Proceedings of the 3rd International Conference on Signal Processing and Machine Learning
DOI: 10.54254/2755-2721/6/20230853

Application of virtual reality technology in the psychological field

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Abstract. Virtual Reality is now widely used in various fields, which includes entertainment, education, working and telecommuting. With the popularization of virtual reality technology, there are more and more fields that VR is able to apply to, such as medical care and corresponding therapies. In this article, a new idea of using virtual reality in psychological field will be provided and scrutinized. By literature review and quantitative analysis, virtual reality technology can actually contribute to psychological consulting by transform the counselling environment, combining with other technologies, together stated in this passage with other potential usage and ethical issues.

Keywords: Virtual Reality, Psychological, Brain Computer Interface.

1. Introduction

There are many psychological problems that always need to be taken into consideration. For instance, according to the data of ENT Tech, there are more than 16 million patients, under the pressure of mental disorder in China, and more than 21% of teenagers, suffered from stress and emotions from their family. In domestic country, the average mental health state is not good for a healthy life. But psychological therapy is also facing problems. WHO predicts that mental disorders will become the primary cause of the global disease burden by 2030, especially Low-Income families, which means there are huge differences between countries with different income levels. Additionally, there are only 13 mental health workers per 100,000 people. Nevertheless, the problem is not only about the shortage of workers. According to the data of Shanghai Normal School, only 180 students out of 20000 students choose to take the initiative to psychological consulting, and among the students who confirmed to have a mental disorder, less than 10% of patients with confirmed to have a mental illness have received regular treatment or consulting [1-2]. However, psychological healing, or psychological consulting, are also facing challenges to give patients a better future. It seems that, psychological problems can not easy to be solved, and a transformation of this field needs to be taken into consideration. Therefore, this article will give some information on how to transform psychological fields using virtual reality.

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2. Analyzing the reason and state current problems

2.1. Reason for bad mental health

For teenagers, there are many factors that lead them to a bad mental health state. According to a psychological worker consulting teenager [3], most of children's psychological problems come from stress and native families, as well as their pressure on studying. Being stressed, kids cannot express their feelings, which leads to depression.

With this personality of stress and depression, it is hard for them to take the initiative to seek psychotherapy, and thus bring more negative emotions, and finally intensify the phenomenon. Which finally becomes a negative loop for their mental health state.

Therefore, what patients need is a lower threshold and a better way to express themselves.

2.2. Current problems

For psychological consultants, there are also many problems occurred while consulting. The consultant [3] also mentioned that, psychological counseling via phone or video (especially during the covid Lockdown in China) was not effective at all. In this way, it is difficult for consultant to see the expression of the patient's feelings, emotions and body language. So, they need an alternative environment to make contact with patients vividly, and virtual reality is one of the solutions.

3. VR in psychological consulting

3.1. Environment transformation

The initial idea is to transform the environment by using VR. In the virtual world, it is easy to transform an environment to another, and it makes up for the defect of remote consultation in the problem statement that mentioned above. Using a user-friendly environment is more convincing and relaxing for patients and makes them less stressful.

In addition, as the figure shows in figure 1, both patient and consultant can change their appearance to a better, animated avatar. In the virtual world, patients can forget themselves in the real world, which enhances the performance of psychological consulting.

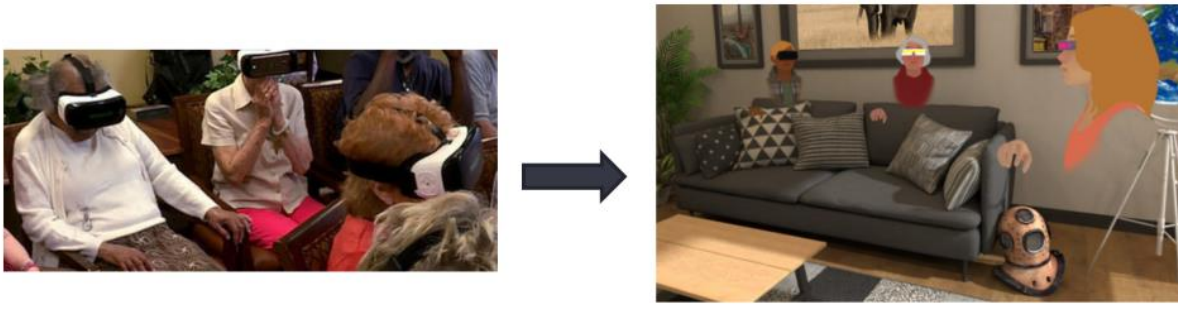

Figure 1. Japanese elderly reduce anxiety by changing avatar in VR world.[4]

AI can also play a great role in changing the environment of psychological counseling rooms. For instance, patients can require an environment they want, and use AI to generate a virtual world using the keywords they prefer. In contrast to the treatment of PTSD, the environment of the consultation room should be pleasant and warm to patients, and will not arouse painful memories. Therefore, using a user-friendly environment is more convincing and relaxing for patients and makes them less stressful.

Additionally, although it has not been practiced yet, artificial intelligence can learn from previous consulting, including all data files from consulting all over the world, and have the ability to offer consultation by deep learning and natural language processing. If AI can replace some of the consultants, the threshold of psychological consulting may be lower.

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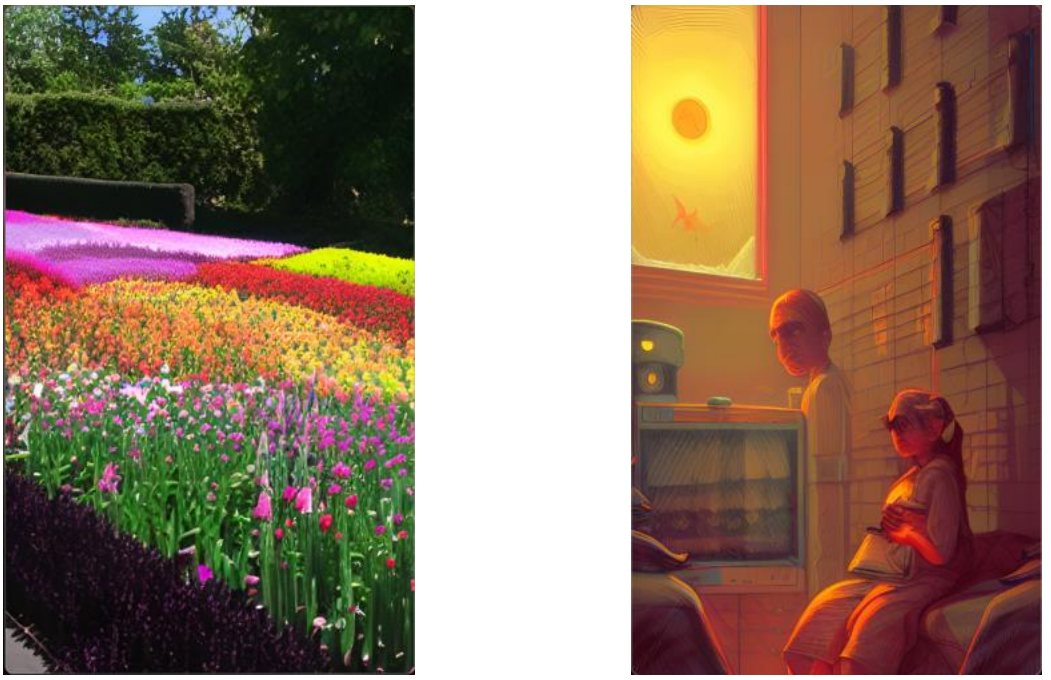

Figure 2. AI-generated environment image based on keywords (Source: wombo.art).

3.2. Combining with BCI

Brain Computer Interface (BCI) is also a cutting-edge technology. Therefore, VR and BCI can also combined together, making psychotherapy more efficient. For example, using brain-computer interface to trace patient's brain data, and compare with existing models, can judge patient's real-time emotion (Figure 2), and the outcome emotion state data can help doctors to quantitatively diagnose the mental status of patients and the grade of depression or other diseases. Similar to emotion recognition, it can also predict what the patient will say or what the patient will do in the future by analyzing brainwave, which can prevent patient from getting hurt by potential words by counselor in psychotherapy.

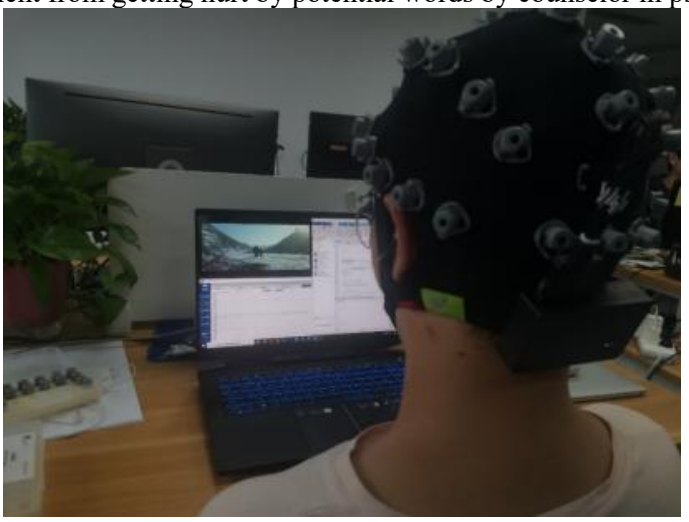

Figure 3. Emotion Recognition using BCI and headset.

More precisely, Alphabet's experimental laboratory X introduced the Amber project (Figure 4) in detail, which aims to develop objective measurement methods for depression and anxiety, and use them for

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diagnosis and treatment. According to Alphabet, blood tests can't detect depression, scanning brain can't detect anxiety in advance, and biopsies can't diagnose suicidal thoughts, so there is no reliable biomarker in the medical field that can be used to diagnose mental diseases. Amber's team tried to combine machine learning with EEG (electroencephalogram) technology to measure EEG activity. They found that the processing of the brain's reward system can be observed through game like activities: compared with those who are not depressed, the reward mechanism of the brain of depressed people is inhibited after winning the game. [5-6] Therefore, the Amber project is implemented to detect depression emotions through EEG, which become an efficient scale for judging mental diseases.

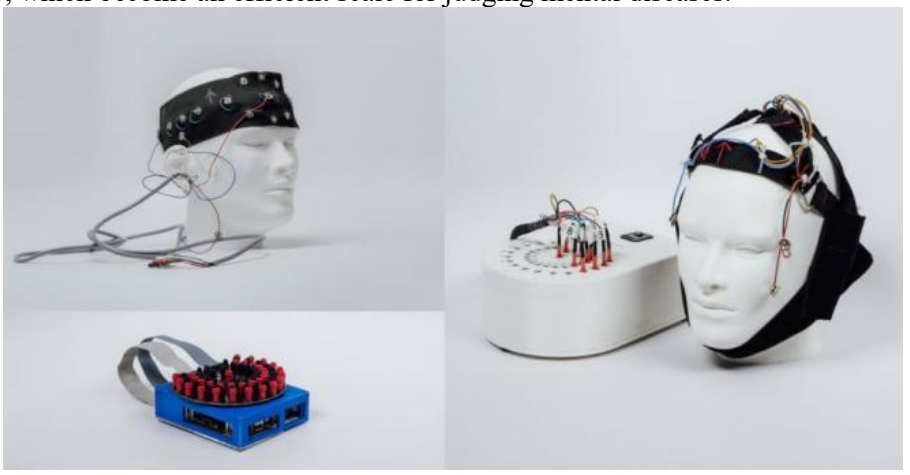

Figure 4. A prototype from Project Amber of an EEG headset by Alphabet [6].

4. Virtual Reality in psychotherapy

Rather than psychological counseling, when mentioned about Virtual Reality in medical field, most people think it will have a great impact on psychology therapy. The facts proved their thoughts, the first medical issues virtual reality was targeted to is Post Traumatic Stress Disorder (PTSD), which is a mental disorder that can develop after a person is exposed to a traumatic event.

4.1. Virtual Reality in treating PTSD

Post-traumatic stress disorder (PTSD) is a mental health condition that's triggered by a terrifying event — either experiencing it or witnessing it (Mayo Clinic, 2018). PTSD patients often flashback scenes of that particular event, which make them terrified, feel anxiety and traumatic thinking [7]. According to The Recovery Village [8], during a man's lifetime, 70 percent of adults experience at least one traumatic event, and 20 percent of them who experience a traumatic event will finally develop PTSD. About 8 million people have PTSD in a given year, and 1 in 13 people will develop PTSD at some point in their life. In addition, according to Matthew Tull [9], exposure therapy is considered a behavioral treatment for PTSD since exposure therapy targets learned behaviors that people engage in (most often the avoidance) in response to situations or thoughts and memories that are viewed as terrified, frightening or anxiety-provoking as the passage mentioned above.

Virtual reality is a perfect tool for exposure therapy, where a patient is supported in facing things that they are afraid of. In another words, virtual reality can recreate different fears as well as various scenes which provide medical supports to the particular patient.

The advantage of VR treating is obvious that VR made unreal or inconvenient therapies virtualized and easy to operate. A patient with height or flying PTSD is a perfect example supporting virtual treating, virtual reality made impossible flying simulations possible. As a result, reliving the experiences can help the medical team to understand the patients' conditions and come up with ways to help them cope better. (M. Garbade, 2018)

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4.2. Virtual reality in psychoeducation

Since virtual reality can create virtual environments, it is useful to educate doctors' mental health during emergency periods. For instance, during the initial pandemic of COVID-19, many doctors and even civilians are in a panic about the unknown. The former is afraid of the shortage of medical resources and the huge pressure on the medical system that may arise in the future, while the latter is afraid of the outbreak of infectious diseases and the risk of its unknown effects. Panic is a kind of morbid psychological state, and operating psychological education, which is known as psychoeducation, to give people knowledge, is way better than psychotherapy. Apart from psychotherapy, virtual reality is an effective tool to prevent and treat stress and anxiety, and also gives people hope after trauma.

For example, some of the health workers used MIND-VR in COVID panic, which is a virtual reality-based psychoeducational experience on stress and anxiety developed following a user-centered design approach (Figure 5). Instead of using traditional slides or images, the immersive feeling are more relaxing, and empirical studies also suggest that virtual reality technology leads to better outcomes than the former [10].

Figure 5. MIND-VR on psychoeducation [10].

Besides psychological educating, there are also many existing use examples and literatures that show that virtual reality can be used to simulate a series of complex and precise operations such as surgery [11], so as to teach doctors to operate more skillfully and alleviate doctors' anxiety. However, this feature can also be used in psychological counseling. Psychological counseling is also a meticulous operation. Some inappropriate words from the counselor will cause patients to have negative emotions and affect the final counseling results. Although there are none existing cases to simulate psychological consulting, VR simulation consultation can at least provide education and practice for some inexperienced consultants and similar students, even patients who are new to counseling.

Instead of psychoeducation, there are also many articles pointing out that virtual reality made various education easy to operate and inexpensive to implement [11]. For instance, a survey shows that 90% of educators believe VR may help increase student learning, and 97% of students would attend a class or course with VR (Laura Martisiute, 2020). Therefore, in the future, the primary objective is to popularize and spread the VR technology to schools and institutions to help VR education develop rapidly. The future of virtual reality in the field of psychology is also bright and waiting for people to lead it to a better tomorrow.

5. Discussion (Potential Ethical issues of Virtual Reality)

As with most new technologies, it is necessary for us to think about its potential risks and ethical issues that may arise when we using the technology. However, instead of basic ethical issues such as user privacy or user isolation, there is some big problems that human beings have been never faced with.

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5.1. Between virtual and reality

In the past, people regard virtual and reality "black or white", they are never the same or even similar. However, with the rapid development of virtual reality, the border of virtual and reality is gradually dimmed and disappeared. So, in a society people cannot distinguish reality and virtual, many ethical issues appeared.

5.2. Applications to reality

Because most of the rehabilitation therapy in VR medical care use virtual environment to treat patients and usually it takes a long time, it is difficult for patients to return to the reality and behave the same way as they did before the virtual treatment. This can be serious when their social relationships are destroyed and their characteristics are changed. In addition, they are hard to apply to real world in various aspects. For example, they can easily do physical exercises in virtual environment, but they cannot even jump or run after back to reality.

5.3. Moral responsibilities between worlds

If thinking deeper in ethical issues of VR, because there are multiple worlds, there is also a problem that whether traditional moral and responsibilities in the real world should be translated into virtual worlds by designers.

Nevertheless, this problem will become a big ethical problem in the not distant future. In my opinion, it is important and necessary to translate into virtual world. For instance, people in virtual world can do anything they want, including illegal behaviors like what they do in video games: killing, stealing, and breaking the law. If people regard virtual world as a video game, that will influence nothing. But as the article mentioned above, in the future there will be many people who cannot distinguish reality and virtual, the distorted moral and responsibilities in virtual world will have a subtle impact on real world, which will cause a major problem. So, it is necessary for designers to unify moral and responsibilities between world.

5.4. Personal information

During psychologic counseling, many discussions include the personal information and background of patients, as well as some personal history. The counselor asks the patient's personal information to get more details and better tailor the medicine to the case. The patient is also willing to tell the whole story to the counselor and communicate with him to express his inner self and inner emotions. Therefore, according to SJSU [12], confidentiality in psychological counseling is important to encourage patients to discuss all of the struggles and background stories that they are experiencing. Counselors are ethically and legally required to keep confidential information shared by you in psychological counseling.

6. Conclusion

In the field of psychology, virtual reality has got rid of distance limit to make remote treatment available. Based on this, exposure treatment appeared, and virtual environment treating are developing rapidly. The appearance of Anxiety Disorder Treating, Paraplegics Treating as well as Autism Treating marked the rapid development of both psychology and virtual reality technology. It is quite possible that VR will continue to improve and become an even more important force in psychology and medical field. The opportunities that VR provide cannot be easily ignored.

Also, there are some limitations in this article. The most important issue is, the conclusions given in this article are only based on analysis and literature review, lacking practical operation and demonstration. Additionally, the number of references used in this paper is limited, and it cannot represent all viewpoints. Nevertheless, taking this article as the starting point, there can also be great improvement, such as testing the idea in the article through online real-time interactive VR platforms such as VRChat and making corresponding software through feedback improvement, or do more

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interviews and survey the respondents through questionnaires and follow-up observation to arrive at a more robust conclusion.

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