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Metaverse: Above an immersion in reality

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ABSTRACT

Although the notion of the Metaverse is implicit in some popular video games, its concept is currently being rethought, in addition to adapting it to various activities that have progressively migrated to the digital world, such as work, commerce, education and recreation. It is projected for the coming years a high financial investment in research, development and implementation of technology, whose main feature is virtual reality. According to the technological conglomerate that drives its progress, the main objective is to make digital connections an immersive experience that enhances human relationships. Now, historically, the tech giants are not driven by altruistic purposes but by mass control in addition to their economic benefits, over and above that which is obvious, the question remains as to whether it is a really necessary technology. At first glance, it may offer advantages in the field of education and labor action. However, the technology has some sharp edges that must be treated with great care. In that sense, this essay, in addition to exposing the technology, offers ideas for debate about its desirability and social impact.

Keywords: metaverse; augmented reality; extended reality; virtual reality

1. Introduction

The term metaverse first appeared three decades ago in the futuristic and dystopian bestseller Snow Crash by Stephenson[1]. In the aforementioned literary work, the characters access a world through artificial stereoscopic vision devices. Once immersed, they adopt some form of graphic representation (avatars), so that they find themselves under an existence that allows them to lead parallel lives to the real world. Beyond the novelistic scope, fundamentally, the technology behind the illusion is virtual reality.

Although the concept of Metaverse has been around for a long time and is present to some extent in some electronic games and even in some applications for sports training, it is from the year 2021 that it has acquired a media hype due to the impulse given by the technological giants, by the elites of economic power and even by some prominent centers of scientific knowledge.

Indeed, the metaverse is one of the top 5 technology trends of the year 2022, according to the World Economic Forum[2]. The new technology platform is estimated to represent an eight hundred thousand (800,000,000,000,000) billion dollars market

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opportunity for online entertainment and social networking companies over the next two years[3]. In fact, in the third quarter of the year 2021, the proposed investment of a multimillion dollars sums by the newly created Big Tech Meta for the development and consolidation of immersive virtual environment technology was a media event[4].

According to Bosworth[5], the new Meta-driven information platform corresponds to "(...) a set of virtual spaces where you can create and explore with other people who are not in the same physical space as you. You can hang out with friends, work, play, learn, shop, create and more (...)" (para. 2). In principle, it can be deduced that technological innovation promises to be directed not only to entertainment, but also to teleworking, distance education and online commerce. To this end, in Latin America, thousands of people are expected to be trained in augmented reality for the development of the proposal[6]. Similarly, in Europe, there is a commitment to build the virtual universe of the next generation of the Internet[7].

However, the debate on human rights in the metaverse is still pending in terms of the risk of being subjected to more exhaustive data collection and permanent surveillance[8]. Likewise, the implications on sovereignty and national security should not be overlooked because it could be a technology that could be invasive of the human mind used to coerce improper behaviors in citizenship, sowing false values in youth or poor training of adolescents, the latter being a key factor in the development of a nation.

Beyond the framework of promising applications and their social repercussions, the metaverse is taking shape and acquiring reality. Indeed, all the pieces necessary for the construction of the fantasy universe are in place: virtual reality, augmented reality, the cloud, 5G mobile telephony, artificial intelligence, haptic and holographic technology. In this sense, due to the remarkable technological advances that support its development, the influential matrix of opinion generated from the technological power that drive its incorporation into society and the increasingly imminent new technological stage of humanity, it is necessary to know what the innovation is about and even more how it would affect society.

The purpose of this essay is to present a perspective of the subject in question, for this purpose and to have a worldview that allows reflection on the true usefulness or relevance of the technology under development, it begins with the definition of metaverse as the third dimension internet, then the key aspects to achieve its operation are addressed, then the challenges associated with its development and implementation are considered, then the positioning of the technology in the public opinion is presented and finally some reflections on the subject are offered.

2. Metaverse: The third dimensional Internet

In principle, Metaverse is the contraction of the words meta and universe, which in the literal sense means "beyond the universe". In the context of Stephenson's novel Snow Crash[1], the term alludes to a virtual universe simulated by computers, governed by its own laws, where the avatars of cybernauts cohabit with beings created and subordinated by those in control of the system. It is important to emphasize that what has been described above has no connection with the concepts of parallel universes or multi-verses that have arisen in the latest physical theories.

Technically, in internet slang, the term "(...) is used to describe a virtual representation of reality implemented by means of virtual reality software"[9]. Today, "(...) generally refers to the concept of a highly immersive virtual world where people meet to socialize, play and work"[10]. It is understood that the technology seeks to move its users from being simple spectators to real actors through more vivid experiences. That is to say, to go from the simple visualization of an image on a liquid crystal screen to a reality where the same is lived and felt through software, actuators and sensors.

Now, for the construction of the Metaverse, a series of base technologies will be needed. Obviously, virtual reality (VR), augmented reality (AR) and the internet are at the forefront. However, rendering, artificial intelligence and supercomputing are key elements for the generation of more realistic content. In addition, frameworks are required to develop video games, cloud services, blockchain, digital twins, satellite internet, 5G, touch science, neurotechnology, behavioral engineering, BCI (Brain Computer Interface) technologies and even power generation technology.

3. Key aspects for the operation of the technology

Fundamentally, the key technology underpinning the metaverse is virtual reality (VR). In this regard, this type of existence can be understood as the replacement of the interaction between a person and the physical environment by an interconnection to a computer-simulated environment, built from physical devices such as omnidirectional treadmills, machine vision devices and gloves with haptic technologies, which work together and synchronize with the sensory organs to form a perception of a physical reality of another place, another body or another logic of how the world works[11].

Like VR, augmented reality (AR) also offers an immersive experience, but is basically different from VR in the way it superimposes virtual elements on the physical reality surrounding the person. AR can be considered a more realistic extension of VR. As a representative example, the popular video game Pokemon GO is a clear application of this technology. The combination of AR and VR gives rise to mixed or extended reality that enhances the total immersion of users in digital worlds.

However, to achieve the sensory experience, it is necessary to have special hardware and software. Basically, you must have a computer to control various devices such as displays that allow stereoscopic visualizations and 3D sound. VR systems use gyroscopes and motion sensors to track head, body and hand positions. The data collected is used by computational algorithms to calculate appropriate perspectives, determine camera positioning and orientation, and create virtual objects that are superimposed on the user's view. The use of moving floors to give the sensation of walking and the use of haptic technology to experience the shape and texture of virtual objects make the experience even more immersive[12,13].

Regarding the synchronization of the digital environment with the physical world and vice versa, the innovation called digital twin plays a key factor in the digital representation of objects, people or physical processes of the real world in a virtual 3D format. Therefore, it plays a key role in the development of virtual content because it allows to make exact replicas of reality from data obtained in real time through the use of[14,15]:

- Sensors that transmit information about objects.
- Technologies related to Big Data.
- Internet of Things (IoT) platforms.

The collected information is processed with AI, cloud computing and machine learning to create a realistic representation in the virtual world. Importantly, sensors powered by IoT connectivity for motion detection and personalized data collection are critical for building 3D digital twins and creating spatial awareness[16].

Likewise, blockchain technology plays a key role as an authentication mechanism for cryptographic assets and user-owned data. Avatars, digital goods, purchase of digital entertainment products and apps, financial transactions, as well as non-fungible tokens (NFT) such as artwork or music, will be backed in the virtual world by blockchain-based software routines. It will even authenticate the ownership of digital goods in interoperable virtual worlds, and may even control access to certain areas of the metaverse by age restriction[17].

Also, 5G is an important piece in the develop-

ment of virtual worlds, particularly for the processing of heavy digital files that require a high bandwidth and low latency network such as video texturing and immersive sound or 3D. The benefits of the technology enable ultra-fast connections between cloud servers and virtual reality devices, thus optimizing the experience[18].

Quantum computing promises to be of great use in the execution of various critical applications. Its potential use cases will be found in aspects related to security optimization, computation, communication, machine learning and simulation. Quantum cryptography will be needed to shield transactions against the development of quantum algorithms that break information security. The enormous amount of computation and simulation that can be performed by quantum phenomenology-based computing can be harnessed to enhance the virtual world experience. To create realism, quantum randomness could ensure that the inhabitants and their algorithms do not game the system. As the complexity of the metaverse increases, machine learning is fundamental to its evolution, and quantum machine learning will be a tool in its favor[19].

4. Challenges in the development and implementation of the Metaverse

To animate thousands of avatars and virtual entities of very high resolution, as well as aspects such as interconnection between users, creation of virtual property, commercial exchange and offering services, would require the use of thousands of powerful servers in data centers with high power consumption for processing and data transfer. Consequently, the global demand for electricity is expected to increase[20].

Similarly, the increased use of cloud services leads to an increase in carbon dioxide emissions[21]. In this sense, it is clear that for the sustainability of this new virtual world and to reduce its environmental impact, it is necessary to improve energy productivity as well as to invest in renewable energy sources such as solar, wind, thermal and even nuclear. In addition, the development of all the necessary hardware requires the use of many natural resources, so the metaverse is a challenge for the conservation of nature.

On the other hand, life in the metaverse could affect visual acuity[22], although it merits an exhaustive study. However, it is possible that such an effect could occur because that when entering the virtual world, users would need helmets or glasses with artificial light screens, as they spend more time playing or socializing in the metaverse that will subject their eyes to greater amounts of unnatural radiation, which can be harmful to vision in the long term. Similarly, wearing headphones for extended periods of time can affect the functioning of the ears and even 3D audio could permanently affect human sensors of coordination and positioning.

In fact, it is known that the main limitation of virtual reality programs or tools used in the scientific world to examine and understand experimental data in a more friendly and dynamic way, lies in the fact that sudden movements produce certain levels of dizziness or vertigo[23]. Of course, scientific research to support the above is lacking, however, these are key elements for debate.

Likewise, the metaverse could enhance or cause body dysmorphia. People may feel increased social pressure to adjust their appearance in the virtual world, thus entering into a kind of game of altering and manipulating their avatars or changing their digital identities according to beauty expectations. So, if the metaverse focuses much of its content on body and lifestyle, it could leave users very susceptible to body dysmorphia and threaten their mind[24]. In this sense, the issue of how technology will affect identity, personality, behavior and emotions in people suffering from mental health disorders or vulnerable groups such as children or youth, represents a challenge for its regulation.

Another aspect to consider is that behind the innovation there is high-level research in computer sci-

ence, cognitive science and forms of interactive narrative technologies supported by AI[25]. This fact raises alarm bells in case recommendation algorithms are used that lead to mass consumption or the development of addiction in users towards certain digital products.

Similarly, it remains to be studied the implications of virtual worlds in the field of national security, in particular in controlling the interference of large technological conglomerates in internal affairs through the collection of data on their citizens. The imposition of technological monopolies that affect sovereignty and technological independence, the installation of opinion matrixes that favor certain political ideas, generating conflicts and public disorder, transculturation to the detriment of national identity and fostering disintegration and placing the public in conflict and public disorder, the installation of opinion matrixes that favor certain political ideas, generating conflicts and public disorder, transculturation to the detriment of national identity, fostering disintegration and placing countries in a vulnerable situation in the face of the action of external agents.

Therefore, another complex challenge is to establish standards and protocols for the virtual world that define clear, precise, ethical, moral, social and political rules concerning the collection of personal information, privacy protection, data security, transparency in the exchange of digital assets, virtual work, restriction of applications that may represent a high risk for users, online harassment or abuse, addiction to crime, confusion between true reality and VR[8,26].

5. Positioning technology in public opinion

There are initiatives or events that are positioning technology in one way or another in public opinion and in turn consolidating its development, specifically, the Korea Advanced Institute of Science and Technology (KAIST[27] organized an international forum on global trends regarding innovations and technological applications of the metaverse along with its impact on multiple aspects of our future. In the same vein, the Massachusetts Institute of Technology (MIT)[28] has been addressing the issue of how the realization of an immersive world has the capacity to radically change the way we connect.

Beyond the colloquia, at the Max Planck Institute for Intelligent Systems (MPIIS)[29], there is already a line of research on human avatar learning, synthesis of realistic humans for games, extended reality applications and metaverse. It is important to mention that Stanford University started to teach its virtual reality courses remotely interacting in a kind of metaverse[30].

At the same time, the Asia Content and Entertainment Fair (ACE Fair) in 2021 featured a pavilion dedicated to the metaverse, ranging from virtual reality workrooms to the use of technology for predictive and proactive mental health care. In addition, at the Consumer Electronic Show (CES) in 2022, technology giants such as Accenture, Hyundai, Nvidia and Samsung presented proposals that bet on immersive virtual worlds[31].

On the other hand, some governments are betting on its applications, for example, the administration of the city of Seoul intends to offer public services supported by the aforementioned technology[32]. In the same vein, the government of Barbados establishes an embassy in the metaverse according to the virtual platform based on blockchain called Decentraland[33].

In such a way that the technological proposal has been gaining ground and renown through technological agents of great weight on the world scene, in this sense, its progress can be considered unstoppable.

6. Final thoughts

From the previous sections, we can identify several aspects in the development of the metaverse. On the one hand, it is costly, and requires disruptive technologies, needs high energy consumption and could represent risks to privacy and even health.

On the other hand, it will drive from product innovation and digital platforms to the generation of a new model of e-commerce and even the rise of the tokenization of the economy, it will also stimulate new raw material requirements, therefore, an opportunity to further boost the economy of the countries.

Likewise, the virtual environment can help to improve the teleworking experience because of its ability to create immersive reality. It can also change the teaching and learning processes in the field of basic sciences and even enable their advancement by facilitating the understanding of complex structures, such as atoms, molecules or macromolecules through artificial vision and interactive reality.

However, we must be alert so as not to be dazzled by the mirage that technology shows, because in the end it turns out to be a deceptive reality, especially when we analyze who are those who have the capacity to develop it. It must be kept in mind that its main impulse is commercial exploitation and not to lighten the burdens of humanity.

It is necessary to reflect that for some decades, a very well-planned advertising campaign has been installed on the need to be more connected, alluding to interact more and more through the network. However, it turns out that rather than strengthening interpersonal relationships, it has weakened them. Paradoxically, the network may be turning us into more isolated individuals, due to the addiction developed by the screen. This kind of contemplative situation of what is presented in the digital world, is taking people away from their reality and driving them to the consumption of digital products, so that the background of the connection promoted by the media is to capture servile consumers that feed the great technological machinery.

In this sense, with the entry of the metaverse on the scene, apparently with no turning back, as it is a technology with a high power of enthrallment, so it is necessary to consider its social, cultural, psychological and ethical impact. Especially when it is understood that behind the innovation, there is a machinery that studies the imagination and social phenomena. Such knowledge can be used for the manipulation of advertising for the consumption of certain goods and services to the sowing of false values in young people or in the population in general, and even the addition to virtual environments as a cause of mental disorders, are sufficient reasons to be alert to the new modes of entertainment.

Also, the consumption of electrical energy represents a new burden on nature. In addition, the demand for hardware to support technology will drive further extraction of new minerals that is traditionally accompanied by the use of pollutants, negatively impacting soils, water and air, ultimately resulting in the deterioration of humanity's quality of life, along with threats of extinction of animal and plant species.

Another aspect to take into account is the exercise of sovereignty in the new digital platforms, in particular, controlling over risks and threats associated with the use of such environments to favor certain trends of opinion that seek destabilization and anarchy in countries for political and economic purposes.

It is an open question that whether its development is necessary. It is also timely to ask what is the need to create virtual parallel lives? Without delving into philosophical questions, the issue is that being a more invasive technology with possible environmental impact, misusing our data to promote economic interests, and even be a potential cause of addictions or some kind of mental disorder, which are elementary aspects to place in a balance its proposed implementation.

Therefore, it is timely to reflect that the metaverse is more than an immersive reality. It is imperative to review the technology, study it, understand it and discuss its relevance to the population. This brief paper does not intend to give a paranoid look at the technological proposal, in fact it has been presented that it may have timely advantages, but it has listed a set of elements that represent sharp edges to which care must be taken.

Conflict of interest

The authors declare no conflict of interest.

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