Changes in technology and civilization—A conceptual study of the Metaverse

Lingzhi Fang, Huangnan Shen*
Fudan University, Shanghai 200433, China. E-mail: hnshen@fudan.edu.cn

ABSTRACT

Advances in media technology continue to drive changes in the shape of human society, and human civilization has stepped into the eve of the Metaverse. Based on this practical background, this paper analyzes the Metaverse concept from three aspects: the proposed background, construction and characteristics of the Metaverse, and analyzes and summarizes the impact of the Metaverse on the current situation of the industry and the future of the industry. This paper argues that the proposal of Metaverse is the inevitable development of society and technology, and the endgame of Internet development. The Metaverse is a product of the constant innovation of the medium and has evolved from the possible worlds in literature to video games. This paper summarizes the basis of Metaverse construction from the perspective of humanities and technologies, and proposes that the Metaverse will develop a virtual civilization in terms of humanities, and be supported by both software and hardware technologies in terms of technologies. On the basis of this foundation, it is extracted that the Metaverse has two characteristics: civilization and intersectionality. This paper summarizes the influence of Metaverse on industry, mainly including the influence of Metaverse on the current layout of industry and the influence on the future development of industry. The concept and impact of Metaverse and its commercial application in industrial development proposed in this paper lay the corresponding theoretical foundation for the subsequent research on Metaverse.

Keywords: Metaverse; virtual world; media technology; virtual civilization

1. Introduction

On March 10, 2021, Roblox company was successfully listed on the New York Stock Exchange. The industry claimed that it was “the first share of the Metaverse”, which directly sounded the horn of human entering the Metaverse. The listing of Roblox not only declares the success of Metaverse as a business concept, but also opens the next generation of the Internet. Then, Facebook CEO Mark Zuckerberg announced that Facebook began to vigorously enter the Metaverse, and changed the company name to “meta” on October 28, 2021. While the global giants of the Internet have devoted themselves to the cause of “Metaverse”, domestic IT manufacturers are unwilling to be lonely and have proposed to transform into “Metaverse” companies. The birth of the Metaverse not only brings a strong shock to everyone, but also stimulates people’s cognitive blind spot. The proposal of Metaverse not only predicts the reform direction of existing industries,
but also stimulates the development of several emerging industries. Virtual space promotes the construction of virtual production scenes in the industry. People can fully use virtual space to simulate reality and realize the projection from reality to virtual, to better guide the production practice of real industry. The development of relevant high and new technologies has also driven an unprecedented Industrial Science and technology storm. A series of technologies such as extended reality technology and brain computer interface technology will appear with the emergence of Metaverse soon. Moreover, the proposal of Metaverse provides a new industrial investment direction for capital. With the rise of Metaverse investment, a large amount of capital has invested in related industries, which not only promotes the development of high-tech, but also optimizes the industrial layout of capital to a certain extent.

Although the rapid development of related industries has changed our understanding, the crazy influx of capital has inevitably brought about a foam in the industry. Under the capital feast, after the carnival, we need to think and analyze carefully: what is the Metaverse? Is it a false concept of capital speculation? If the Metaverse really exists, what is the basis for its existence and development? What are the characteristics? What is its impact? These topics will be fully discussed and elaborated in this paper.

It can be seen from the search of relevant documents that few scholars have studied the Metaverse itself at present. Although some experts in the industry have conducted pioneering research, generally speaking, the discussion on the Metaverse itself is still insufficient\[^{[1-3]}\]. Therefore, in order to solve the above four problems, this paper intends to discuss and analyze the contents related to the Metaverse in combination with relevant practical and theoretical background. This paper includes the following four parts: firstly, analyze and explain the proposal and background of the Metaverse. Secondly, extract the construction basis of the Metaverse through existing academic research and industry reports, and then summarize the characteristics of the Metaverse. Finally, based on the above analysis, summarize the potential impact of the Metaverse on industrial development and evolution.

### 2. The proposal of Metaverse

#### 2.1. Metaverse: Does it exist?

Before 2021, Metaverse is just a science fiction concept. In 1992, Neal Stephenson, a famous American science fiction master, described the Metaverse in his novel snow crash: “Put on headphones and eyeglasses, find the connection terminal, and you can enter the virtual space simulated by computer and parallel to the real world in the way of virtual separation”\[^{[4]}\]. Although Neal Stephenson is the person who created the term “Metaverse”, he has not carefully analyzed the Metaverse itself. Not only that, although many film and television animation work began to fully imagine the Metaverse very early, such as the well-known film matrix, people still feel that the Metaverse is in a state of “invisible and untouchable”. Film and television works and literary works create the possible appearance of the Metaverse through words and images, but the Metaverse still faces the situation of unclear concept definition and fuzzy boundary, and few scholars have seriously discussed such problems.

The fuse for Metaverse to enter the public view is the listing of Roblox company. Roblox claims to be a Metaverse company because it provides players with a virtual world so that players can freely transform the virtual world. As of the second quarter of 2021, Roblox’s dau is 43.2 (million), and more than 10 million users have browsed and played the world. User generated content (UGC) casts Roblox’s virtual world and is the main body of Roblox’s virtual world, which makes Roblox a representative of the Metaverse at this stage.
Based on the existing data on the Metaverse, although people have formed a relatively mature image cognition of the Metaverse, it is still lacking in strict definition. Although many media reports claim that the Metaverse is the end of the development of the Internet, due to the fiction and imagination of literature and film and television works, the Metaverse as a science fiction concept will make people reflect on its real existence. Therefore, in order to clarify the existence logic and the inevitable trend of the development of the Metaverse, this paper starts from the development trend of the Internet, summarizes the evolution process of the Metaverse, demonstrates the possibility of the emergence of the Metaverse on this basis, and puts forward the strict concept of the Metaverse.

2.2. Background of Metaverse: Starting from web 1.0

The emergence of the Internet is the product of military technology. The Internet was born in the US military in 1969. In order to strengthen military connection, its protocol rules are based on the existing ARPA protocol. Subsequently, burners proposed the classified internet protocol, namely the world wide web, in 1989. The emergence of the world wide web has enabled the Internet to realize the “interconnection of all things” and began to move from military to civilian.[5]

Web 1.0, Web 2.0 and Web 3.0 summarize the main development stages of the Internet[6–8] Web 1.0 is the information age. Since the earliest use of the Internet is to transmit information, the convenience and immediacy of information transmission are the dividends brought by the Internet. When the Internet is gradually popularized, people enjoy the dividends of the Internet and usher in the information explosion. Web 2.0 is the era of relationship, which is due to the fact that people instantly transmit information through the Internet, and the relationship between people is built on the Internet.[9,10] Starting from Web 2.0, the Internet has gradually evolved from a simple information transmission channel to a virtual interpersonal network.

It is generally believed that the current Internet development is in the stage of Web 2.0[8–10]. However, as the Internet is still in rapid development, this strong relationship feature will eventually evolve into other forms with the development of the Internet. Based on this, academia and the industry have always discussed the future state of the Internet, and proposed and imagined Web 3.0 based on Web 2.0. However, the status of Web 3.0 is still under debate in academia and industry.[5,11,12] Although there are arguments, it can be seen from the summary that the basis of Web 3.0 is semantic network, which corresponds to highly developed intelligent technology. Web 3.0 enables the “interconnection of all things” to be fully realized, and people can enjoy a strong sense of immersion compared with reality. The above development stage also shows that in the process of Internet evolving from web 1.0 to Web 2.0, its development focus gradually transits from information to interpersonal relationship, and highlights the status and role of “people” in the Internet. It can be inferred that Web 3.0 must be a highly “human” centered network. It can be seen from the existing research that in order to realize the highly “human centered” function, Web 3.0 must be an Internet era with high intelligence and high interactivity. Therefore, intelligence is the main feature of Web 3.0.

Marx once put forward that “the essence of man is not the inherent abstraction of a single person. In its reality, it is the sum of all social relations”[13]. The transfer of the function center of the Internet also marks the deepening of people’s demands for the construction of themselves and their own relations. The construction of self and self-relationship requires people to interact. Therefore, the transfer of Internet function center not only brings about the change of people’s status and role in the Internet, but also puts forward new demands for the development of the Internet, that is, to meet people’s increasing interaction.
Changes in technology and civilization—A conceptual study of the Metaverse

requirements. The proposal of such demands constantly drives technological changes and ultimately affects the morphological development of the Internet.

Therefore, by summarizing the above development process of the Internet (as shown in Figure 1), the development of the Internet is accompanied by the function center moving from information to people. At the same time, in order to continuously solve people’s increasing demands for the level of interaction, the form of the Internet is constantly driven by technological development and changes dramatically. It can be predicted that the final form of the Internet must be completely “human” centered and a completely “socialized” virtual space Metaverse was put forward at the right time. It summarizes the end of the development trend of the Internet. Once the Internet has entered the Metaverse, it declares that the functional center of the Internet has completely changed from information to human, which marks the complete formation of the “cosmopolitan” form of the Internet. To sum up, although Metaverse is still a science fiction concept that has not yet been achieved, Metaverse may indeed be the end of the development of the Internet.

2.3. Presentation and evolution of the Metaverse from literature to video games

The development of media technology continues to promote innovation in the field of information. McLuhan proposed in his classic bibliography that “the medium is the message”, because of this, people can access a lot of information through the media. As the end of the Internet era, the Metaverse must also be the product of information. Through the current description and imagination of the Metaverse, it can be inferred that the Metaverse is a virtual world completely displayed through developed media technology, with the characteristics of “virtual”. Then we can see that the virtual world is the foundation of the Metaverse, and the essence of the Metaverse is a developed virtual world. Research shows that the earliest virtual world is the spiritual world of human beings, this kind of world appears with the emergence of information architecture and media. In other words, the earliest virtual world existed in language and text. The relationship between technology and the virtual world is reflected in the fact that the development of media promotes the continuous display of the virtual

Figure 1. Stages of Internet development.

![Figure 1](image-url)
world: text brings literature, screen brings movies, and computer brings video games. Therefore, the evolution and development of Metaverse cannot be separated from the transformation of media, that is, the earliest Metaverse appeared in literature, and the development of technology promoted the emergence of new media. Thanks to this, electronic games show the Metaverse at this stage.

### Metaverse in literature

Although the Metaverse may be regarded as the end of the development of the Internet, the Metaverse itself is not the product of the development of the Internet. Zhao et al.\[21\] believed that the Metaverse appeared very early, but most people ignored it. The “realization” of Metaverse is realized through technological development, but Metaverse is also not the product of high-tech development. It can be said that from the long-scale human history, the Metaverse is very old.

The earliest Metaverse was constructed by words. As the most important medium in human society, characters carry a lot of rich information. Possible world theory has long been put forward by philosophers, while writers use people’s logical way of thinking to make up stories with words, to construct the whole virtual “functional universe.”\[^{18–20,22,23}\] Combined with the previous and current discussions on the Metaverse, it can be inferred that the earliest form of the Metaverse in front of people may be the “possible world” in literature\[^{1,20,23–25}\].

The possible world in literature is common in real life, which leads people to ignore that this may be the original form of the Metaverse. Whether it is “Middle Earth” written by J R Tolkin or Arrakis, the long yellow sand spice planet created by Frank Herbert in dune, people are always willing to indulge in this imaginative virtual world. Words are naturally used to convey information at the same time, as the oldest medium, the extended function of words allows people to use words to describe people’s spiritual world, with a strong fictional color. Therefore, novelists are good at building their own spiritual world through words\[^{26}\]. As the earliest medium used by people, words carry many human spiritual activities. The virtual world conveys its existence information through words.

This discussion on the virtual world constructed by pure words has lasted for a long time. Many sages have paid attention to the relationship between the “possible world” and the “real world” constructed by words. Indeed, this description of a world does not only exist in literature, but also contains many “world” descriptions. Aristotle explained the difference between poets and historians thousands of years ago: “historians describe what has happened, while poets describe what may happen”\[^{22}\]. From Aristotle’s point of view, we can see that the difference between literature and history lies in that history describes what is already and literature describes what is possible. Further, Leibniz believes that “the world is a combination of possible things, and the real world is a combination formed by all possible things. There may be different combinations of things, and some combinations are more perfect than others. Therefore, there are many possible worlds, and every combination formed by possible things is a possible world”\[^{27,28}\]. For the proposal of possible world in literature, previous studies have made it clear that the virtual world first existed in literature. Moreover, due to the fictional nature of the text, people can explore the spiritual and imaginary world of the authors through the text: This is the virtual world displayed by the text.

Although the earliest virtual world was built by words, words, as a very primitive and ancient medium, have very strong limitations, so people cannot come into close contact with the world. For example, the description of “only meaning cannot be expressed” is exactly the limitation of word media. It is still an indisputable fact that “virtual world” first existed in words, whether words have limitations or not. People use words to record what
happens in the virtual world and standardize the operation rules and framework of the virtual world through corresponding expressions. The possible world full of wild imagination in literature is the most primitive form of the virtual world, and the virtual world is the foundation of the Metaverse. Therefore, it can be judged that the Metaverse first appeared in literature.

**Metaverse in video games**

The development of media has promoted the progress of the Metaverse, and the emergence and high development of electronic games have accelerated the “reality” of the Metaverse. Early electronic games were very simple, represented by board games and poker games. With the progress of computer hardware technology, electronic games also show a trend of rapid development: people are no longer satisfied with this simple game, hoping that the rules of electronic games are more complex and more kinds. The emergence of complex electronic games has made people try to classify electronic games. Poole[29] believes that video games can be divided into strategic type, role-playing type, educational type, action type, shooting type, sports type, fighting type and driving type. The proposal of video game classification shows that video games have been divorced from the characteristics of “simplicity”, and increasingly complex video games are the mainstream in the game industry. Highly developed video games show the simulation of the real world, especially the new game categories formed by increasing differentiation, such as sandbox games, which itself is a complete virtual world.

The emergence of electronic games provides people with the opportunity to directly enter the virtual world: people wander in the virtual world and forget to return. With the help of superb digital technology and display technology, the virtual world in video games not only provides people with a virtual space, but also allows people to engage in activities basically consistent with reality in this space: people can buy and sell in this virtual world, or even collect materials and build houses. It can be seen from this that the progress of technology has promoted the development of media, so that the virtual world can gradually become more and more obvious. With the help of video games, people can get close to and even integrate into the “possible world” described in previous literature. The emergence of electronic games has realized the interaction and blending between man and machine, and completed the key step of upgrading the virtual world into a Metaverse.

With the help of the Internet, video games not only complete the interaction between people and machines, but also complete the interaction between people. This has once again completed the revolutionary development of the virtual world. The birth of MMORPG (massively multiplayer online roleplaying game) is a milestone in the history of electronic games. This kind of game breaks through the limitation of human interaction in the virtual world, and gradually develops from the interaction between human and machine to the interaction between human and machine, and then to the interaction with human. This also provides an opportunity for people to build their own social network platform in the virtual world, and highlights the fidelity of the real world[30]. The emergence and development of electronic games have completed the “reality” of the virtual world, accelerated the development of the virtual world and laid a solid foundation for the emergence of the Metaverse. The emergence of electronic games presents the virtual world that originally existed only in words to people through advanced digital technology and display technology, and completes the essential “man-machine interaction” and “everyone interaction” of the virtual world. The virtual world is no longer a fantasy on the shelf, but a virtual space that can be actually integrated: people have changed from a bystander who can only complete the exploration of the virtual world through a simple description of words to an interactive person who can participate and experience it personally. Video games have
completed the construction of the virtual world at this stage, which is very important to promote the development of the Metaverse. Video games solve the interactive problem that words can’t solve, and the resulting changes in new media forms constantly promote the increasingly explicit virtual world, and then accelerate the process of upgrading the virtual world into a Metaverse. Therefore, video games are a crucial link in the formation and development of the Metaverse.

2.4. Concept of Metaverse

Wikipedia has given relevant definitions for Metaverse: “Metaverse, or post universe, metaphysical universe, meta boundary, hypersensitive space and virtual space, is used to describe an online three-dimensional virtual environment with persistence and decentralization in the future.” At the same time, combined with the above discussion, we can summarize the corresponding analysis of the concept of Metaverse: first, the essence of Metaverse is an artificial virtual world. This virtual world was first constructed by words and appeared in literature. Later, with the development of technology and the change of media form, computers and the Internet can gradually and concretely present the Metaverse in front of people, the motive force for the proposal of the Metaverse lies in the transformation of the Internet function center from information to people. The increasing requirements of people for interaction drive the continuous progress of media technology, which promotes the development of the Metaverse. Third, the condition for the emergence of the Metaverse is the high development of information technology and the high prosperity of social civilization. Its emergence will carry out all-round changes to the society and may form a new social form in the future. To sum up, Metaverse is the ultimate product of the development of the Internet, the upgrade of the existing virtual world at this stage, and has a highly developed virtual social system.

To sum up, this paper holds that Metaverse is the inevitable trend of social informatization and virtualization, and it is the ultimate stage of Internet development. The motive force of its emergence and evolution is the transfer of the functional center of the Internet from information to people, which drives the continuous development of media technology, brings all-round changes to the current human society, and shapes a new social form in the future. Moreover, for the Metaverse itself, the Metaverse is a highly developed artificial virtual world that blends with reality but does not rely on reality in this world, people use digital avatars to communicate with each other and interact with the world, and form many virtual communities on this basis. With the development of time, virtual society has emerged and gradually developed into a virtual civilization relying on and independent of the real world.

3. Construction of Metaverse

If the Metaverse is the end of the Internet and the peak of the virtual world, what elements are needed to build the Metaverse? At present, in the research on the Metaverse, there is little discussion on the construction basis of the Metaverse. In other words, what conditions are needed to realize the Metaverse is not clear. Therefore, based on and summarizing the existing research on the virtual world, this paper puts forward that the construction foundation of the Metaverse needs to find the corresponding elements from the two aspects of technology and humanities to build the Metaverse and make it run smoothly.

3.1. Technology: The blending foundation of the Metaverse

The development of Internet has promoted the information transformation of society. This kind of change makes people have a strong demand for deep-seated interaction, which leads to the emergence of new media devices. When people travel in the Internet ocean with the help of intelligent devices, they not only break through the barrier between virtual and reality, but also change
people’s lifestyle and self-cognition\textsuperscript{17,31,32}. Therefore, technological breakthroughs, including hardware and software, can make the Metaverse explicit from the “possible world” in literature to a “virtual world” that people can see and touch.

The hardware technology construction of Metaverse needs to start from the real world and Metaverse itself. From the perspective of the real world, there needs to be an entrance and exit for the real world to enter and exit the Metaverse, that is, the Metaverse must have a corresponding interface with the real world. From the perspective of Metaverse itself, huge hardware equipment is also needed to support the operation of Metaverse. For the interface of Metaverse, extended reality (XR) is a typical representative. This technology includes virtual reality (VR), mixed reality (MR) and augmented reality (AR)\textsuperscript{33,34}. Bowman et al.\textsuperscript{35} believe that augmented reality technology is an important manifestation of social virtualization, in which immersion, interaction and imagination are the main characteristics of augmented reality technology. Interface technology is not only extended reality technology, but also the emergence and development of brain computer interface technology can provide people with additional access to the Metaverse. Secondly, in order to meet the needs of the operation of the Metaverse itself, digital and intelligent equipment technology is indispensable. Therefore, the requirements for computer hardware technology are increasing day by day: high-end chip manufacturing technology, display hardware technology (graphics card), data storage device technology, etc. Are all important equipment technologies for the construction of Metaverse development? In the Metaverse, in order to realize people’s deep interaction, relevant technologies for communication are also very necessary, including 5 g (or even 6 g) technology, cloud technology, communication equipment technology, etc. To sum up, these kinds of hardware technologies jointly build the material foundation of the Metaverse.

The operation of the virtual world inside the Metaverse requires both a strong material foundation and strong software technology\textsuperscript{36–40}. For example, the gradual improvement of people’s interaction requirements will promote the continuous development of artificial intelligence technology. In the Metaverse, artificial intelligence is a highly intelligent software technology, which can always meet people’s increasing interaction needs. The development of digital assets also puts forward higher requirements for new encryption technology. The development of block-chain technology can not only ensure the security of digital assets, but also ensure the security of normal digital asset transactions (smart contracts). Similarly, the development of graphics and image technology not only reproduces the real world better, but also makes people have a more profound immersion experience in the Metaverse, and promotes the development of virtual civilization in the Metaverse.

To sum up, the construction of the Metaverse requires technology to provide an interface to facilitate people’s access, and technology to provide strong support for its normal operation. In particular, the development of software technology blends with the virtual society with rich humanity, which determines the emergence and development of virtual civilization in the Metaverse.

3.2. Humanity: The civilized foundation of constructing the Metaverse

In order to integrate and build the civilization foundation of the whole Metaverse, people need to rely on digital avatars digital avatar, British avatar, originally refers to people’s animation or personal character in the field of computing. From a certain point of view, digital avatar is the product of people’s identity virtualization in the real world and the extension and mapping of people’s real identity in the virtual world, which also makes digital avatar become people’s “second identity”\textsuperscript{17,41}. The emergence of digital avatars enables people to complete interaction in the virtual world. Girvan\textsuperscript{1} believes that the residents
of the virtual world are digital avatars, which mediate our experience of this space and promote us to share our common understanding of the world with others.

Specifically, the virtual world is a world composed of “people”, but in this world, “people” are not specific people, but virtual “people”, which are digital doubles. With the help of digital avatars, physical people can participate in activities in the virtual world, such as walking, running, jumping and even flying in the virtual world, and use digital avatars to explore the virtual world and interact with the environment in the virtual world. Moreover, digital avatars can also enable people to interact with others. Digital avatars are of great significance to the virtual world. Only with the help of digital avatars can people realize a series of interactions between people and machines, people and people.

Through the above analysis, it can be judged that the digital avatar is the aboriginal of the virtual world. Similarly, in the Metaverse, the role of digital avatars is also very important. With the help of the second identity formed by digital avatars, people can map real activities into the Metaverse, to shape the virtual civilization in the Metaverse. The evolution process of virtual civilization in the Metaverse is very similar to that, but it forms faster due to the highly developed information technology. With the help of digital avatars, people have completed the interaction with the virtual world. In the virtual world, digital avatars give real people a second identity, and people gather with the help of the second identity to form a virtual community. With the continuous expansion of the scale of the virtual community, the unique rules and regulations in line with the community have been formed, and then the corresponding social system has been formed. The “meta social” in the universe is a strong symbol of the formation of “meta social” in the universe.

In the formation of virtual civilization, people not only use digital avatars to participate in and promote the formation of the whole civilization, but also need to formulate the operation rules of the Metaverse in reality. From the perspective of the virtual world currently existing in literature and games, the Metaverse must have its own operating rules in order to maintain its normal operation\(^{20,42}\). In order to maintain the operation of the whole Metaverse, people must make a complete “world outlook setting” like that in literature: depict the operation logic of the whole virtual world through words, otherwise it will lead to the collapse of the virtual world. At present, the research on the virtual world reveals the operation logic of the virtual world, that is, the creator of the virtual world can make the virtual world have a unique “sociality” through words\(^{43}\). This original “sociality” can evolve into “culture” or even “civilization” through the continuous renewal of the world by the creator and the recreation of readers. Therefore, whether it is the possible world at the literary level, the virtual world in the Internet era, or even the real world, social rules with humanistic nature need to be contained in it to maintain its normal operation.

To sum up, in addition to the ability to build a complete virtual world, people need to have a more powerful ability to think about the universe. By using digital avatars to build people’s second identity in the Metaverse, people use digital avatars to build the “sociality” of the Metaverse, to shape the virtual civilization in the Metaverse step by step. This virtual civilization is different from reality, but it is also an extension and subsidiary of human social civilization. It serves the real social civilization and blends with the real civilization. Therefore, humanity has become the civilization foundation of the Metaverse by building the operation rules of society in the whole Metaverse.

3.3. Construction basis of Metaverse

Based on the above analysis, this paper obtains the construction basis of the Metaverse, as shown in Figure 2.
Changes in technology and civilization—A conceptual study of the Metaverse

Specifically, the construction of Metaverse needs to start from two aspects: technology and humanities. Among them, from a technical point of view, hardware technology and software technology constitute the material bottom layer to realize the Metaverse. Moreover, hardware technology and software technology influence each other. Hardware technology provides people with the key to open the door of the Metaverse, so that people can really feel the Metaverse, while software technology stipulates and improves the operation logic and rules of the Metaverse.

Technology is the bottom material support of the Metaverse. Without technology, people cannot reach the Metaverse and the Metaverse cannot appear. From the perspective of humanities, the development of society and humanities in the Metaverse needs strong technical support. Moreover, in the Metaverse, people communicate with people and the environment through digital avatars, forming a virtual society. When the virtual society is mature and stable, it will form a virtual civilization. Virtual civilization includes mature political system, economic system and cultural system. The continuous development of humanistic Foundation in the Metaverse will in turn affect the technological development related to the Metaverse and point out the development trend and direction of technology in the future. Therefore, technology and humanities blend in two directions to jointly build a Metaverse.

4. Characteristics of the Metaverse

Through the above analysis of the background and construction basis of the Metaverse, we can see that the Metaverse should have the following two main characteristics: blending and civilization. Among them, blending is refined from the perspective of technology, while civilization is refined from the perspective of humanities. It should be clear that civilization should be the most important feature of the Metaverse and the core of its characteristics. The reason why the Metaverse is different from the current virtual world is that the Metaverse has its own relatively independent civilization. Compared with civilization, blending is its foundation. As discussed above, although the Metaverse is different from the current virtual world, the virtual world is still the basis of the Metaverse. Therefore, the cosmopolitan characteristics of the virtual world are the fundamental cornerstone for building the two characteristics of the Metaverse.
4.1. Blending

It is concluded that the development trend of the Internet is the deepening user interaction. At present, the development of technology is constantly improving people’s interaction, both with people and the surrounding environment. Therefore, it can be seen that the driving force of the development of media technology is the continuous improvement of people’s interaction requirements. The emergence of the Metaverse must rely on powerful interaction technology. However, the relationship between the Metaverse and the real world is not just a simple interaction, but should have a stronger “Interaction & Merge” feature. This blending is reflected in that the Metaverse can be integrated into the real world from all aspects, to change the real world (for example, digital twins and digital mainline have appeared in advanced digital manufacturing industry). However, as an artificial virtual world, the Metaverse should be attached to the current real world. Although the development of the internet continues to promote the increasing digitization and virtualization of the real world, and the emergence of the Metaverse is the ultimate product of the virtualization of the real world, it does not mean that the Metaverse is another independent system completely independent of the real world and controlled by technology and algorithms.

On this basis, we believe that the blending of the Metaverse includes the following four aspects. The first is construction since digital avatars are the aborigines of the Metaverse, and digital avatars are the second personality (virtual personality) formed by real people as individuals in the virtual space, if the Metaverse wants to develop its own unique civilization, all digital avatars must participate in the construction of the Metaverse, so as to form a large number of humanistic achievements and civilization. The strong interaction brought by the development of media technology also promotes people to constantly interact, transform and build with people and the surrounding environment in the Metaverse second, timeliness judging from the current development trend of internet technology, these technologies continue to drive people to connect to the internet more conveniently and quickly. It can be inferred from this that, as a highly developed internet virtual society, the Metaverse must have the characteristics of immediacy, that is, people can enter and leave the Metaverse through convenient equipment anytime and anywhere. The third is immersion although the Metaverse is a virtual world, its powerful immersion will make people have a strong sense of presence and authenticity, and make people feel that their personality is completely integrated with the digital avatar. Therefore, the Metaverse is bound to present a situation of “true and false” Fourth, service although the emergence of the Metaverse is the ultimate product of the complete virtualization of the real world, it does not mean that the emergence of the Metaverse is a subversion of the real world. The fundamental purpose of the powerful blending brought by the yuan universe is to serve the real society and promote the more convenient development of the real society. Therefore, the blending characteristics of the Metaverse must contain service content, that is, serving the real society.

4.2. Civilization

Civilization is generally interpreted as “the living habits of species and all derivatives extended”. The spark generated by the interweaving and collision of biological form, social form and environmental ecology is “civilization”. Although most scholars have made corresponding explanations for human civilization human civilization must relate to human activities and is the product of human interaction with the surrounding. Since the Metaverse is relatively independent of the real world and contains many human activities, the Metaverse should be civilized.

Through relevant research, the Metaverse is not equivalent to the current virtual world. However, the Metaverse is above the virtual world
Changes in technology and civilization—A conceptual study of the Metaverse

and is a highly developed virtual world. Compared with the current virtual world, the biggest difference between the Metaverse and the virtual world is that the Metaverse has a virtual civilization that originates from reality, relies on reality but is independent of reality. This civilized system has its own complete political system, economic system and cultural system. The humanistic attribute of the Metaverse is very strong, and its civilization is generated by the joint construction, development, and evolution of digital avatars.

This civilization includes the following aspects. First, virtualization. Since the Metaverse is a virtual world constructed by people above reality, the civilization extended in this world must be a virtual civilization. This virtuality is the product of the extension of the civilization system in the real world, with strong simulation characteristics. Second, attaching attributes. The essence of the Metaverse is the virtual world created by human beings. The development of media technology makes the world gradually go from implicit to explicit. However, the Metaverse is the product of human real activities after all. Although the Metaverse will be produced by digital avatars and has a civilization system relatively independent of reality, this civilization system is still an extension of the real civilization system. Therefore, the virtual civilization in the Metaverse is not completely independent of the real civilization system, but a subsidiary of the real civilization and a civilization system serving the real civilization. Third, independence. Although the virtual civilization existing in the Metaverse is an appendage of real civilization, since the Metaverse is relatively independent of the real world, its endogenous civilization system should also be relatively independent. This independence is reflected in the virtual civilization in the Metaverse, which has the characteristics that are obviously different from the real human civilization system. At the same time, to some extent, it can operate itself in a closed environment without too much interference from the outside world. The fourth point is unity. Metaverse is a virtual world built by human beings from scratch through technology and imagination. Due to the development of media technology, the world should not be fragmented, but unified. The real-time interaction of media technology enables the real “global village” to be truly realized in the Metaverse. Therefore, the endogenous virtual civilization in the Metaverse should also have the same characteristics of unity as the Metaverse, that is, there are no regional and ethnic differences.

Figure 3. Characteristics of the Metaverse.
To sum up, the Metaverse is mainly characterized by civilization and blending, and civilization includes four contents virtuality, subsidiary attribute, independence and unity; blending includes co-construction, immediacy, immersion and service. The virtual world is the foundation of the Metaverse, and its worldwide characteristics are the cornerstone of the two characteristics of the Metaverse. The characteristics of the Metaverse are shown in Figure 3.

5. The influence of the Metaverse: Industry driven, guidance and change

The impact of yuan cosmos on the industry is mainly in two aspects: the first is the impact on the current situation of the industry, and the second is the impact on the future of the industry. Among them, the construction conditions of the Metaverse are summarized above. In order to make the Metaverse appear, the construction of the Metaverse determines the impact of the Metaverse on the current situation of the industry. The impact of Metaverse on the current situation of the industry is mainly to accelerate the development of relevant industries, which can be embodied in the relevant industries that can build Metaverse, including the corresponding hardware equipment manufacturing industry and software technology development industry. After the emergence of Metaverse, the impact on the future development of the industry mainly focuses on the application of Metaverse. Furthermore, the development trend of the future industry needs to be judged through the characteristics of the Metaverse. Specifically, the Metaverse has two characteristics of “blending” and “civilization” extracted from the perspectives of “technology” and “humanities”, which determine how people use the Metaverse. Therefore, the research and judgment on the future development of the industry should also focus on these two characteristics: on the one hand, it shapes the future technology and on the other hand, it shapes the future society. Figure 4 shows the industrial impact of Metaverse.

5.1. Impact on the current situation of the industry: The construction of the Metaverse

The construction of the Metaverse reflects the impact of the Metaverse on the current situation of the industry. In order to make the Metaverse appear in advance, with the massive inflow of capital, related industries will develop rapidly. From the previous discussion, we can see that the Metaverse is independent of the real world and has its own relatively independent virtual space. Therefore, the
Changes in technology and civilization—A conceptual study of the Metaverse

impact of the Metaverse on the current industry mainly includes two aspects: the first is to promote the development of the interface industry of the Metaverse, that is, how to enter and exit the Metaverse through hardware equipment; The second is to promote the industrial development of shaping the Metaverse, including hardware equipment manufacturing industry and software technology development industry.

In terms of the impact on the interface industry of Metaverse, the technical equipment conditions at this stage cannot allow people to easily enter and leave the Metaverse at anytime and anywhere. Therefore, the proposal of Metaverse has an impact on the interface industry mainly to promote the development of the interface equipment manufacturing industry. In order to meet the needs of people to enter and leave the Metaverse anytime and anywhere, relevant industries need to be able to produce convenient and timely interface equipment, such as optimizing the current extended reality equipment and strengthening the invention and manufacturing of immersive equipment (brain computer interface, etc.). Moreover, for the Metaverse itself, its proposal also promotes the emergence and development of the industry shaping the Metaverse. Specifically, in terms of hardware facilities,

The machinery and equipment that can support Metaverse are needed, including but not limited to the following industries: intelligent computing equipment manufacturing industry, instant messaging industry, display equipment industry, development of these industries provides strong support for the construction of Metaverse in terms of equipment. In order to meet the needs of the formation and development of virtual civilization in the Metaverse, the development of relevant software technology development industries will also accelerate, such as blockchain industry, artificial intelligence industry, and related audio-visual technology industries. Their development can accelerate the shaping of the Metaverse.

Finally, the influence of Metaverse on current industries will accelerate the emergence of some future industries related to Metaverse. In other words, with the emergence of the Metaverse, the current impact of the Metaverse on the current situation of the industry will relate to the development direction of the industry in the future.

5.2. Impact on the future of the industry the application of Metaverse

The emergence of Metaverse is the end of the development of the Internet. Therefore, the impact of Metaverse on the future development of the industry is mainly focused on the application of Metaverse. Based on this, starting from the characteristics of the Metaverse, this paper briefly analyzes the impact of the application of the Metaverse on the future development of the industry, and summarizes the changes brought by the Metaverse to the future industrial development.

Impact of blending: Primary and secondary industries

The Metaverse is a completely virtual space created by digital information technology. This space can correspond to reality one by one or be completely overhead. The blending characteristics of the Metaverse determine that the possible changes brought by the Metaverse to the primary and secondary industries are: the continuous blending between virtual and reality.

Although the Metaverse has not yet appeared, the emergence of “digital twin technology” and “digital mainline technology” in the Metaverse has a great impact on the industry producing tangible products. With the continuous explicit of the Metaverse, people can map reality into the virtual space through “digital twin technology” and “digital mainline technology”, and build models and simulate reality at the same time, so as to realize the guidance of production\[^{47,48}\]. Digital twin technology, English “digital twin”, was first proposed by Professor grieves during product lifecycle management (PLM) at the University of
Michigan. At that time, it was called “mirror space model”[49]. Subsequently, NASA first used the concept of “digital twins” in the 2010 space technology roadmap[50]. After years of research, academia and the industry agree that digital twin refers to “simulating a physical entity, process or content within an information platform”[51]. It can be seen from this that the emergence of digital twin technology is the result of the integration of virtual and reality, and then extends the digital main line technology. Digital thread technology, English “digital thread”, originated from aerospace. Its definition is relatively clear, which is given by the US Air Force collaborative working group in cooperation with the industry. They pointed out that “digital mainline is an extensible and configurable enterprise level analysis framework. Based on the template of digital system model, it seamlessly accelerates the interaction of authoritative data, information and knowledge in the enterprise ‘data information knowledge’ system, and provides decision-makers with information of the whole product life cycle by providing the ability to access, integrate different data and convert them into operable information”[52]. In short, digital twin technology reproduces reality into virtual space, while digital mainline technology achieves the purpose of guiding real specific production activities through the simulation and analysis of the mapping of real objects in virtual space. The above-mentioned “twin industry” is the main line of “digital production”, which has an important impact on the integration of tangible products.

Therefore, the emergence of Metaverse will directly improve and change the production mode of primary and secondary industries in an all-round way. Due to the strong “blending” of the Metaverse, people’s production activities can be fully interconnected between virtual and reality in the future. It can be inferred that the emergence of Metaverse will not only subvert the product production process within the primary and secondary industries, but also promote a series of industries serving this new mode of production (including hardware and software). The emergence of the Metaverse will enable people to accurately simulate reality and deduce the development of reality in the Metaverse, to better guide and transform reality.

**Impact of civilization: Tertiary Industry**

The civilized characteristics of the Metaverse determine that the Metaverse may bring a new tertiary industry. Since human beings are higher intelligent creatures and their civilization is also the product of high intelligence, the “virtual civilization” in the Metaverse should also have the characteristics of high intelligence. Therefore, the impact of meta cosmic civilization on the tertiary industry should be to fully digitize and intellectualize the tertiary industry.

Specifically, the development of the tertiary industry has been affected by the Metaverse. For example, the emergence of “digital assets”. Meyer[53] first proposed digital assets, and Toyger et al.[54] believed that “in essence, digital assets have data ownership in binary form and are generated and stored in computers, smart phones, digital media or cloud devices.” The emergence of digital assets marks the gradual virtualization of assets. It can be imagined that future assets may not exist in the form of real entities, but in the form of digital simulation in the Metaverse. In the current music and record industry, singers hold concerts online more and more frequently. With the emergence of Metaverse, this kind of concert held in online space can enable people to enjoy the same concert as reality without difference. With the continuous development of artificial intelligence technology, people can use computer technology to create realistic “virtual idols” and a series of characters that do not exist in the real world.

Therefore, based on the above analysis, the civilization of the Metaverse will make the tertiary industry completely digital and intelligent. In the Metaverse, the tertiary industry will be presented to people in another form in the future. People can enjoy the same services as in reality, can use digital
avatars to serve others, and can also enjoy the services brought by other digital avatars. The emergence of virtual civilization in the Metaverse will bring a new tertiary industry, which is bound to have a revolutionary impact on reality.

**Industry wide reform**

The emergence and application of Metaverse will have an impact on the future of the industry. The emergence of the Metaverse is the reconstruction of the whole social form, which is bound to subvert the current human cognition and understanding of society. After the emergence of Metaverse, the application of Metaverse will also permeate all walks of life. Since the primary and secondary industries are the infrastructure of the tertiary industry, the transformation of the primary and secondary industries will also affect the form and development of the tertiary industry; the highly digital and intelligent tertiary industry is the “superstructure” of the primary and secondary industries, which is bound to promote the reform of the primary and secondary industries. The emergence of Metaverse will reshape the new whole industry development logic from the bottom, guide and comprehensively drive the coordinated development of the whole industry, and then bring all-round linkage reform.

6. Conclusions

Science fiction can indeed show the future development direction of mankind to some extent: in 1865, Jules Gabriel Verne published a sensational science fiction novel from earth to moon at that time, in which three Americans were launched into space with cannons. In the novel, the “lunar shell” carried by these three people is called “Columbia”, which weighs slightly less than 20,000 pounds and costs about $5.5 million. 100 years later, the United States really used “Columbia” to send three astronauts to the moon Science fiction’s imagination of the future subverts people’s inherent cognition of the world all the time, and so does the Metaverse.

Although the proposal of new things will always experience some sharp criticism, from the current development trend of society and technology, the emergence of the Metaverse is not far ahead. In the development of the Internet, with the function center gradually changing from information to adults, people’s increasing requirements for interaction have driven the continuous progress of media technology and the continuous transformation of the form of human society. The development of human society will also accelerate the continuous iteration of technology. The establishment of this development cycle allows people to predict the form of future society. The proposal of Metaverse is not only a prediction and imagination of the future social form, but also an all-round reflection on the current social form. The proposal, construction and application of Metaverse is bound to change the whole industry and guide the future industrial development direction. There is no doubt that the emergence of new things is always accompanied by unpredictable risks. The in-depth development of the Internet has accelerated the process of social informatization and virtualization. The emergence of the Metaverse is bound to completely change the operation logic of the whole society, break through people’s current cognition and bring some uncertainty. The lack of people’s sense of control over the future will stimulate people’s fear of the unknown and lead to panic about the uncertainty of the future. However, we ca not blindly suppress and criticize new things because of this panic. We always must embrace this uncertain future. No matter whether the Metaverse can successfully appear in the future or not, the current trend of social virtualization brought about by the development of the Internet is worth us to deeply reflect on the development of the whole industry, the development of the whole society, and then the future of mankind - the proposal of the Metaverse is precisely the starting point of this reflection process.
Conflict of interest

The authors declare no conflict of interest.

References

1. Girvan C. What is a virtual world? Definition and classification. Educational Technology Research and Development 2018; 66(05): 1087–1100.
2. Sparkes M. What is a metaverse. New Scientist 2021; 251(3348): 18.
3. Yu G. The evolution logic of future media: The iteration, reorganization and sublimation of “human connection”—From the “age of context” to the “Metaverse” to the future of the “mental world”. Journalism and Mass Communication 2021; (10): 54–60.
4. Stephenson N. Snow crash: A novel. New York: Spectra; 2003.
5. Hendler J. Web 3.0 emerging. Computer 2009; 42(01): 111–113.
6. Lassila O, Hendler J. Embracing “Web 3.0”. IEEE Internet Computing 2007; 11(03): 90–93.
7. Fuchs C, Hofkirchner W, Schafranek M, et al. Theoretical foundations of the web: Cognition, communication, and co-operation. Towards an understanding of Web 1.0, 2.0, 3.0. Future Internet 2010; 2(01): 41–59.
8. Barassi V, Treré E. Does Web 3.0 come after Web 2.0? Deconstructing theoretical assumptions through practice. New Media & Society 2012; 14(08): 1269–1285.
9. Tim OR. What is Web 2.0? Design patterns and business models for the next generation of software. Communications & Strategies 2007; 1: 17–38.
10. Murugesan S. Understanding Web 2.0. IT Professional 2007; 9(04): 34–41.
11. Nupur C. World wide web and its journey from web 1.0 to web 4.0. International Journal of Computer Science and Information Technologies 2014; 5(06): 8096–8100.
12. Gao G. Wulianwang he Web 3.0: Jishu geming yu shehui biange de jiaodie yanjin (Chinese) [The new spirit of reason and cultural poetics]. Southeast Academic Research 2002; (02): 45–47.
13. Bureau of Compilation of the Works of Marxist-Leninist of the CPC Central Committee. Makesi Engesi xuaniu (Chinese) [Selected works of Marx and Engels]. China: People’s Publishing House; 1995.
14. Winston B. Media technology and society: A history from the telegraph to the Internet. London: Routledge; 1998.
15. Williams D. The video game lightning rod. Information Communication and Society 2003; 6(04): 523–550.
16. McLuhan M. Understanding media: The extensions of man. He D (translator). China: The Commercial Press; 2000.
17. Messinger PR, Stroulia E, Lyons K, et al. Virtual worlds—Past, present and future: New directions in social computing. Decision Support Systems 2009; 47(3): 204–228.
18. Ronen R. Possible worlds in literary theory. Cambridge: Cambridge University Press; 1994.
19. Doležel L. Possible worlds of fiction and history. New Literary History 1988; 29(04): 785–809.
20. Feng M. “Keneng shijie” gainian de jiben hanyi (Chinese) [The basic meaning of the concept of “possible world”]. Journal of East China Normal University (Humanities and Social Sciences) 1995; (06): 31–37.
21. Zhao G, Yi H, Xu Y. Yuanyuzhou: Hulianwang de weilai jiushi yuanyuzhou (Chinese) [Metaverse: The future of the Internet is the Metaverse]. 1st ed. Beijing: China Translation & Publishing House; 2021.
22. Zhang J. Keneng shijie shi shenme? (Chinese) [What is the possible world?]. Philosophical Trends 2002; (08): 12–17.
23. Zhao Y. Accessibility among the three worlds: Using possible theory to explain the relationship between fiction and reality. Journal of Lanzhou University (Social Sciences) 2013; 41(02): 1–7.
24. Burt RS. Network-related personality and the agency question: Multirole evidence from a virtual world. American Journal of Sociology 2012; 118(03): 543–591.
25. Xiong M. Reading multi-themes in a mercy: A cognitive approach. Contemporary Foreign Literature 2011; 32(04): 11–23.
26. He D. Meijie ji wenhua—McLuhan meijie lilun piping (Chinese) [McLuhan’s media theory]. Modern Communication (Journal of Communication University of China) 2000; (06): 25–31.
27. Stockwell P. Cognitive poetics: An introduction. London: Routledge; 2019.
28. Tong Q. Xin lixing jingshen yu wenhua shixue (Chinese) [New spirit of reason and cultural poetics]. Modern Communication (Journal of Communication University of China) 2000; (06): 25–31.
29. Poole S. Trigger happy: Videogames and the entertainment revolution. New York: Arcade Publishing; 2004.
30. Schwarz A, Schwarz C, Jung Y, et al. Towards an understanding of assimilation in virtual worlds: the 3C approach. European Journal of Information Systems 2012; 21(03): 303–320.
31. Moore MG. Three types of interaction. American Journal of Distance Education 1993; 3(02): 1–7.
32. Pike WA, Stasko J, Chang R, et al. The science of interaction. Information Visualization 2009; 8(04): 263–274.
33. Çöltekin A, Lochhead I, Madden M, et al. Extended
Changes in technology and civilization—A conceptual study of the Metaverse

reality in spatial sciences: A review of research challenges and future directions. ISPRS International Journal of Geo-Information 2020; 9(07): 439.
34. Burton N, Schlieeman T. User response to extended reality sponsorship activations on social media: Exploring impressions of gopro’s use of 360° video in marketing. Journal of Interactive Advertising 2021; 21(02): 93–107.
35. Bowman DA, McMahan RP. Virtual reality: How much immersion is enough? Computer 2007; 40(07): 36–43.
36. Targowski AS. Informing systems as the transformers of information wave into virtual civilization and their ethics question. Informing science: The International Journal of An Emerging Transdiscipline 2015; 18: 177–204.
37. Targowski AS. Virtual civilization in the 21st century. New York: Nova Science Publishers; 2015.
38. Russell S. Artificial intelligence: The future is super intelligent. Nature 2017; 548(7669): 520–521.
39. Yuan Y, Wang F. Blockchain: The state of the art and future trends. Acta Automatica Sinica 2016; 42(04): 481–494.
40. Shao Q, Jin C, Zhang Z, et al. Blockchain: Architecture and research progress. Chinese Journal of Computers 2018; 41(05): 969–988.
41. Suh KS, Kim H, Suh EK. What if your avatar looks like you? Dual-congruity perspectives for avatar use. Mis Quarterly 2011; 35(3): 711–729.
42. Chaturvedi AR, Dolk DR, Drnevich PL. Design principles for virtual worlds. Mis Quarterly 2011; 35(3): 673–684.
43. Woolgar S (editor). Virtual society: Technology, cyberbole, reality. Oxford: OUP Oxford; 2002.
44. Huntington E. Civilization and climate. New Haven: Yale University Press; 1924.
45. Mumford L. Technics and civilization. Chicago: University of Chicago Press; 2010.
46. Freud S. Civilization and its discontents. Canada: Broadview Press; 2015.
47. Tao F, Zhang H, Liu A, et al. Digital twin in industry: State-of-the-art. Transactions on Industrial Informatics 2018; 15(4): 2405–2415.
48. Bonnard R, Hascoët JY, Mognol P. Data model for additive manufacturing digital thread: State of the art and perspectives. International Journal of Computer Integrated Manufacturing 2019; 32(12): 1170–1191.
49. Grieves MW. Product lifecycle management: The new paradigm for enterprises. International Journal of Product Development 2005; 2(1–2): 71–84.
50. Piascik R, Vickers J, Lowry D, et al. Technology area 12: Materials, structures, mechanical systems, and manufacturing road map. New York: NASA Office of Chief Technologist; 2010. p. 15–88.
51. Liu D, Guo K, Wang B, et al. Summary and perspective survey on digital twin technology. Chinese Journal of Scientific Instrument 2018; 39(11): 1–10.
52. Liu T, Zhang J. Preliminary discussion on application of digital thread to aero engine. Aerospace Power 2021; (02): 30–34.
53. Meyer H. Tips for safeguarding your digital assets. Computers & Security 1996; 15(7): 588.
54. Toygar A, Rohm Jr CE, Zhu J. A new asset type: Digital assets. Journal of International Technology and Information Management 2013; 22(4): 7.