The Role and Impact of VR during the Epidemic

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Abstract. Since the outbreak began in the world, people have been so frantic that they can't go about their normal lives. But virtual reality is an almost perfect solution to this problem. This paper from virtual reality technology to office and learning help; The influence of virtual reality technology on economic market and the influence of virtual reality technology on medical treatment are discussed in three parts respectively. First of all, people's feelings about the integration of virtual reality technology into daily life under the epidemic and the acceptance of virtual reality technology to realize remote working and remote teaching. Secondly, virtual reality technology combined with all social strata and applied to all walks of life, the only virtual reality technology cannot solve the tourism industry suffered a heavy blow. Finally, during the epidemic period, virtual reality technology can also be used if offline training or rehabilitation training with patients is not available. These technologies are also applicable even in the future when there is no epidemic.

Keywords: VR remote working, VR tourism; VR medical training; Epidemic.

1. Introduction

Since COVID-19 has been rampant, people's lives have been greatly affected. People can't get together with friends, have dinner parties, watch movies, watch games, or even attend important exams and meetings.

It's worth thinking about how people can get their lives back on track even at home. So, some people find that virtual reality technology may be a good solution to this problem, virtual reality technology can achieve remote interaction between people, people and the environment. For example, for many people who are waiting for the results of big exams to apply for jobs, promotions or universities [1], it is very serious that they cannot take exams because of the epidemic, which will greatly affect their life plans. At this time, virtual reality technology can give a great help, virtual reality technology can let all examinees take the exam on the Internet, the examiner can also be very convenient real-time invigilation, there will be no monitoring dead corner this problem. And people who are isolated at home can also use virtual reality technology to conduct online classes or online meetings, and start studying and working anywhere. All in all, VR holds great promise now that COVID-19 is serious.

What impact virtual reality has brought to the market with the advent of COVID-19. As people consciously home quarantine to reduce cross infection, the benefits of physical stores are reduced by a cliff, so that stores have to open online malls through virtual reality technology. This promoted a market economy [2].

This paper mainly expounds the impact and role of VR during the epidemic from three aspects. First, the impact of telecommuting and distance teaching based on virtual reality on people's work under the epidemic situation. Secondly, the integration and development of virtual reality technology and different industries, as well as the development of virtual reality technology in tourism. Finally, the rapid development and application of VR in the medical field during the epidemic.

2. Online working during the Covid period

2.1. Using VR let working more suitable

As most of the work has to be done online due to the unexpected COVID-19 pandemic, most companies have adopted a cross-working mode of part online and part offline.

During the Covid period, due to the technological limitations, most companies have adopted a rotation system, some of workers need to be at the company and some at home. Like Hardware development requires equipment that cannot be done at home and the collaboration of several departments, they may probably have to work at the company. Although efficiency is affected to some extent, the role of middle management is highlighted at this time [3]. At present, some people work in the office, because some local policies allow some people to work, but at the stage, we still need to control the number of people working. In China, where companies originally set up offices in multiple locations, online work is not unfamiliar to us. For some enterprises with branches, the usual way of calling includes Dingding and WeChat. It's just that the tools and conditions at home are not as good as in the office. With the exception of those who are required to be present, such as hardware testers, non-essential personnel are working from home.

Offline restrictions have increased online demand, and awareness of VR and AR has also been significantly improved during the epidemic. For example, an article published in more than 500 panoramic tourist sites across the country has been read by 150 million people during the epidemic period. Since the lock down, more than 1,300 museums across China have launched online museums and exhibitions through their websites, Weibo and WeChat, such as the Palace Museum, Dunhuang Academy and the National Museum of China. People who are "confined" at home "visit" China's beautiful rivers and mountains through the panoramic way, in other words, millions of people understood the panoramic form. At the same time, online classes and online office has become a mainstream way. On the February 3, the first day of the resumption of work, the number of online office users of Dingding reached 200 million. Under the instruction of the Ministry of Education, online education platforms and office software for enterprises flooded into a large number of users. Games and entertainment also peaked in this Spring Festival [4].

2.2. People’s feeling about the huge change

The pandemic offers people insight into the possible future of online work and the impact of digital applications on our lives. Through this temporary seclusion, people can recognize in advance, and realize that some technical solutions can be use in a specific environment between people, objects and even space. Telecommuting, education and entertainment are all areas that people really need, and through this pandemic, we need to rethink our working methods, which are more suitable for this generation and the next, and we will have more freedom to work. The future of telecommuting, including online account management, will affect people's judgments about how they will work and live in the future, bringing the digital age even earlier.

According to the survey (Figure 1), mixed working is becoming the new fashion in the global labor market, and the workforce has adapted to working with the epidemic. Flexibility in workplace choice has become a top priority [5], especially for younger workers known as Generation Z (born between 1995 and 2012) and Millennials (born between 1980 and 1994). 51 percent of Gen Z are considering changing jobs, and 48 percent expect to move to mixed work in the next year, while 28 percent expect to move to telecommuting in the next year.

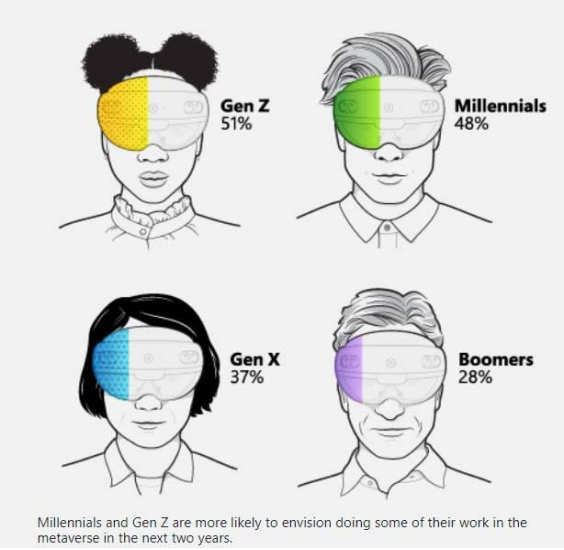


Figure 1 Acceptability of working in Metaverse between different ages.

Pininfarina, which introduced social distancing early in the pandemic, before Italy's lockdown, then told all its employees across China, Italy and the United States to work at home. The company uses VR design technology, and compared with offline work, the work schedule has almost no impact. At a high school in western Poland, for example, teachers are using the VR game Half-Life: Alyx for online learning [6]. Teachers at the school have teamed up with local media company OFFshot to offer online lessons to students using small blackboards from Half-Life Alyx, which significantly increased students' interest. It happens that there is also one similar case, Microsoft MR Development Day was originally scheduled to be held in Seattle on May 21, but due to the epidemic, the event has to change to VR online [7]. In addition, there are some furniture exhibitions, which use VR/AR technology to ensure the fair can be held normally.

Figure 2 is a research pie graph according to Chinese VR Market Survey (Aug 2020, sample number=2870+). This shows that majority of people use VR more frequently while in the lock down.

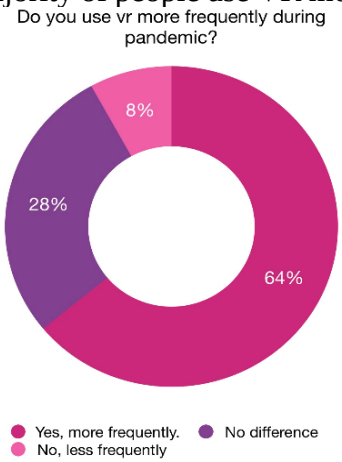


Figure 2 Pie chart of frequency of VR using

3. The impact of vR on the market under the epidemic

3.1. Using virtual reality technology to combine all sectors of society.

In recent years, VR virtual reality technology has developed at a fast speed. While upgrading and innovation of this technology, it is skill fully integrated with all sectors of society, so as to provide sufficient power for social and economic development and guide the orderly development of market economy. Therefore, VR virtual reality technology can fully tap the potential of the economic market, achieve a reasonable allocation of capital, VR industry unprecedented development of good results.

And one of the notable effects of the novel Coronavirus outbreak in 2020 is that it has forced much of the world to switch to working in virtual remote environments [8]. This has dramatically advanced the timeline of digital transformation, and as we become more immersed in the digital world, now is a good time to take stock and look ahead to the impact of emerging virtual reality.

Just a year ago, people were still struggling with visions of a digitally connected, networked workforce that seemed a distant future. While videoconferencing, cloud computing and other technologies have played an important role in realizing this vision, the world needs more and better innovation as virtual work becomes a new reality rather than a short-term solution.

3.2. Virtual reality technology has produced various forms of products and services.

In order to meet the needs of market development, there are various forms of product services centered on VR virtual technology. Virtual reality panoramic roaming, real navigation, virtual reality live broadcast, virtual reality video, 3D displays and other products and services, more and more widely used in various fields, with high commercial value. With the innovation breakthrough of virtual technology, the deep application solution in vertical field has gradually matured.
The virtual industrial chain has been maturely used in many fields such as real estate, navigation, education and exhibition hall.

Health care is one of the fastest growing areas of AR / VR. Immersion technology can help researchers and health experts better analyze viruses such as COVID-19. For example, scientists are using the real-time collaboration platform of VR start-up Nanome to visualize, modify and simulate proteins, compounds and nucleic acids, thereby accelerating scientific decision-making. Artificial intelligence companies Insilico Medicine and Nanome are assisting in drug discovery in COVID-19, supporting scientists to understand the molecular mechanism of novel coronavirus in virtual reality.

VR/AR remote health platform XR Health is providing VR remote medical services for new coronavirus patients at Sheba Medical Center in the Middle East. Hospital staff are using a variety of technologies including XR Health to monitor patients. The epidemic also promoted the demand for telemedicine, and urged XR Health to cooperate with Pico, the VR leading supplier, to provide an optimized experience. This partnership provides a virtual telemedicine toolkit for patients with new coronary pneumonia or those who need telemedicine, and a Pico header containing pre-loaded virtual reality treatment programs.

3.3. Tourism has suffered the most in the market.

Due to strict travel restrictions, tourism has become one of the most hit industries during the epidemic. According to the latest research of the United Nations World Tourism Organization, 83 % of European tourist destinations have implemented comprehensive border closure for international tourism. This proportion is 80 % in America, 70 % in Asia-Pacific, 62 % in Middle East and 57 % in Africa. Virtual reality plays an important role in this challenge [8-9].

Since the epidemic has limited travel and public gatherings, the Tower of David Museum has immersed tourists in the old city of Jerusalem through a three-dimensional 360-degree virtual reality documentary. The director and producer Nimrod Shanit said: ' Due to the inability to enter the holy land of Jerusalem, virtual reality technology can become a virtual alternative, and extends to the relevant places of worship, providing a new form of virtual pilgrimage for believers. This new immersion experience allows visitors to travel to Jerusalem ' s most unique and hardest to reach, and you seem to be in it' [10].

Similarly, visitors are banned in the Faroe Islands, Denmark, to curb the spread of new coronavirus pneumonia. The team created a remote travel tool that allows people around the world to explore the island as virtual tourists. In Xi ' an, China, Emperor Qinshi Terracotta Warriors Museum also opened the use of VR technology to lead tourists around the world to appreciate the charm of eastern culture. Under the leadership of Qin Shihuang Terracotta Warriors Museum [10], famous museums in various provinces and cities in China have also begun to use VR technology to attract tourists ' attention.

Although virtual reality may never replace personal travel, it can save time and cost, adapt to the new normal brought by the epidemic to the tourism industry, and help reduce the relevant environmental footprint.

4. Virtual reality in the healthcare

Many industries have experienced a decreasing trend as a result of the outbreak over the last two years. In this environment, however, VR and AR technology have progressed to some level [11]. First and foremost, let us discuss the benefits and influence of virtual reality in the healthcare field. Just like what Asadzadeh mentioned in their article, "Applications of virtual and augmented reality in infectious disease epidemics with a focus on the COVID-19 outbreak.", "Various pieces of evidence indicate that VR and AR have the potential to be used in any industry. In the clinical care context, these technologies are a useful tool for providing tele-health services, visualizations, and communication, as well as helping healthcare providers in education, diagnosis, and drug discovery" [12].

4.1. VR Medical training

In an environment where the virus is easy to spread, how to get doctors to consult and discuss while ensuring safety has become a problem. VR plays a very important role in this; It can provide real-time 3D pictures of patients and can provide voice communication. In the case of ensuring the safety of medical staff, VR successfully conducted a successful consultation. VR has the ability to be used in any viral outbreak or catastrophe event to improve pandemic preparedness by examining numerous variables such as human behaviors, disaster implications, and experiences by mimicking the real world. Education, professional skills training, popularization of disaster medical information, and post-disaster psychotherapy are some of the more common uses of virtual reality in disaster medicine. Disasters can also cause a difficult condition in the healthcare sector. In COVID-19, the VR software contains medical information and skills training courses, successfully allowing physicians who need to receive specialized training to perform systematic exercises even during isolation.

VR can solve these problems by offering an instructional environment for various complications. Education and training play a significant part in preparing healthcare providers to handle or respond to these scenarios. "A plethora of technical-related XR educational packages have been created that typically surround tools, anatomy, and surgical/medical procedures. The application of AR characteristically utilizes holograms projected into the real-world environment" [12]. The benefits of intra-operative surgical guiding were proposed by the participating surgeons as a result of the material interaction. This can be beneficial in education because the surgeon's views can be broadcast live via Wi-Fi and ever-improving wireless data transfer means, allowing students to get a firsthand surgical perspective and grasp how imaging data can be used for planning. Due to the impact of the epidemic, surgeons are no longer able to travel to various hospitals for academic discussions and joint surgeries whenever and wherever they want. VR can provide real-time video calls and interoperable communication. This somewhat alleviates the problem of information gap and different levels of medical care in different regions.

At the University of London, a virtual reality environment was constructed to better explain the geometry and structure of the COVID-19 virus through immersive or non-immersive presentations of its basic molecular dynamics. Users can easily follow the software instructions to learn. Due to the extremely delicate structure of the human brain, a small area often contains hundreds of millions of neurons, and the slightest mistake that results can be fatal. Even if the patient is able to survive, the risks resulting from an accidental surgical mishap can last a lifetime. Therefore, the use of VR simulation allows for the training of trainee doctors and nurses, while also ensuring safety. Also, especially in the case of a raging epidemic, VR training becomes even more important. Even if they

cannot be taught face to face, doctors can get systematic training through VR. This becomes especially critical for surgeons.

4.2. VR Rehabilitation

Immersion and involvement in interactivity are two well-known qualities of VR that make interventions in healthcare beneficial. Immersion refers to the ability of virtual reality systems to deliver experiences that are comprehensive, all-encompassing, vivid, and accurate. “It is important to address the challenges in the existing rehabilitation paradigm to better the outcomes of musculoskeletal health interventions” [13]. If various forms of information feedback can be provided during the training process, giving full play to the patient's initiative and giving the patient hints or suggestions according to the patient's status, etc., the rehabilitation effect will be greatly improved. Therefore, the researchers designed a virtual reality-based rehabilitation training system to stimulate the interest and motivation of patients to conduct rehabilitation training. Due to COVID-19, patients are unable to go to hospitals to gain systematic medical care and rehabilitation. “While patients may benefit from an integrated approach to address COVID-19, this is generally not readily available in the inpatient setting due to inadequate access to integrative health providers and suboptimal resources, particularly during the COVID-19 pandemic.”[14] By using VR, users can receive rehabilitation treatment even during isolation at home.

Microsoft and a few 3D motion tracking gadget firms started a new revolution in physical therapy a few years ago. With the development of virtual reality technology, their ability to innovate has been significantly boosted. VR, a Boston-based physical therapy startup, can help patients with physical therapy by providing them with an immersive, interactive virtual world. A patient, for example, must hit a target with a virtual sword, which necessitates first verifying shoulder movement. During the game, the patient can also exercise his neck by moving his head to operate the simulated water gun in his hand.

The application of VR technology in the application of pain management is the most highlighted in the Mobi Health News article. Dr. Brennan Spiegel of Cedars Sinai Medical Center in Los Angeles recently launched a new virtual medical endeavor to help patients ease pain using virtual reality technology. This concept is based on Dr. Brennan Spiegel's "bio-psycho-social model" (or BPS), which states that various elements, such as individual physical differences, mental state, stress tolerance, and so on, can influence a person's treatment effect and health status [15]. As a result, with the reasonable application of VR technology and psychiatry, patients can better manage their pain.

5. Conclusion

VR is a feature that breaks through time and space. However, this application still has a long way to go. Online classes are not very convenient for children and teachers to communicate at the present stage, video communication lack of five senses, body language communication. Face-to-face physical and emotional states cannot be expressed through online video communication, but this is the most common way at present. Although the high-tech hardware which allow people achieve much higher quality of VR is not widely available, Online meeting can now solve the space problem, allowing everyone to digitally build a safe environment in a closed environment during the epidemic. After solving the space problem, the next step is to solve the problem of five senses, how to make it more realistic.

COVID-19 has caused many impacts on people's daily lives, but it has also shown us the potential of VR. These VR technology application cases in the field of medical rehabilitation demonstrate not only the convenience that VR technology provides to people as a result of its quick development, but also the need for VR technology to continue to improve in the future. Virtual reality technology allows us to develop novel therapeutic strategies for some difficult-to-treat ailments. It is expected that new applications of VR technology in the field of medical treatment and rehabilitation will emerge in the future, allowing more people to alleviate disease suffering and overcome disease with VR technology.

References

[1] E M Clarke, E A. Emerson. Design and synthesis of synchronization skeletons using branching time temporal logic, 25 Years of Model Checking. 2008, pp.196-215.

[2] J.P. Queille, J. Sifakis, Specification and verification of concurrent systems in CESAR, in: M. Dezani-Ciancaglini and U. Montanari (Eds.), Lecture Notes in Computer Science, vol. 137, 2012, pp. 337–351. DOI: https://doi.org/10.1007/3-540-11494-7_22

[3] F. A. Schiopu, I. R. Hornoiu, M. A. Padurean, Ana-Maria Nica, Virus tinged? Exploring the facets of virtual reality use in tourism as a result of the COVID-19 pandemic, Bucharest University of Economic Studies, Romania 2021, 4, pp.332-344 DOI: https://doi.org/10.1016/j.tele.2021.101575

[4] Y. Cheng, Y. Wang, W. Zhao, Shared Virtual Reality Experiences during the COVID-19 Pandemic: Exploring the Gratifications and Effects of Engagement with Immersive Videos, Int. J. Environ. 2022, 19, pp.5056-5067 DOI: https://doi.org/ 10.3390/ijerph19095056

[5] S. Agarwala, N. S. Punna, S. Sonbhadraa, Unleashing the power of disruptive and emerging technologies amid COVID-19, 2021, pp. 20-31 DOI: https://doi.org/10.48550/arXiv.2005.11507

[6] S. Rashid, S. S. Yadav, Impact of Covid-19 Pandemic on Higher Education and Research, 2020, pp.569-572. DOI: 10.1177/0973703020946700

[7] S Manjushree, G Kavya, B M Mala, Scientists Use Virtual Reality to Refine New AI-Generated Drugs for COVID-19 Using Virtual Reality. Annals of the Romanian Society for Cell Biology, 2021, pp.5748-5751. Doi:10.20944/preprints202003.0445.v1

[8] Haryanto T. COVID-19 pandemic and international tourism demand. Journal of Developing Economies, 2020, 5(1), pp. 1-5. Doi: https://www.annalsofrs cb.ro/index.php/journal/article/view/3140

[9] R. P. Singh, M. Javaid, Significant applications of virtual reality for COVID-19 pandemic, Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2020, pp.661-664, Doi: https://doi.org/10.1016/j.dsx.2020.05.011.

[10] F A. Schiopu, I. Remus, Ana-Maria Nica, Virus tinged? Exploring the facets of virtual reality use in tourism as a result of the COVID-19 pandemic, Telematics and Informatics, 2021, 60, 101575, Doi: https://doi.org/10.1016/j.tele.2021.101575.

[11] M. H. Hatta, H. Sidi, S. Sharip, S. Das, The Role of Virtual Reality as a Psychological Intervention for Mental Health Disturbances during the COVID-19 Pandemic: A Narrative Review. International Journal of Environmental Research and Public Health, 2022 19(4), 2390. DOI: https://doi.org/10.3390/ijerph19042390

[12] A. Asadzadeh, TS Afsoon, T. Soltani, PR, Peyman Rezaei-Hachesu. Applications of virtual and augmented reality in infectious disease epidemics with a focus on the COVID-19 outbreak. Informatics in medicine 24 (2021): 100579. DOI: https://doi.org /10.1016/j.imu.2021.100579

[13] PM, Pears, Matthew, YM. Marina Yiasemidou, MA. Mohamed A. Ismail, Role of immersive technologies in healthcare education during the COVID-19 epidemic. Scottish Medical Journal 65, 2020 no.4 pp.112-119. DOI: https://doi.org/10.1177/003693302 0956317

[14] KL. Kolbe, Laura, AJ. Abhishek Jaywant, AG. Alka. Use of virtual reality in the inpatient rehabilitation of COVID-19 patients. General Hospital Psychiatry 71 2021, pp76-81. DOI: https://doi.org/10.1016/j.genho sppsych.2021.04.008

[15] RT. Rose, Tyler, CN. Chang S. Nam, and KC. Karen B. Chen. Immersion of virtual reality for rehabilitation-Review. Applied ergonomics 69 2018: pp.153-161. DOI: https://doi.org/10.1016/j.aper go. 2018.01.009