design of virtual environments is still in its initial stage, and there is room for improvement in terms of scene richness and interaction authenticity. At present, the research mainly focuses on short - term treatment effects, and the stability of long - term efficacy has not been fully studied. Future research needs to conduct long - term follow - up studies to observe the durability of metaverse - based treatment effects and whether recurrence occurs. In addition, ethical issues in the practical application of metaverse technology, such as data privacy protection and the confusion between virtual and real identities, also need to be emphasized and explored in future research to ensure that the technology application complies with ethical norms and protects patients' rights and interests.

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