

The Social Impact of VR Technology on Society: A Systematic Literature Review

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Abstract— Humans are social creature who used to interact directly. As technology advanced, human interactions were deeply impacted. One of the many popular technologies in the 4.0 era is VR technology. An example of this technology is the metaverse, a combination of real world and virtual world. This paper presented a review to analyze the social impact of Virtual Reality technology, especially the metaverse. This paper used the systematic literature review (SLR) as the method. The research was conducted based on the RQ that had been made. There were 18 related articles generated from the initial searching attempt. This study concluded that Social VR has three impacts on society: Social Presence Illusion, Virtual Embodiment, and the Proteus Effect. In addition, this paper also explain some alternative ways to create a safe social VR environment, such as by playing with family and friends, educating the public about VR technology, and suggesting the platform to provide age limit for accessing VR environment.

Index Terms— metaverse; social; technology; virtual reality.

I. INTRODUCTION

Since the late 1970s and early 1980s, much of the tech community has envisioned a future state, if not a pseudo-successor, that is the Internet—the so-called "Metaverse" [1]. The word 'metaverse' was first coined by Neal Step-Henson. He described it as a giant virtual universe parallel to the real world. Neal took this term from the the dystopian and cyberpunk novel Snow Crash [2]. Since then, Facebook CEO Mark Zuckerberg has had a significant impact on the concept of the metaverse. And nowadays, the idea of the metaverse is very global and well known in wider community.

In this modern, digital era of 4.0, the metaverse has brought many changes in technology. Metaverse is a VR technology where a person can interact as an avatar. Virtual reality is a computer-generated reality simulating an advanced world where one can browse the artificial world virtually [2]. Social VR refers to a 3D multi-user immersive space where users are connected via a head-mounted display (HMD) and represented by a full or partial bodily-tracked virtual

avatar. This is considered as the modernization of Neal Stephenson's concept of the metaverse [3]. According to Stephenson's theory, the metaverse has evolved to include affordances (i.e., what the environment offer to an individual) specific to a given system, whether through the chosen mode of communication, the promotion of group/collaborative behaviors, or the ability to design and personalize avatars [3]. A metaverse is a place for interaction between computers, computer to human and between humans. The development of this interaction technology was the development of augmented reality technology. This technology integrates the actual and virtual worlds [4]. These developments have enabled the development of new, increasingly realistic empathy technologies and experiences [5].

Many changes have brought about by this technology. From an end-user perspective, there are three main waves of innovation. The presence of personal computers, the internet, and mobile devices. Virtual and augmented reality are technologies driving today's fourth wave of computing innovation. Future waves will include Metaverse technology [6]. The VR technology has played a positive role as happened at science museums in Japan. Using VR, the museums were able to set up a 3D landscape simulation. Other example is the Dinosaur Exhibition that can show the Earth's history [7].

According to Mark Zuckerberg, the more sophisticated version of metaverse will focus on giving the users a more inclusive digital experience. Typically, two types of metaverse can be found: one that allow user to build the environment from zero and the other one that already has an embedded environment so the user can instantly browse the world. An example of the first model is NFT, a digital token that cannot be exchanged or conversed to money but can be used as proof of ownership of certain work. Examples of the second model are Fortnite and Roblox. Both Roblox and Fortnite are games that allow users to design their avatars based on their creativity.

The metaverse integrated a variety of emerging technologies. The 5G network provided ultra-high reliability and ultra-low latency connections for enormous metaverse devices, wearable sensors, and brain-computer interfaces (BCI). In general, the growth of the metaverse occurred in three sequential phases: digital twins, digital natives, and surrealist realm. In the first phase, the activity and the user are clones in which there were two parallel worlds. In the second phase, its digital content can transform and innovate in the real world. In the last stage, the virtual sphere changes, the reality will assimilate so that seamless integration will be present where many things can only be done in the virtual world [8].

This paper reviewed many fields related to VR use to enhance perspective. Moreover, many of these fields are related to each other. So, even though this paper aims to explain the impact of VR technology on social frameworks, the analysis also consists of a more general point of view. This is what differentiates this paper from other papers.

The social impact was chosen as the main topic because social frameworks have a more comprehensive approach. Moreover, it is related to many other fields that bind together as a coherent range of influence. In this sense, starting from this paper, future researchers can further develop the discussion on VR impact.

This paper was divided into several sections that aim to analyze the impact of VR technology. The theory was discussed in Section 2. Section 3 examined the systematic review of literature as the research method. In Section 4, the results of the literature review were discussed. In section 5, the conclusion was stated.

II. THEORY

A. VR Technology

Virtual reality is an activity that people can explore virtually online. VR is an artificial application created by various devices to create a real-life environment [9]. Furthermore, VR is an interactive experience wherein one can become immersed within a computer-generated environment, encompassing programs viewed on a flat screen [10]. This apps provides users with experience of altered reality in different ways by giving different stimulus to human major senses like sight and hearing. According to Ramos, virtual reality can detach experiences and interactions of the actual world or mix them with the real world, making the real and virtual worlds on a par. In recent years, the number of users has expanded significantly for this reason [11]. The purpose of Virtual Reality is to create an immersive experience using technology to modify reality. Virtual Reality display must be highly immersive, with a wide field of vision and realistic 3D visuals [12].

B. Social VR

Social VR can be defined as a user experience to socialize, interact, and prosper in a digital social arena where people meet, interact, and socialize in new and more engaging ways. The emergence of a new era of computing has been attributed to the increase in the number of commercial social VR apps, which has spawned a new research agenda in HCI and ushered in a new era of computing. Using these avatars, social VR users can enjoy real-life social activities such as wandering in public locations, playing a game, watching a movie, performing, or singing at a virtual stage, and throwing a party in highly realistic 3D replicated virtual surroundings [13]. In addition, virtual reality technology improves the creative performance of its learners, which can increase inspiration and imagination and make an immersive creative environment more conducive for creativity [20].

C. Metaverse

A metaverse can be defined as a collection of virtual reality spaces connected to a perceived virtual universe. Similar to the internet which allow people to access almost every bit of information. The word metaverse is composed of the prefix 'meta-', which indicates beyond, and the word 'verse', the final form of the word universe. Typically, the word metaverse represents a future version of the internet that consists of a shared 3D virtual world that is always connected to a perceived virtual cosmos. Metaverse, in a larger sense, may relate to the virtual world, the internet, and the full spectrum of augmented reality [1].

III. RESEARCH METHODOLOGY

A. Systematic Literature Review

Systematic Literature Review (SLR) is a study that map, identify, critically evaluate, consolidate, and collect preliminary study results on a specific research issue to solve a problem. SLR has become the usual way of finding answers by doing a literature review based on past studies relevant to the question.

SLR aims to summarize previous research, identify research gaps between previous and current studies, publish a coherent report/synthesis, and develop a research framework. This research's literature review aimed to better understand the objective, tools, and user experience of virtual reality in social life and how it affect and give the optimal solution. This study examined various journal articles retrieved from search results to achieve comprehensive conclusion.

SLR consists of multiple stages: determining research questions, selecting relevant research, collecting the necessary data, analyzing, and reporting the results.

B. Research Question

The following table contain the research questions that has been carried out on this paper. Table I showed three questions that is the main focus of this paper.

TABLE I. RESEARCH QUESTION

ID	Research Question	Motivation
RQ1	How do people use social VR?	To analyze how people use social VR
RQ2	How does the use of social VR influence people's social life?	To identify if social VR influence the social lives of people
RQ3	What is the way to create a safe and comfortable social VR environment?	To explain what advice can be given for comfortable and safe environment to play VR technology

C. Work Procedure

Work Procedure includes literature search, selection, documentation, analysis, and drawing conclusions. According to Creswell, there are six steps in the procedure of Literature Review.

First, identifying key terms. Searching on journals or literature using keywords. The keywords used in this paper was: VR, social technology and metaverse. Second, determining the origin of literature (local literature) following the topics that have been found from the database or the internet to collect relevant journals or literature. Journals or literature in this study were obtained by accessing them online. Third, critically evaluating and selecting the literature for review. There are 48 works of literature that have been searched and collected through the internet. Following initial screening, only 18 journals were selected and will be reviewed. Fourth, organizing the literature that has been chosen. Information materials and data from previous researchers have been obtained, read, recorded, and reprocessed. At this stage, information will be collected regarding the topics discussed from 18 literatures that have been evaluated and read. Fifth, writing the literature review. After gathering information on the literature, a summary will be compiled regarding the topics discussed to answer the research questions.

And then the last, making results and conclusions. The results were produced to answer the information collected and have been analyzed to answer research questions. After the results have been made, then at the end, the conclusions will be drawn. Figure 1 is the flowchart of this paper's work procedure structure. There were sequential stages from the beginning to the end of this paper.

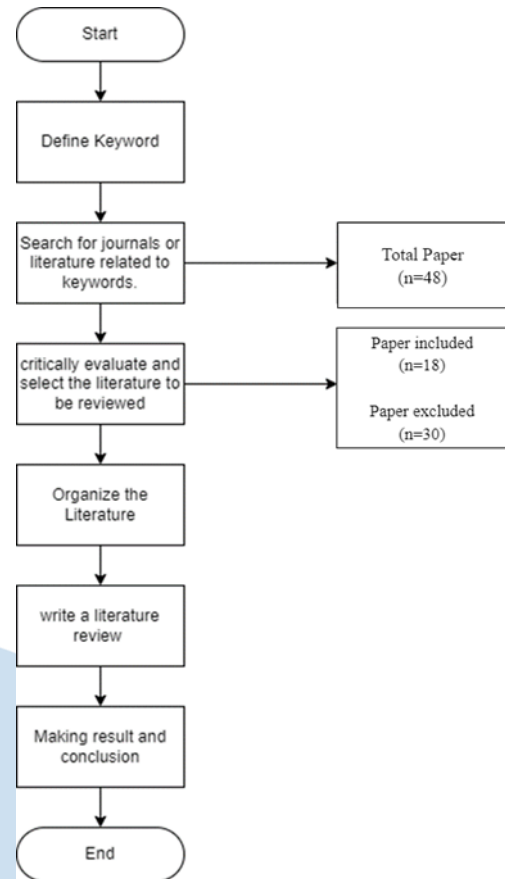


Fig. 1. Flowchart Work Procedure

IV. LITERATURE REVIEW

A. The Impact of Metaverse in General

The impacts and changes effected by the metaverse technology are manifold. Some have a negative impact. For example, in the environmental field, in the journal *Metaverse Future Addiction Concerned for Human-Being* (2022), it was stated that metaverse can harm the ecosystem [1]. Some say that the metaverse trend of implementing empathy tools has a limited effect on users [5]. In the field of psychology, where the governance model and privacy security were not handled properly, it will lead to a lifestyle that is full of worries and vigilance of others [12]. However, there are also positive impacts. For example, in the social field, in research conducted by Divine Maloney (2021), a metaverse with high level of interactivity can act as a tool for social development [3]. In the journal *Metaverse: Future of the Internet* (2022), it was also stated that with the metaverse, we can understand each other and communicate better [13]. From a technology perspective, the metaverse offers a great opportunity to use a human-centered approach to create additional high-value applications [14]. This technology can be used for speculation that is not yet possible [2]. Augmented reality technology can help humans solve social problems that is currently being studied, especially in terms of interaction [4].

Metaverse technology continues to develop with more sophisticated technology and creates dimensional virtual reality [15] by linking various factors that can affect Metaverse technology with its users [16]. Since the COVID-19 pandemic, it has affected the lives of multiple sectors, from Education to Industry, creating the concept of work and distance learning. Metaverse provides a VR/AR concept that simplifies remote concepts [17]. Metaverse has links in various industrial fields, including education and health. In the industrial sector, the metaverse can be used in making business strategies in the form of dimensions [18]. In the health sector, metaverse can create a virtual social reality for people with disabilities [19].

In education, metaverse technology functions as a central teaching system by examining the relationship between the surrounding environment and students' lives [6]. By changing the traditional (teacher-centered) learning system to VR (machine-centered) technology, many factors are involved in the transfer of the system, such as mindset and technology mastery [20]. It can be started by collaborating between virtual concepts and conventional learning, [21]. The creation of the metaverse, which the creators of Facebook started, still has shortcomings, the data used in user identification for VR/XR is insufficient for people with disabilities [7].

Regardless of the metaverse's sophistication and positive impact, there will certainly be a downside and security threats. There are seven dimensions to classify security threats in the metaverse: identity, data, privacy, network, economy, physical/social effects, and governance. In the identity-related dimension, there are threats of identity theft, impersonation attacks, and avatar authentication issue. In the data-related dimension, there are threats of data tampering attacks, false data injection attacks, issues in managing new data types, threats to data quality, and threats to gun ownership. On the privacy dimension, there are pervasive data collection, privacy leaks, compromised end devices, unauthorized data access, misuse of avatar data, and accountability. There are also SPOF, DDoS, and Sybil attacks on the network dimensions. On the economic-related dimension, there are issues of trust, threats to digital asset ownership, and threats to economic justice. On the dimension of physical/social effects, there are threats to infrastructure security and social impact. On the governance-related dimension, there are new laws for virtual crime, bad regulators, and threats to collaborative governance [8]. Table II show the summary of this section. Table II has several categories of metaverse benefits with their references.

TABLE II. LIST OF METAVERSE IMPACT IN MANY FIELDS

No	Impact	References
1	Psychology	[2]
2	Ecosystem	[3]

3	Empathy	[6]
4	Social	[1], [2], [4], [5], [8], [9], [13], [16]
5	Education	[7], [15]
6	Law and privacy	[10]
7	Technology	[14], [11]
8	Health	[16], [18]

B. Online Social VR Experience with Metaverse

Many studies have investigated how society utilize and experience metaverse, particularly among young people. Habbo Hotel, one of the largest social virtual environments for adolescents, is well-known for three qualities. The ability to co-create a social setting comes first. Second, utilizing the virtual world as a location for digital artifacts, such as avatars, goods, and experiences such as escapism, voyeurism, and self-image. Thirdly, anonymity and security in metaverse permit freedom of expression and experimentation with various avatar skins and identity-based social events [3].

This feature suggests that young people perceive certain aspects of the virtual social world to be less risky than the offline world. They primarily use this environment for social experimentation, creating exciting challenges and opportunities around identity construction because, for most young people, engaging in a virtual world may become their first experience to be truly free on expressing their identity. This process allows them to construct, reconstruct, and comprehend themselves and others in the online world. This process of self-discovery may not always be beneficial because sometimes undesired interactions such as harassment, cyberbullying, and sexual harassment also occurred in this virtual realm. This demand for higher security stringency [3].

C. Social Effect in Metaverse

There are three social effects that occur in the metaverse:

1) Social Presence Illusion

Experiences in social VR can be described as having a real sensations, similar to offline sensations with other people. This sensation can be referred to as social presence, which generally refers to feeling connected to other people [3]. Additionally, VR gives the users access to real-time experiences in a 3D world while allowing them to participate in interactive situations that give them the sensation of being in another place [21]. In the user's mind, there will be an illusionary sensation of being in another world. The illusion makes a person think he is somewhere else even though he is still there.

2) Virtual Embodiment

Virtual embodiment, often known as "presence self," refers to the user's representation in a virtual world. Ben-ford et al. describe embodiment as

providing users with a suitable body image to represent them to others (and themselves) in collaborative contexts. The illusion of body possession, which may be described as a method in which the user executes a movement to support their perception of ownership of a virtual creature, can be used to induce an embodiment [3]. A virtual embodiment is a feeling when playing a virtual game where one feel one's body is playing an avatar like in the real world where they can move their body as their wishes.

3) *Proteus Effect*

Many works have demonstrated the effect of virtual avatars on a person's perception, behavior, and cognition. This is called the Proteus effect, which describes how the characteristics of their avatars alter individuals' behavior in the virtual world. For instance, inhabiting a juvenile avatar may induce immature behavior and perceptual shifts in the user [3]. The nature and personality of a person when playing sometimes cause an effect in the form of a character that is different from the real world and created new traits both in the virtual and real world.

D. *Create a Safe Social VR Environment*

There are many worrying issues in the VR world. The VR environment may bring about a person's social negativity instead of fixing it. Therefore, to avoid this, we can create a safe environment in the following ways:

1) *Experience Social VR With Loved Ones and Friends*

Mentally unstable minors are better off playing with their closest friends or family to avoid the bad effects of playing with strangers, such as bullying, bad attitude, or mental down. Playing with strangers can also lead to feelings of discomfort and uneasy. For example, games such as PUBG, when played with strangers sometimes cause alertness and fear compared to playing with friends or family.

2) *Educate People about VR Technology*

Educate the people about Virtual Reality Digital Literacy. A more comprehensive and proper education on social VR and broader immersive technologies is required to provide a secure online social space for the general public, particularly for minors. There are two ways to educate people about technology; directly and indirectly. In a direct way, educator can held an event that talk about VR world routinely. They can also implement tools while on it. Meanwhile in an indirect way (online), educator can build a website that can be used by all ages that contain a complete information about Virtual Reality and provide space for discussion because the more people know about technology the more they will be able to use it effectively for their benefit.

3) *Grouping Independently in The Environment*

This medium means that the platform must support the age-centered design and practical activities that

focus on the target age group because everyone is different. For example, like Fortnite, age restrictions are made to avoid improper socialization, such as harsh words, swearing, violence and sexual harassment. In addition, games can influence emotions and behavior in children's brain development.

V. CONCLUSIONS

The use of VR Metaverse has a social impact on society. Bad things such as bullying sometimes still happen in society. However, playing VR gradually can also cause social effects such as Social Presence Illusion, virtual embodiment, and the Proteus effect. Therefore, we must prevent this and create a safe environment in the VR world. Our study provides solutions such as building advance security, playing with loved ones or friends, and educating the public more about VR technology. We hope there will be a safe environment for social VR that does not have bad effect on society.

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