| Review | Virtual Reality and Metaverse in the Treatment of Post Traumatic Stress Disorder |
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**ABSTRACT:** The rapidly increasing technological advancements such as virtual reality tools, which are becoming a part of our daily lives, provide opportunities to receive better services in many fields, including the field of mental health. Studies have investigated how virtual reality and the metaverse can be integrated into the treatment of mental health issues, particularly in the treatment of post traumatic stress disorder (PTSD). However, as this is an emerging field that is still under research, there is a need for more studies to focus on different ways to integrate those tools to minimize the potential disadvantages. Especially, few applications currently exist for metaverse usage in mental health. This review aims to present studies on the usage of virtual reality tools in the treatment of PTSD, provide suggestions on how metaverse can be integrated in the treatment protocols and finally put a light on the possible disadvantages that could come with it.

**KEYWORDS:** Virtual Reality, Metaverse, Post traumatic stress disorder, Trauma, Psychological treatment

**ÖZET:** Hızla ilerleyen teknolojik gelişmeler, özellikle sanal gerçeklik araçları gibi yenilikler, günlük hayatımızın bir parçası haline gelirken, ruh sağlığı alanı da dahil olmak üzere birçok alanda bizlere daha kaliteli bir hizmete ulaşabilme imkanı sağlamaktadır. Birçok araştırma, sanal gerçeklik ve metaverse teknolojilerinin psikolojik bozuklukların tedavi protokollerine, özellikle de travma sonrası stres bozukluğunun tedavisine nasıl entegre edilebileceğini incelemiştir. Bununla birlikte, bu alan henüz gelişmekte ve araştırma aşamasında olduğu için, bu teknolojilerin entegrasyonunu daha verimli hale getirecek ve olası olumsuz etkileri en aza indirecek yeni yöntemlere odaklanan daha fazla çalışmaya ihtiyaç duyulmaktadır. Özellikle, şu anda metaverse teknolojisinin ruh sağlığı alanında kullanımına yönelik çok az uygulama bulunmaktadır. Bu derleme, sanal gerçeklik araçlarının travma sonrası stres bozukluğunun (TSSB) tedavisindeki kullanımına dair yapılan çalışmaları sunmayı, metaverse teknolojisinin tedavi protokollerine nasıl entegre edilebileceğine dair önerilerde bulunmayı ve son olarak bu teknolojinin beraberinde getirebileceği olası dezavantajları tartışmayı amaçlamaktadır.

**ANAHTAR KELİMELER:** Sanal Gerçeklik, Metaverse, Travma Sonrası Stres Bozukluğu, Travma, Psikolojik Tedavi

## 1. INTRODUCTION

Technology has advanced in recent years at a rate that has never been seen before, ushering in a new era in which virtual reality and the digital world are becoming more and more entwined with our everyday lives. This phenomenon began with the initial integration of the digital world into our lives, through platforms such as online shops, virtual classrooms, and games, eventually evolving into what we now refer to as the metaverse. The term metaverse refers to a multiuser environment where physical reality merges with a digital environment, creating a shared virtual space, in which people are using avatars to interact with each other and other virtual objects [1].

The concept is not a new one. It was introduced for the first time in a science fiction novel titled "Snow Crash" by Neal Stephensen, envisioning a virtual world where people are interacting with each other through "*customizable avatars that is integrated with the real-world economy.*" Since then we have seen the idea presented in fiction books such as otherland, rainbow ends, deamon and movies such as Matrix and Avatar over and over again. Until recently, however, this remained purely fictional. With recent technological advancements and the emergence of virtual reality tools, this fiction started to become part of our reality today. Vast majority of the service providing industries has already adopted virtual reality and augumented reality tools and began to conduct researches for possible integration of the metaverse to this already enhanced technology based service providing culture. Some of the examples for those industries include healthcare [2], hospitality and tourism [3], education [4], games [1]. Recently the mental health industry has also joined the list of the industries integrating the new technologies into the treatment protocols [5], [6].

Although the use of metaverse as it is in the treatment of psychological and psychiatric disorders is not common today, the effectiveness of technologies like VR and AR has been demonstrated in many scientific studies [7], [8]. Studies on attention

deficit hyperactivity disorder (ADHD), found that it increases patient compliance in the diagnosis and treatment process and helps patients learn new coping behaviors in performance tests, manage their symptoms better and increase productivity in their daily lives [9]. In eating disorders, it has become a tool that makes it easier to determine which stimulus increases the desire to eat more by exposing the client to different stimuli [10]. Similarly, in the treatment processes of anxiety disorders, it has been observed that the level of anxiety can be reduced and the person's coping skills can be increased with controlled exposure to anxiety-provoking stimuli [11]. In the therapy process for the Autism patients, cognitive therapies using VR simulations creating environments where patients can learn how to deal with stimuli in a safe and controlled environment and improve their life skills, have shown positive results of improvements in concentration, cognition and memory [12]. Although the results are less significant in the Alzheimer's patients compared to the improvement of patients suffering from other disorders, an improvement in their life skill was observed. It has also been found to help treat paranoia in patients with positive symptoms of psychosis, depression, and schizophrenia [13].

In addition, it is predicted that there will be less need for psychologists in the long run, as there is less need for therapists in psychological intervention applications where technologies such as VR and AR are used. Which is in line with the recent approach of task shifting that World Health Organization (WHO) has adopted with MhGap project, which aims to develop treatments that require less need for trained psychologists due to the lack of mental health professionals required to meet the need for psychological support [14].

Research has provided practical examples on the latest technologies that can be used in many clinical cases and the ways to improve the quality of treatment. It offers an alternative for the therapy process, especially in cases where it may be dangerous for the client to encounter the situation he is having difficulty with in real life or when it is not possible to re-create that situation [7]. The treatment of post-traumatic stress disorder (PTSD) is considered one of the top ranked treatments that faces these difficulties in the therapy process. For this reason, many trauma therapists have started to use VR and AR technologies in their daily clinical experiences [8].

## 2. TRAUMA, SYMPTOMS AND EXISTING TREATMENT OPTIONS

Human history is full of natural disasters, combats, pandemics, individual attacks and many other disastrous events. According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorder (DSM-5), those events are called traumatic events when they include unexpected incidents that has actual or threatened death, serious injury, or sexual violence and causes physical or emotional harm [15]. There are many types of traumatic events a person may experience; such as health problems (cancer, heart attacks, brain injuries, limp loss, etc) [16], [17], transportation accidents (car accidents, plane crashes, etc.), natural disasters (hurricanes, floods, earthquakes) [18] or interpersonal experiences (rape, sexual assaults, combat, child abuse, etc.) [19]. One common point among all those traumas is that the incident is highly challenging for the survivor's cognition to make sense of it within their existing cognitive structures and world vision. The normal reaction a person is programmed to present at the time of a danger is to either fight, flight or freeze to protect their survival. However, when the situation is so overwhelming, the normal human system of self-defense becomes disorganized, *"producing profound and lasting changes in physiological arousal, emotion, cognition and the memory"* of the survivor [20].

There is a common misconception that only the moment of the traumatic event is what determines how the survivor would get affected afterwards. However, in reality, the whole process from the moment of the first traumatic event and afterwards is crucial to determine the long-term impact of the experience. And to be able to comprehend the mechanisms of the interventions required afterwards, it is important to understand the concept of trauma, the change it creates in the survivor's cognition and its reflection on the individual's life [21].

The life of a trauma survivor changes radically after the traumatic experience. Nightmares and flashbacks related to the traumatic event become part of the survivor's daily life. Accompanied with hyper-arousal symptoms such as being alert all the time, giving extreme reactions not compatible with the situation, outbursts of anger. Anything that is reminding the traumatic event becomes a trigger, causing the person to avoid all the reminders and even isolate him/herself from his surroundings. Trauma itself becomes the center of the person's life, leaving nothing positive in his/her life alive [20].

According to DSM-5, there are six trauma related disorders triggered by a stressor, where PTSD and acute stress disorder come at the top of the list. Additionally, there is a high comorbidity between trauma related disorders and mood disorders such as depression and anxiety related disorders, such as generalized anxiety disorder [22].

Although most of the survivors who are struggling with depression and PTSD shows a reduction in the symptom over a time, specifically for the ones who are living in conditions where the stressors are lower than others, others may keep experiencing PTSD symptoms for many years [23], [24] and a necessity for an intervention arises.

There are many possible intervention and treatment options that are effective in the treatment of PTSD and related disorders, where some are more effective than others. Research has demonstrated that trauma survivors who receive treatment such as Cognitive Behavioural Therapy (CBT), Eye Movement Desensitization and Reprocessing (EMDR) or trauma focused treatments

show lower levels of Post-traumatic stress symptoms (PTSS) and higher levels of Post traumatic Growth (PTG) compared to other treatments [25], suggesting that especially the intervention the person receives has a crucial role in the process. However, even today's most effective PTSD treatments have their limitations. Therefore, there is and should always be a search for improvement and ways to compensate for those limitations and utilize the new developments and the new technologies to improve the results and the experience in the process. One of the most recent technologies that is being integrated into the mental health field is metaverse. Although it is a very novel technology, there is a growing literature examining its effectiveness in the mental health field, its working mechanism in the treatment process, its integration into the already existing treatments and its limitations [7], [8].

## 3. VIRTUAL REALITY AND METAVERSE IN THE TREATMENT OF PTSD

There are many approaches for the treatment of PTSD and exposure which is part of cognitive behavioral therapies is considered to be one of the most common one. The traumatic experience is too much and frightening for the client to cope with, so after the trauma, when the survivor encounters stimuli that may remind him/her of the experience or trigger that memory, he/she gets stuck with the same emotions he/she had at the moment of the incident as if he/she is reliving it. Sometimes this emotion is terror and fear, but sometimes it is just numbness. In reality, the danger has passed, and he/she is physically safe at that moment but in the individual's mind, those stimuli are associated with trauma and therefore every time the person is exposed to that stimulus, his/ mind signals danger and his body reacts. For this reason, he/she starts showing symptoms of avoidance. This avoidance may be in the form of physically avoiding a stimulus related to the traumatic experience seen in daily life, or it may be an effort to mentally avoid the memory [20].

The aim of exposure therapy is to support the client in confronting the traumatic experience without endangering his/her safety, to gradually eliminate the triggering effect of these stimuli by gradually exposing him/her to the stimuli that he/she avoids, and to gradually reduce unrealistic anxiety. Basically, it is an approach built on the principle that the overwhelming effect of the stimulus will decrease as she/he gets exposed to it in a controlled environment. There are two types of exposures; imaginal exposure and in vivo exposure. In imaginal exposure, the person is asked to visualize the situation he/she is avoiding and is mentally exposed to that triggering stimulus in his/her imagination. In experiential exposure (in vivo), the client is asked to gradually experience the events and situations she/he avoids in her/his real life [26].

However, for many clients, it is difficult to remember and imagine the traumatic event and its details [20]. Also it is important to consider that since it is a traumatic event, there may be a real danger, or even when there is not, the client may avoid it because it is too challenging for her/him [27]. For this reason, it is quite difficult to provide the necessary conditions for experiential exposure, which is an alternative to imaginary exposure. In this sense, VR offers an additional option to both the therapist and the client. In a controlled and safe environment, the client can confront triggers and develop the skills necessary to overcome them. This new type of exposure is called in virtuo exposure (VRET). In virtual reality exposure therapy, the client is confronted with the traumatic event or its triggers in a virtually prepared environment. It is very important that the prepared environment is realistic. Thus, in this process, the client feels as if she/he is really in that situation and feels the anxiety she/he feels in real-life stimuli and shows physiological symptoms. By this process, the patient would have an opportunity to develop appropriate reactions and coping mechanisms [26].

Studies have found that virtual reality exposure therapy is as effective as other alternative therapy options when compared to checklist and waitlist [7], [8]. Hospitals, army bases and university centers affiliated with the US Department of Veterans Affairs have begun treating soldiers with PTSD using a VR exposure therapy system called 'Bravemind'. They have achieved promising results in relieving trauma symptoms and reducing suicidal ideation, depression, and anger [28], [29]. However, meta-analysis results do not provide any evidence that it is more effective than other therapies [7], [8].

Although it has not provided significantly better results than other therapies in terms of treatment outcome, it offers certain advantages in terms of ease of application and preference by the client. VRET increases the therapist's control by reducing the client's avoidance behavior and facilitates the emotional participation of patients with PTSD with the multi-sensory stimuli made possible by the virtual environment [30], [31]. It facilitates the emotional processing of trauma-related memories with the sense of reality and "being there" provided by a virtual environment rich in sensory stimuli [32]. Additionally, virtual reality exposure preserves privacy better than experiential exposure and may therefore be more preferred by clients. If a person who is exposed to a triggering stimulus in real life is triggered, he/she will have to experience PTSD symptoms in front of everyone, and this is a situation that the client wants to avoid [26].

Some of the traumatic situations that need to be addressed during the therapy process are uncommon, e.g. boarding a plane, flood, storm. In these cases, waiting for the actual event to occur may prolong the therapy process or be very costly, so the client is usually expected to visualize it with imaginary exposure. Some clients have difficulty in imagining those situations. Although VRET technology was not preferred due to its high cost when it was first introduced, its cost has decreased significantly today, and they have become a useful tool for therapists in such situations [33]. With the usage of VRET, the desired situation can be achieved in a more economical and controllable manner, at the desired frequency and intensity, which makes this method more preferable [34], [35].

In addition to the use of VR in the field of mental health, studies have begun on the integration of metaverse, which is a further step of virtual reality technologies and has become widespread recently, in the field of mental health. Metaverse offers people the opportunity to interact with different individuals in a virtual environment through avatars. The envisioned system is that it will be an upgraded version of existing experiences in VR, with more real and lifelike encounters. It will offer individuals a new virtual world where they can make new friends, socialize and maintain their relationships [3].

Usmani, Sharath, and Mehendale [36] have suggested that the metaverse can contribute to the field of mental health and improve currently available treatment techniques in many ways. Metaverse provides many opportunities for the patients. Through metaverse, patients can consult mental health professionals in simulated environments through avatars. Due to the endless possibilities of virtual simulation, different virtual environments personalized for each individual can be created for trauma treatment and can provide a platform that allows individuals to come together for group therapy sessions led by mental health professionals or support groups without professionals. The necessary infrastructure and virtual safe meeting areas have been built for this. Additionally, areas where individuals can practice mindfulness, meditation or yoga have also been added to the metaverse. We also see that many companies have already begun to develop virtual mental health clinics with mental health professionals serving patients simultaneously. Some governments have also initiated the establishment of VR counseling and therapy associations that will provide cryptocurrency-paid services in the metaverse. These virtual clinics will be especially useful for those who have limited access to mental health services due to disability or are unable to reach them geographically or cannot attend therapy to avoid exposure to stigmatization.

## 4. PREDICTED NEGATIVE EFFECTS OF VIRTUAL REALITY ON MENTAL HEALTH

These technological tools, which are rapidly becoming a part of our daily lives, have offered us the opportunity to receive better psychological support and good opportunities for a more effective treatment process. These advantages should be used for the good of the patients. However, in this process, it is important to calculate the negative effects it may bring along with these advantages carefully. Any technology to be integrated into the field of mental health should be thoroughly researched and tested by scientific studies. Otherwise, it may cause serious negative side effects. If virtual reality is not used correctly, the possible exacerbation of the patient's psychological disorder is one of the main problems that we may encounter.

Misuse of virtual realities may cause additional symptoms such as addiction, anxiety, or sadness. There are studies of numerous cases in Japan where people known as Hikikomori become reluctant to leave their homes because they become addicted to virtual games, increasing the likelihood of developing mood disorders such as depression and anxiety [37]. Compared to other individuals in society, trauma victims are a more sensitive group and want to escape from their own reality because the traumatic experience they have experienced is extremely challenging [38]. For this reason, if an alternative world is presented, there is a high probability that they will prefer the virtual environment and develop addiction.

Time spent in the virtual environment is also important. Prolonged and frequent exposure to virtual profiles can unknowingly foster one's habit of comparing oneself with others, which in return affects psychological well-being. For example, Instagram, Snapchat, and similar social media applications are full of filters that distort reality, which encourages a person to present himself/herself not as he/she is, but with a view intended to meet social expectations [39]. Especially victims of sexual trauma have negative thoughts about their appearance [40]. When presented with an avatar option in a virtual environment, this option can make the person feel more comfortable and use this option as an avoidance. A similar situation may be valid for trauma victims whose physical integrity has been damaged.

Some points should be especially taken into consideration during the trauma treatment process. One of these is the therapeutic relationship. The therapeutic relationship is very important for every psychological treatment process, but when it comes to trauma, the importance of the therapeutic relationship doubles because the sense of trust of the traumatized individual is damaged and therefore it is of great importance to establish the relationship correctly [20]. When the therapist and the client interact through an avatar in the virtual reality environment, it should be questioned to what extent the principle of honesty, which is fundamental for this therapeutic relationship, can be preserved and necessary precautions should be taken.

## 4. CONCLUSION

In conclusion, the integration of virtual reality (VR) and the rapidly emerging metaverse technologies offers revolutionary opportunities for treating mental health disorders, especially for individuals suffering from trauma-related disorders such as PTSD. These innovations enable the development of engaging, controlled environments in which patients can confront and process their traumatic memories in ways that were previously unimaginable. Virtual reality exposure therapy (VRET) has proven to be effective in addressing PTSD and associated issues by enabling patients to gradually face stimuli related to trauma, decreasing avoiding behaviors, and offering a secure environment for individuals to interact with and reinterpret their experiences. By providing a more dynamic, multi-sensory environment where patients can interact with both virtual stimuli and

other people through avatars, the metaverse's development of virtual reality opens up even more possibilities and improves patients' emotional engagement and sense of presence during therapy.

Although the preliminary findings are encouraging, it's crucial to acknowledge that VR and the metaverse are still relatively new in the field of mental health treatment. More study is required to determine the long-term efficacy and safety of VR therapy, even though studies have indicated that it can be just as successful as more conventional treatments like Cognitive Behavioral Therapy (CBT) or Eye Movement Desensitization and Reprocessing (EMDR). With its enormous potential for customization and virtual communication, the metaverse has the ability to completely transform the therapeutic field by providing new avenues for peer support, group therapy, and individual treatment that are not possible with conventional in-person therapy. The potential for offering mental health services via online clinics is also quite promising, particularly for those who are unable to get therapy in person because of social, physical, or geographic constraints.

However, as with any new technology, the integration of VR and the metaverse into mental health care raises important ethical and practical concerns. One of the main risks is the potential for over-reliance on virtual environments as means of avoidance. Trauma survivors may become overly used to these digital environment and choose to interact with their trauma in virtual rather than real-world settings, which could eventually hinder their recovery.

Furthermore, the therapeutic relationship—a fundamental component of successful trauma treatment—may be harmed by the anonymity and distance offered by avatars in virtual environments. It is crucial for mental health practitioners to adjust and figure out how to maintain the depth of the therapeutic relationship in virtual spaces because avatar mediation may jeopardize the sense of trust and rapport between therapist and client. additionally, although virtual reality and metaverse platforms might provide privacy and anonymity benefits, they also raise issues with data security, user privacy, and possible abuse.

In conclusion, although virtual reality and the metaverse are promising new avenues for treating PTSD and trauma, their incorporation into traditional mental health services needs to be handled cautiously and optimistically. It is essential to make sure that these technologies work in patients' best interests by giving them safe, accessible, and effective therapeutic options as more research is done and new applications are created. The successful integration of these virtual tools may very well be the key to the future of mental health treatment, but only if the risks they pose are adequately managed and the benefits they provide are realized in a way that complements rather than replaces the human aspects of healing.

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