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A Study on the Future Prospect of the Metaverse through Human Cognition

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Abstract

This study measures the current preference and future technological development potential in the four areas of the metaverse(augmented reality, lifelogging, mirror world, and virtual reality). Based on previous research, detailed measurement variables in 4 areas were set. An online survey was conducted with 105 people, and negative/positive factors were derived by drawing a scatterplot by examining future technology development possibilities on the x-axis and current preferences on the y-axis using IBM SPSS version 20. In particular, lifelogging improvement needs to supplement privacy, and the mirror world needs convenience improvement that can reduce time and effort compared to offline. Through this study, we hope to utilize detailed measurement variables that can suggest factors for improvement and advancement for the continuous growth of the metaverse.

요 약

본 연구는 메타버스의 네 가지 영역(증강현실, 라이프로그, 거울세계, 가상현실)에서의 현재 선호도와 미래 기술 발전 잠재력을 측정하였다. 이전 연구를 기반으로 각 영역의 세부 측정 변수가 설정되었다. 105명을 대상으로 온라인 설문조사 후, IBM SPSS 20 버전을 사용하여 미래 기술 발전 가능성을 x축, 현재 선호도를 y축으로 하여 산점도를 작성하여 부정적인/긍정적인 요인을 도출했다. 분석 결과, 증강현실과 가상현실의 미래 전망은 긍정적으로 인식되었다. 그러나 라이프로그와 거울세계는 부정적으로 인식되었다. 특히, 라이프로그 개선은 개인 정보 보호를 보완해야 하며, 거울세계는 오프라인과 비교하여 시간과 노력을 절약할 수 있는 편의성 개선이 필요하다. 본 연구를 통해, 향후 메타버스의 지속적인 성장을 위한 개선과 발전 요인을 제안할 수 있는 세부 측정 변수를 제공하고자 한다.

Keywords

metaverse, human-cognition, IPA, future prospects, technological resistance, technology perception

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Ⅰ. Introduction

Recently, we can see a trend to implement many parts of our daily life into a virtual world. The so-called metaverse is a phenomenon such as augmented reality that converges virtual reality and the real world, and a kind of revolutionary movement that allows many people to see daily life such as Facebook, Instagram, YouTube, etc. through video or text[1]. It's happening. In the mirror world, there are Google Earth, a GPS-based virtual map, and a delivery service, and in virtual reality, avatars that project the ego of a person such as Roblox and Geppetto are those[2]. However, even if these characteristics of the metaverse are present in our daily life, if technology is developed without considering people's perception and orientation, it will eventually remain as a plausible technical term that is not used[3]. We are curious to know what the level of awareness in the four areas of the metaverse is and what the future prospects will be.

It is good to study specific areas of the metaverse, but it is necessary to reexamine whether the direction of such technological progress is correct. In fact, the current metaverse does not reach the level of realizing a virtual world and gathering many people together to realize collective intelligence to solve certain problems or form a consensus[4]. Despite the lack of awareness among people about this metaverse, various studies are being conducted. For example, recently, due to the Corona situation, it was predicted that the metaverse could be used to view digital cultural contents in a non-face-to-face situation[5]. In this way, ordinary people do not need the term metaverse. It is simply defining and classifying a metaverse, and finding ways to improve or use it. In the mirror world, it is also true that it is difficult to find any other perceived value other than the convenience of use. In previous studies, the criteria for dividing the metaverse into four areas and the reasons for it have not been clarified[6].

As various technologies have already developed, it seems to imply content and convenience added to virtual reality. Is there any reality? Are people aware? Is it measurable? It is true that various questions arise. There are many technical terms that appear and disappear for a certain period of time about a technology trend or a certain phenomenon. In 2009, LG Business Insight presented 10 promising future technology keywords[7][8]. Mobility, ethics, regulatory compliance, creation, emotion, substitution, eco-friendly metropolis, human care, global/locality, etc., presented 10 promising technologies in the 2021 MIT Technology Review. The main keywords are as follows. Messenger RNA vaccine, GPT-3, TikTok recommendation algorithm, lithium metal battery, data trust, eco-friendly hydrogen energy, (COVID-19) digital tracking, ultra-precise location information technology, remote era, versatile AI[9]. After 11 years, the promising technology used in the past is no longer a promising technology. A completely different area is presented. An unimaginable future outlook trend is presented. For this reason, in this study, can the metaverse exist even 10 years from now? Continuous research is needed. In order to develop a measurement tool for continuous research, this study will provide a starting point. Although it is true that the metaverse is being used but not recognized[10], it is intended to measure current preferences and future prospects by explaining as much as possible. Finally, by calculating the difference between the current preferences and future prospects in the four areas of the metaverse, we would like to present detailed areas for improvement. What should not be overlooked here is that even if there is a positive perception and prospect, we would like to derive and suggest areas that require advancement for continuous technological progress. Therefore, by presenting the user's perception of the metaverse and the research status of the last 5 years to future researchers, we are trying to find out what areas of focus for future research can realize a level of metaverse that people can recognize.

II. Theoretical Background

Metaverse is a combination of Meta, which means transcendence, and Universe, which means the world[3]. It refers to a transcendent world implemented through connection. Through the development of internal-external technologies and the development of augmented reality-simulation technologies, the technology research group ASF(Acceleration Studies Foundation) divides the Metaverse into four types: Augmented Reality, Life Logging, Mirrors Worlds, and Virtual Worlds(Acceleration Studies Foundation, 20220[11]. Accordingly, this study attempts to measure preference from the perspective of perceived usefulness and ease of users. Metaverse has connectivity that overcomes spatial and temporal limitations. In addition, content scalability based on connectivity is the biggest advantage of it. users can ultimately save time and economic costs through it. According to Web of Science, the world's largest comprehensive academic information database, As of November 1, 2021, a total of 211 publications related to Metaverse have been published[12].

Metaverse is applied to all ecosystems where services are provided, including healthcare, education, entertainment, and commerce. The current research trend on metaverse is mainly about how to apply technology in services in each field. A number of studies deal with how metaverse is applied to education and practice. B. Kye analyzes the application status of metaverse technology in education and derives its possibilities and limitations[13]. The way to promote purchase and create a new market by using metaverse in commercial transactions is a direction that attracts attention from consumer research. B. Shen conducted a consumer behavior study to design virtual commerce applications using metaverse. Research analyzing diversified content and interactions built inside the content through metaverse is also increasing. H. Ning proposed a point of discussion on the present applications and industrial developments of the Metaverse[12]. [14] summarized the method of using Metaverse, focusing on the user's perception of social value. He analyzes how implementation through inference is currently being used in representative metaverse services along with the user's perception method of metaverse. A comprehensive study of Metaverse was conducted by [15]. it is the first case provide to a tutorial on the Metaverse. the authors discuss the Metaverse's role in promoting social good[16].

However, despite the formation of such public opinion, the difference in perception between users will be large. The concept of metaverse has not yet been clearly defined[13]. this is because even among the participants currently using metaverse, there is no recognition as a metaverse user. Therefore, the four areas of the metaverse to be specifically measured are defined and detailed measurement items are derived based on existing studies to derive recognition and preference through a survey. Beyond the general concept, the four areas to be defined in this study are shown in Figure 1.

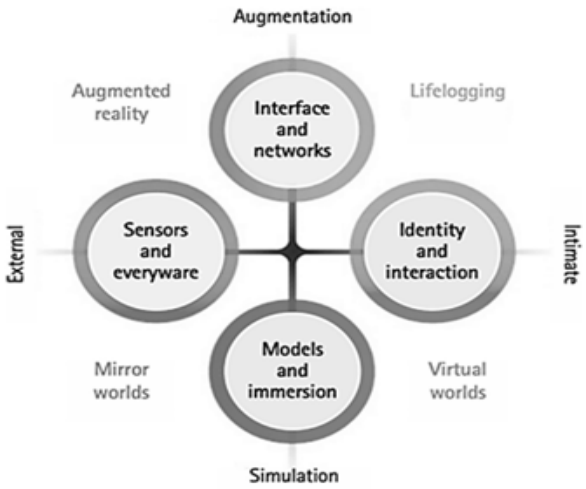

Fig. 1. Four types of metaverse

2.1 Augmented reality

Augmented Reality is a Metaverse that augments a virtual concept on the real physical world. And implements an idea that induces emotions or provides information in real space through a specific medium.A representative example is 'Zepeto', a networking

application that creates personalized avatars based on the user's appearance[17]. Another example is the game 'Pokemon Go', which has not been popularized, but information providing services such as displaying navigation information on the windshield of a car have been developed[18]. The core components of the augmented reality world include virtual images, realism, ease of information acquisition, immersion, and content diversity[19].

2.2 Life logging

Life Logging is a Metaverse that records personal impressions or experiences which encountered by individuals in their daily lives[20]. It supports users to shares the record and interacts with others. Through this procedure, it expands private data to be contented in a vast form or multiple times. Representative examples include 'Twitter', a platform that records personal views, and 'Vlog' of YouTube, which records and posts personal daily life. An example of a representative technical implementation is the service 'Twitter', which was launched to record "I'm drinking coffee now"[21]. The key components of the lifelogging world include daily posting, the immediacy of content creation, a sense of connection between users, the daily life of content, and surrogate satisfaction through other users[22].

2.3 Mirror worlds

Mirror Worlds is a Metaverse that maximizes efficiency and information provision by copying information and structures of the real world[23][24]. It is widely applied to all areas of society based on scalability. Examples of representative technical implementations include ‘WeChat’[25], which supports not only simple service like restaurant and taxi reservations but stock and real estate transactions within one application. WeChat is actually not like Mirror worlds. The reason can be seen by looking at WeChat's features. First of all, WeChat is a service not only used in China, but used all over the world. The main features are chatting and free phone service. However, in addition to these basic functions, WeChat allows users to freely create their own functions when they want to service their own functions through Official Account. You can use banking services, transportation-related reservations, payment of fees, and reservation services for sharing economy. But like Mirror Worlds, it doesn't offer everything in the real world.

Mirror worlds represent the real world in a virtual world. Recently, it refers to an augmented support system that helps decision-making in various fields by simulating with 3D computer graphics on the web. Google Earth is a representative example, and the digital twin can also be called a mirror world. However, WeChat, which connects existing services in various ways, does not provide virtual graphics and cannot reflect all areas. Another example is 'WeChat Universe', which provides transportation, product purchase[26][27], and company reservations all through a single brand, and 'Baedal Minjok (Korean delivery service)', where you can order a variety of menus through a single platform[28]. There are many studies on marketing within the mirror world of the metaverse[29]. The core components of Mirror World include variety of choices, ease of search, convenience of payment, reduction of time and space constraints, and reference of opinions among users.

2.4 Virtual worlds

Virtual Worlds is a Metaverse that provide designs and experiences independently in another world which has time, space, culture, and rules completely distinct from reality[30][31]. However, virtual reality and augmented reality are different. Virtual reality is a virtualization of the real world rather than a combined form of the real world, and augmented reality is an overlapping implementation of virtual reality with the

real world in the background. It induces cooperation and competition among participants. In addition, supporting achievement and relationship formation. An example of a representative technical implementation is 'Roblox'[32], an online game production platform that allows users to create and exchange online games with elements purchased directly through their own currency.

In other words, the virtual world is a technology that independently provides a world in which time, space, culture, and rules that are completely different from reality are applied[33]. Representative examples include mobile and online games. Recently, global companies have conducted marketing targeting the virtual world, and as a result, events such as collaboration items of luxury brands being sold in games[34] or artist performances are increasing. The core components of the virtual world are unreality, new rules, virtual goods, marketing content, and a sense of accomplishment[35].

Table 1. Summary of meta-analysis characteristics

Division	Augmented reality	Lifelogging	Mirror worlds	Virtual reality
Definition	Interactive environment by overlapping virtual 2D and 3D objects in real space	Technologies that capture, store, and share everyday experiences and information about objects and people	Reflect the real world as it is, but provide integrated external environment information	Virtual world built with digital data
Characteristic	Building a smart environment using location-based technology and network	Recording information of objects and people using augmented technology	Utilization of virtual map and modeling GPS technology	Based on interaction activities between avatars in which the user's ego is projected
Utilization field	HUD for Smartphones and Vehicles	Wearable device, black box	Map-based service	Online multiplayer game
Use cases	Pokemon Go, digital textbooks, realistic content	Facebook, Instagram, Apple Watch, Samsung Health, Nike+	Google Earth, Google Maps, Naver Maps, Airbnb	Second Life, Minecraft, Roblox, Jepedo

Tasks	Assignment
Culture and art	Artistic activities and art appreciation such as ultra-realistic virtual performances, contests, two-way communication with large audiences, etc.
Education	Immersive education in the classroom, multi-participation discussions, user's educational content production, transaction, and utilization support
Medical treatment	Digital treatment, non-face-to-face group addiction treatment, rehabilitation exercise guidance
Media	Virtual broadcasting and realistic OTT services conducted by avatars whose movements and facial expressions are synchronized with reality
Creation	Realization of a virtual world in which general users develop metaverse services easily and conveniently, and the ownership and reward system of the developed results operate.
Produce	Optimization of work efficiency, productivity improvement, quality improvement, and safety management through virtualization of production and manufacturing processes and facilities
Office	Provides a realistic office environment that can perform tasks such as online office environment access, video conference, and data sharing
Government	services, public services such as education, society, and welfare

2.5 Definition and application area of metaverse

A summary of the definition and usage examples of the metaverse are shown in Table 2.

If we talk about the utilization of the metaverse in various fields, it is as follows. In Korea, the Ministry of Science and ICT presented a task to develop a metaverse platform in 10 fields in 2022. Metaverse will be used not only in everyday life, but also in the areas of biotechnology, space exploration, climate crisis, and disaster risk in the future.

Table 2. Example of metaverse usage

Tasks	Assignment
Tourism	Purchasing food, clothing and shelter while traveling to tourist attractions such as tourist attractions and museums, or vividly watching local festivals
Life	By realizing major urban centers as a digital mirror world, connecting virtual and real experiences and realizing daily life

2.6 Metaverse market analysis

Looking at the size of the global metaverse market (US$ billion) announced by Markets & Markets for Metaverse(October 2020), the CAGR from 20 to 25 was 35.1% in North America, 34.9% in Europe, 37.8% in Asia Pacific, and 25.9% in other countries. The global metaverse market growth rate is predicted to be 35.5%. The market size for this is shown Table 3.

Table 3. Market size by region worldwide [unit: USD billion]

Year	A	B	C	D	Total
2016	19.92	14.89	4.68	4.68	55.69
2017	30.66	22.81	6.88	6.88	86.67
2018	41.92	30.78	8.96	8.96	119.35
2019	56.52	40.94	11.43	11.43	161.94
2020	74.73	52	14.28	14.28	214.65
2021	108.69	75.37	19.62	19.62	313.79
2022	151.51	105.29	25.69	25.69	493.43
2023	210.04	147.46	33.24	33.25	611.46
2024	273.38	191.71	40.03	40.03	797.05
2025	335.75	232.54	45.21	45.21	972.21
CAGR(%) (20~25)	35.10	34.90	37.80	25.90	35.50

A. North America, B. Europe, C. Asia Pacific, D. Other Countries

The fact that the market size has already been established since 2016 is the result of putting out the R&D concept of a virtual world for the metaverse in "Snow crash" in Neal Stephenson's novel in 1992 and putting it to the market and utilizing it. When looking at the CAGR growth rate from 20 to 205, Asia Pacific is the largest at 37.80%, and North America and Europe are 34.90~35.10%. The growth rate was predicted. However, although the growth of the metaverse continues, people's perception of the metaverse and positive/negative predictions will be different. Also, in fact, we will analyze the research keywords from 2018 to 2022 to examine the diversity of research and whether continuous research is being conducted. Research literature aims to collect and analyze keywords based on published papers in Google Scala. However, there is a limit to keyword collection because it is based on published papers.

However, even if it is a single keyword, it cannot be judged whether the marketability is small or large. Therefore, even if the limitations of keyword collection are taken into account, we want to collect and analyze all keywords.

2.7 Metaverse prospects presented by existing studies

In the Jason et al. (2022) of study, the impact of COVID-19 on the digital-based economy is enormous[36]. In particular, the disruption of offline business models is accelerating.

In this context, a metaverse of virtual blockchains, digital assets and non-fungible tokens (NFTs) is indispensable. After 2022, the following insights are presented on the impact of the metaverse on the real world over the next five years in various sectors such as financial services, automobiles and manufacturing, real estate, education and retail. First of all, in financial services, if NFT develops together in Metaverse, it will give financial service companies a huge growth opportunity. Looking forward to the next

five years, the entire user-generated ecosystem will be built in which the metaverse will create a virtual society in which transactions and participation are performed in a decentralized manner. Ecosystem here refers to the development of a virtual physical repayment and financial system that underpins payments and financing. NFTs will provide users with digital ownership and a new class of access for transactions[37]. The sophistication of AR and VR narrows the gap between on/offline and induces more participation in financial services, eventually leading to the convergence of traditional financial services and a new era of innovation.

Traditional financial services companies already believe in the potential of Metaverse. For example, “Eunhae” in Asia has created a virtual space for branding, education and product development. In addition, Universal Bank is using Metaverse for training and education for both internal stakeholders and external customers. Paying players are actively developing crypto proposals and partnerships to maximize their position on the metaverse. Therefore, it is said that the integration of Metaverse and financial services is a matter of "when", not "if".

In the automotive and manufacturing sectors, the combination of VR, AR and MR will make the automobile manufacturing industry deeply rooted in the metaverse[38].In the industrial metaverse, this is possible by organically integrating cyber-physical systems. For example, digital twins, 5G-based AR, VR and AI computer vision, low-latency remote control and convergence of applications. Through the industrial metaverse, we will use AR and VR for on-site auxiliary installations in factories or for technical training, as well as creating immersive virtual experiences where people work together in a virtual world. You will be guided by AI to view results and correct errors in real time without the need to be on site[39]. In addition, the company's product design, development process, prototyping testing, operations management, marketing and other operations will be verified with simulations first within a virtual community. The failure rate can be reduced if it is determined that it is possible to proceed to production. Through blockchain, other applications record decisions and results as the basis for evaluation and auditing in both virtual and physical worlds[40].

In the automotive industry, the automobile has evolved into a mobile space that integrates simple mobility tasks, entertainment and other functions. Autonomous driving will do work for the driver, allowing you to enjoy an entertainment experience instead of driving.

Metaverse utilizes AR and VR of cars layered on existing technologies such as smart cockpit, voice recognition, and AI[41]. Virtual cars are built on the metaverse and mapped to real cars, regardless of whether the driver is using the car in the real or virtual world. Driving behavior, skill upgrades, modification preferences and the corresponding data generated will be shared between the two dimensions to ensure a seamless experience.

In real estate, it becomes an asset in the real world, but it is questionable whether the value of real estate assets can be the same in the metaverse[42]. However, it is expected that the metaverse will reflect and adopt the characteristics of the real world, and the concept of supply and demand for virtual land will affect the value and price of real estate. Many foreign celebrities have even created virtual real estate investments that have sparked heated debates. However, in the case of China, due to differences in understanding and perception of the metaverse, it may not attract as much attention as in the West. The metaverse tends to reflect a reasonably quantifiable physical world rooted primarily in Western ideology and culture. Therefore, investment in virtual land and real estate in China is still speculative and risky. Because of this concept, it is impossible to predict whether price movements will be safe as they gain popularity, or whether they will

continue to surge or plummet[43].

With the accumulation of distance education experience, the campus digital twin has already improved a lot. It is predicted that Metaverse will naturally lead spatial changes throughout the education industry over the next five years[44]. The search for knowledge is no longer limited to words, images and lectures delivered on-demand, but is restructured to include immersive experiences with digital records in the metaverse. Education in the metaverse era will not be a realistic learning experience, but a natural experimental playground[45]. Through the establishment of a standard framework for creating a collaborative and shared digital ecosystem, Metaverse will realize the sharing of high-quality educational resources[46] around the world and benefit a broad audience of all ages and social classes to realize true education. Companies that have started entering the metaverse will show immersive experiences, helping limitless possibilities of future learning. With the already declared “best player” focused on the education sector, opening the limitless possibilities of learning in the metaverse. It will be a matter of time.

[36] predicted the role of metaverse in the relationship between retail and consumer brands in the next five years of metaverse. First of all, the brand approach has been continuously improved to make it easier and more convenient for consumers. From the early days of website building, to embracing e-commerce, opening social media accounts, to live broadcasting, Metaverse now offers new concepts for brands to experiment with. In fact, the prevalence and increasing importance of virtual characters or avatars have recently provided various business opportunities in the retail sector[47].

The possibilities are endless by creating experiences such as clothing, daily necessities, vehicle test drives, and browsing in virtual stores. The game The Sims 4, for example, already provides insight into the metaverse. Consumer brands are actively working with game developers to embed products into every aspect of their games. Since its launch in 2014, consumer brands have enabled gamers to interact with brands in the virtual world to increase brand awareness and increase brand awareness. We have released an item expansion pack that can increase brand love. Brands organize or engage in activities that go beyond product marketing and interact with consumers. Metaverse has become a playground for luxury fashion brands in particular[48][49]. Some have launched new collections in virtual worlds, while others have worked with developers to create their own custom games. In the near future, more brands will blur the lines between virtual and real, creating more innovative and meaningful interactions with consumers.

III. Research Methods

3.1 Analysis methods

The future prospects of Metaverse are mostly positively evaluated in various reports, papers, and books. However, is it really positive in people's perception? Specifically, are you looking at the four areas of the metaverse positively: Augmented reality, Virtual worlds, Life logging, and Mirror worlds? There are the 4 metaverse areas which were composed of 20 detailed questions and surveyed. In this study, the Y-axis was set as the present (AS_IS) and the X-axis as the future prospect (TO_BE), and a survey was conducted with 150 people for positive or negative prospects. Through this, the prospects for 20 detailed queries in 4 areas were investigated. In addition to users' metaverse perception, we want to investigate any trends in the research field. This is to see the difference between ordinary people about the metaverse and researchers who study in depth. In addition, I would like to present an objective outlook on the metaverse by summarizing interviews with many people in previous research reports. Therefore,

before giving vague expectations that the four areas of the metaverse will benefit people, I would like to suggest which areas should be developed in a balanced way. This is to suggest the area necessary for the metaverse to become a reality rather than a concept.

3.2 Analysis tools

In recent existing studies, the following analysis tools are used to investigate the perception of the metaverse in the entertainment area[49], the aspect of instructors[50] and learners in the education area[51], and the recognition area of the industrial ecosystem[52]. Most of the detailed queries for the four areas of the metaverse were organized for each area, and the degree of awareness was measured using a 5-point scale. It does not measure the user experience of existing research. In fact, it is still because the metaverse is not universal in our lives. Therefore, it is necessary to make sure that you understand it first rather than the concept. So, in this study, the respondents had time to read and explain the metaverse before surveying the respondents. Also, for easy understanding, we searched the metaverse on YouTube.

3.3 Metaverse human cognition analysis

3.3.1 Measurement metrics

This study compares the difference in preference between the present and the future in the areas of augmented reality, lifelogging, mirror world, and virtual world, and suggests factors to be improved in the future. The preference difference is measured on a 5-point(5 is the highest value) scale, and the X-coordinate for the average value of each element measures the future and the Y-coordinate measures the present preference. The detailed areas of augmented reality are to be measured by virtual image, realism, ease of information acquisition, immersion, and content diversity. For lifelogging, detailed measurement variables were set as daily posts, writing immediacy, sense of connection, daily content, and surrogate satisfaction. The mirror world will examine the perception of selection diversity, search ease, payment convenience, space-time constraint reduction, and opinion reference as measurement variables. In the virtual world, it will be measured with characteristics such as unreality, new rules, virtual goods, marketing content, and sense of achievement.

The analysis tool will analyze with Excel and IBM SPSS version 20, and the analysis menu will present the results of a scatter plot[53][54] of the graph.

3.3.2 Survey respondents

The subjects of the survey measure the metaverse they encounter in their daily life, and they want to measure it without limiting their age, gender, or region. In order to generalize the results of this survey, the statistics of respondents were summarized as data that can be analyzed with the final 105 people. Initially, data from 150 people were collected, but the rest of the data was deleted because there were many parts that could not be answered in the online survey due to a lack of understanding of the metaverse. Among the initial 150 respondents, 45 excluded respondents among the initial 150 respondents were eliminated as follows. First of all, 11 out of 150 participants participated in the survey to check only 1 or 5 on a scale of 1 to 5 among the response items, but were removed as meaningless data. In addition, 13 of them were aware of AR and VR among the four areas of the metaverse, but lacked understanding of Lifelogging and Mirror worlds, so there was a blank in the response. There were also 7 people who denied the term itself for the metaverse. As a result of interviewing 7 people, they questioned why the term metaverse was used. As a result of the

basic explanation of the expansion of the world by connecting the virtual world and the real world, people know VR, AR, and MR. However, it is said that it is not acceptable to conclude the mirror world and lifelogging with the term metaverse. As a result, it was found that they could not recognize the current level of the mirror world and lifelogging, and could not grasp the positive or negative direction for the future. Also, 14 were very aware of the metaverse. However, 14 people were very pessimistic and said that they could not present a positive or negative prospect in the absence of such a present reality in the present as well as in the future. This study aims to reflect these points. The purpose of this study is to first investigate the perception of new technology, rather than querying user experience for new technology like previous studies. As mentioned earlier, it was judged that it was difficult to investigate the general public's perception of the metaverse through a preliminary pilot survey, so a YouTube channel was introduced about the definition, meaning, and utilization of the metaverse, and a questionnaire survey was conducted on the four areas of the metaverse. An explanation was added at the beginning. For this reason, not only a questionnaire but also an interview were conducted to explain the results in detail and to explain the reasons in more detail. Data were collected for 2 weeks, and 20 sub-elements of 4 types of metaverse were queried.

IV. Result

4.1 Metaverse user recognition analysis result

The analysis results for the future orientation of Metaverse are shown in Figure 2 Among the four areas of the metaverse, positive perceptions appeared in augmented reality and the virtual world, but negative perceptions appeared in lifelogging and the mirror world.

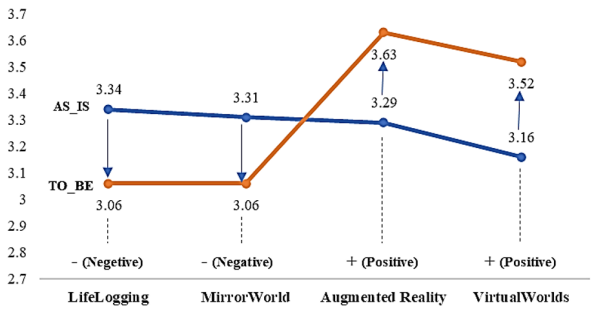

Fig. 2. Metaverse overall change outlook

As a result of conducting interviews and responses to this phenomenon, the virtual world and augmented reality are at a level that users can intuitively recognize, and if improvements in technical aspects and user convenience are made in the future, it will be a positive prospect for the future. On the other hand, lifelogging and mirror world did not have a positive outlook for the future due to insignificant awareness of terms even though users were already using them. In many reports, although the technological evolution of lifelogging and the mirror world is still in progress, it has been revealed through interviews that the term itself is not familiar.

In an interview, I understood when I told users that Facebook, Instagram, wearable devices, and black boxes were lifelogging. The mirror world also reflects the real world, such as delivery service and Google Earth, rather than virtual maps, modeling, and GPS, and implements an informationally expanded virtual world. We had to explain it to understand. In other words, these four types of metaverse are classifications and terms recognized only by scientists or experts in related industries. In order to solve this problem, education and public relations that can raise the current level of awareness are required. In fact, users do not need to know these terms. Obviously, lifelogging and the perception of the mirror world were not at a level that could be measured. For that reason, it is difficult to derive a positive outlook for the future of lifelogging and the mirror world. Nevertheless, the example of lifelogging and the mirror world was again explained to the survey respondents to measure future prospect.

4.2 Prospect of user recognition-based metaverse

4.2.1 Result of augmented reality

The five sub-domains of augmented reality are virtual image, realism, ease of information acquisition, immersion, and content diversity, and positive perception was confirmed in all sub-domains. The definition of the detailed areas constituting the augmented reality metaverse is shown in Figure 3. (Virtual image) A virtual image is defined as a virtual story, object, and phenomenon realized through technical and abstract methods on top of physical reality.

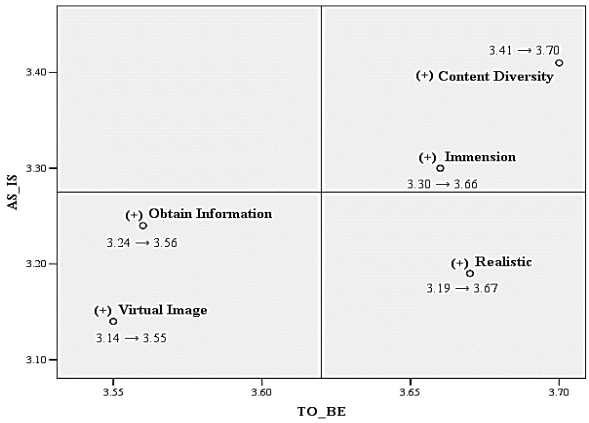

Fig. 3. Augmented reality outlook

(Realism) Realism is defined as the degree of realism that the implemented virtual image gives. (Easy to obtain information) Ease of obtaining information is defined as a function that can provide information without distracting users by providing explanatory information through virtual images on physical reality. (Immersion) A immersion is defined as the user's concentration which increases due to the realism of the provided image(Content diversity) Content diversity is defined as the diversity of virtual images provided by the virtual reality metaverse.

The perception of each sub-area and the prospects for each technology were most positive in terms of realism, followed by virtual images, immersion, ease of information acquisition, and content diversity. This means that it is necessary to upgrade the ease of information acquisition and content diversity in the future. Virtual images and immersion are technical, psychological, and aesthetic factors that are directly superficial to users, but ease of information acquisition and content diversity already refer to content as non-superficial factors. To put it pessimistically, it means that there is a lot of research on the aesthetic and technical aspects, but the research on the ease of information acquisition and content diversity is weak.

4.2.2 Result of life logging

The five sub-areas of lifelogging are daily posting, immediacy of content creation, sense of connection between users, daily life of content, and surrogate satisfaction through other users, and negative perceptions were confirmed in all of the detailed areas. The definition of the sub-area composing is show in Figure 4. (Daily Post) Daily posting is defined as personal material becoming content by writing an individual's daily life as a post. (Immediateness of writing) Immediacy of writing is defined as the immediacy of writing a post that can be posted as content as soon as an event occurs. (Sense of Connection) The sense of connection is defined as the relationship that users build through consensus on their posts. (Daily content) Daily content is defined as the familiarity caused by the daily life of the content provided by the lifelogging metaverse.

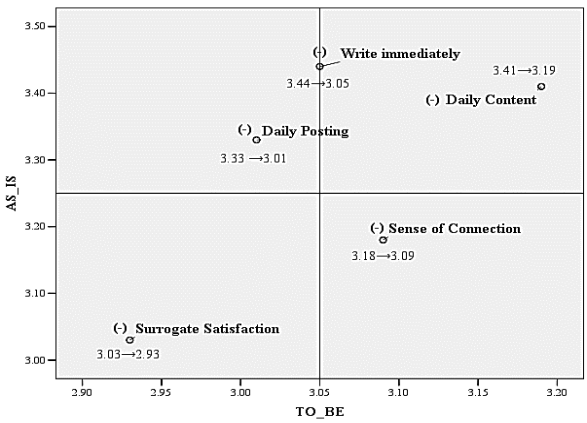

Fig. 4. Life logging outlook

(Variety Satisfaction) Vicarious satisfaction is defined as a sense of satisfaction that can be obtained by a user indirectly experiencing the daily life of another user. The perception of each sub-area and the outlook for each technology was the most negative in the immediacy of writing, followed by daily posts, daily content, vicarious satisfaction, and sense of connection. It can be seen that in writing personal daily routines, people are still sensitive to misuse. The negative perception is strong because the immediacy of writing is raised without considering the influence through the writing. Although there is a positive aspect of forming consensus on posts, this study says that it is practically difficult to form consensus on mutually diverse opinions. Daily content also showed a sensitive reaction to private life, and indirectly experienced life also reflected negative perception in satisfaction[59, 60]. In summary, it is necessary to prepare standards for the scope of content creation, upload, and sharing for private life. The sharing of lifelogging, where privacy is violated in a situation where the scope is not limited, will have a very negative impact.

4.2.3 The result of Mirrors Worlds

In the five sub-areas of the mirror world, negative perception was confirmed in 4 of the 5 sub-areas due to selection diversity, ease of search, convenience of payment, and reduction of time and space constraints. The definition of the detailed areas that make up the mirror world metaverse is as follows. (Selective Diversity) Selective diversity is defined as the increase in the number of physical reality services accessible to users through the mirror world metaverse. (Easy Search) Ease of search is defined as the ease of access that users have to comprehensive information on service providers and services. (Payment Convenience) Payment convenience is defined as the simplicity of the process in which users pay for services.

(Reduction of Space-Time Constraints) Reduction of space-time constraints is defined as the amount of reduction in temporal and spatial constraints of physical reality services accessible to users through the mirror world metaverse.

(Refer to comments) Opinion reference is defined as the user's utilization of the service experience of previous users. As for the recognition level of each sub-area and the outlook for each technology, selection diversity was the only positive one, and the negative perception had the highest reduction in time and space constraints, followed by payment convenience, search convenience, and opinion reference. Looking at the negative factors for the detailed domain of the mirror world, it means that there are difficulties in the number of physical reality services that users can access.

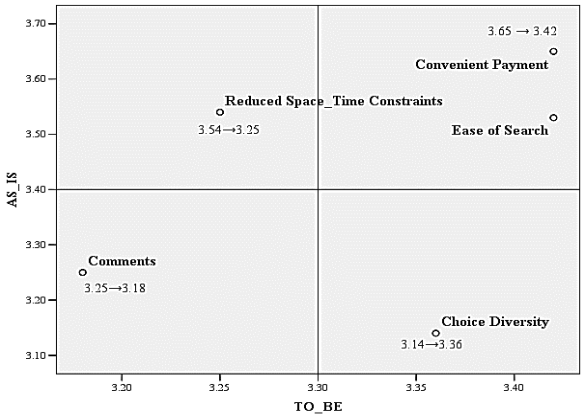

Fig. 5. Mirrors worlds outlook

The conclusion is that it is difficult to access comprehensive information in terms of searchability, and simplicity is not provided in the payment method. It is also negative that time and space constraints will decrease. This means that it is possible only in an environment where the mirror world can be used, and it takes a lot of time to use it. The conclusion is that there is a space to see the service experience, but there is no way to utilize it. In summary, it means that improvements are needed in accessibility, convenience, and payment methods. The results of this analysis are as follows.

4.2.4 Result of virtual worlds

The five sub-domains of the virtual world are unreality, application of new rules, virtual goods, marketing content, and sense of achievement. Positive perceptions were confirmed in all sub-domains. The definition of the detailed areas constituting the virtual world metaverse is shown in Figure 6. (Reality) Unreality is defined as the degree to which the world constructed by the virtual world metaverse is different from reality. (New rule) The new rule is defined as the degree of interest the user feels in the overall rule applied to the world constructed by the virtual world metaverse.

(Virtual goods) Virtual goods are defined as the degree of interest given to users by goods that can only be used in the world constructed by the virtual world metaverse. (Marketing content) Marketing content is defined as the degree of interest that users feel about marketing content provided by companies in physical reality in the world built by the virtual world metaverse. (Sense of Achievement) The sense of accomplishment is defined as a sense of satisfaction that users can secure in the world built by the virtual world metaverse. The perception of each sub-area and the prospects for each technology were most positive for virtual goods, followed by unreality, marketing content, new rules, and sense of achievement. This is because, in unreality, disasters, disasters, and dangerous material simulations are possible.

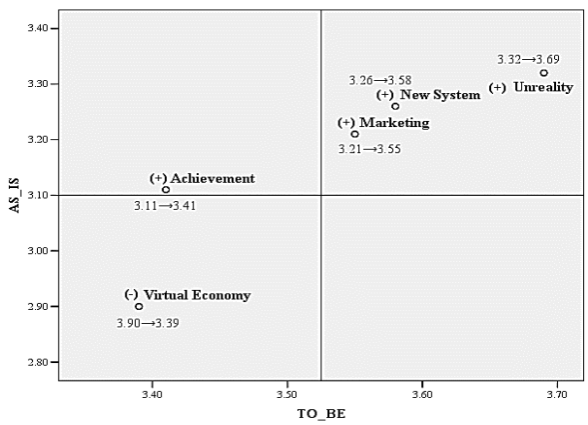

Fig. 6. Virtual reality outlook

There is a positive perception of the new rules because they feel a sense of belonging and interest in rules such as games. It can be seen that virtual goods are positive in a sense of privilege as currency that can only be used in the virtual world. Marketing content is possible in a variety of ranges and methods that cannot be expressed in the real world in the virtual world. For example, there is a scene where a bear is drinking Coke with the Antarctic and the North Pole in the background. The sense of achievement is the feeling of achievement that I have acquired in a certain area. Taken together, it can be said that experiments in dangerous situations, citizenship that can be enjoyed in the virtual world, playfulness of marketing content, and a sense of achievement belonging to the virtual world are positive. However, research on belonging and privilege in the sense of achievement needs improvement.

4.2.5 Meaning of results

It means that the scope of application will be expanded with content diversification, which is the brightest prospect in the field of augmented reality in the future. Although it is expected that the immersion in augmented reality will increase, the response is that the reality, which is a realistic expression of the simulation, will still be in a satisfactory state. Being able to acquire information through augmented reality also responded positively. It is a field most recognized by respondents and is expected to continue to improve in the future. In order to create positive results for augmented reality in the future, it is necessary to continuously develop a way to expand the scope of application rather than improvement and to develop graphic elements to increase the sense of immersion.

Lifelogging overall has a negative outlook for the future. It can be seen that the convenience of uploading content every day, the immediacy of writing and posting as you remember, and the ability to connect with others and view your private life are all

negative. It was perceived negatively to raise the daily work of the people who upload it every day and to obtain vicarious satisfaction.

In the end, I am reluctant to expose my private life to others, and I think more negatively than surrogate satisfaction or convenience.

The mirror world also sees the future in a negative way overall. The variety of choices is positively recognized, but the convenience or ease of paying money or searching will be improved considerably in the future, but it is still not expected to improve to a satisfactory level. This does not mean that the mirror world is simply virtualized, but a satisfactory level of service must be provided first. The virtual world generally sees the future in a positive way. In particular, it will be further improved in realizing the unreal world, and it is expected that there will be a new system to implement virtual reality and the development of peripherals for users to experience. In addition, it is expected that virtual reality will be more effective in conducting marketing. In particular, I think positively about realizing a virtual economy rather than a real economy.

The future trend of metaverse through this study is not bright. Lifelogging and the mirror world are negative except for the technological advances in virtual and augmented reality. When we think in common sense, Facebook, Instagram, twitter, hundreds of millions of people are currently using it, and he asserts that there will be no negative effects. The negative perception in the future, however, means that I record my private life in Life Logging and consider it to be a community activity with people I know, but I am reluctant to expose my private life to people I don't know. Vicarious satisfaction also means that you do not feel satisfied by looking at other people's private lives. To be more honest, this kind of life logging means I want to record my life and be active on a limited network. It is perceived that it will not be activated because there is a large negative perception even when forming a network with others. The mirror world was created in order to make our real world convenient and to save the time and cost of moving and complicated space, but those who use the mirror world are inconvenient in the end.

Table 4. Future outlook of the metaverse that people perceive

Metaverse construct	Sub factor	Rank	Result
Augmented reality	Virtual image	5	(+)
	Obtain information	4	(+)
	Realistic	3	(+)
	Immersion	2	(+)
	Content diversity	1	(+)
Life logging	Surrogate satisfaction	5	(−)
	Daily posting	4	(−)
	Sense of connection	2	(−)
	Write immediately	3	(−)
	Daily content	1	(−)
Mirror world	Comments	5	(−)
	Choice diversity	3	(+)
	Reduced space-time constraints	4	(−)
	Ease of search	2	(−)
	Convenient payment	1	(−)
Virtual world	Virtual economy	5	(+)
	Achievement	4	(+)
	Marketing	3	(+)
	New system	2	(+)
	Unreality	1	(+)

Although it is possible to provide a virtual space in the virtual world in the future, it means that it is difficult to use the search, payment, and advice of others provided by the mirror world. Also, if application diversity is not secured in the mirror world, it may disappear from the realm of the metaverse.

Ⅴ. Discussion and future research

5.1 Discussion

The Based on the results of this study, we would like to present the following issues. Summarizing the results of people's perception of the first metaverse and future prospects, Lifelogging and Mirror world do not have a positive future prospect. However, Augmented Reality and Virtual Worlds responded positively in the future. In fact, Lifelogging and Mirror world are part of our everyday life. Specifically, lifelogging refers to sharing daily private life information such as Facebook or Instagram with others. However, it is noteworthy that vicarious satisfaction is the most negative in the detailed quality items of Lifelogging. People do not feel vicarious satisfaction by looking at other people's private lives. I am only somewhat satisfied with the daily life of Lifelogging, the convenience of posting simple articles, the up-to-datedness of daily postings, and the functionality of Sense of Connection, but this is also not positive. In addition, as a result of interviewing the respondents about the reasons for their negative views on this, many of them said that it was the damage of sharing personal information. They are good at sharing private life, but there is enough room to use it as a tool for crime, and in particular, there is a negative side rather than a good side in that they try to form a network through Facebook's algorithm for adding friends or recommending friends to people they don't know. The most negative thing about Mirror World is Comments, which means that many people stop using it in the middle due to lack of guidelines or information messages during use. As the variety of choices in the virtual world is narrower than in the real world, they complained of the inconvenience of having no choice but to choose only a limited number. However, although it was somewhat positive for the simply functional aspects of convenience of payment, ease of search, and reduction of time limitations, overall negative perceptions were still strong. In addition, by conducting detailed interviews with the respondents, it was possible to understand why they gave negative prospects for the future. Although it is said that the real world is implemented as a virtual world, it is not the same as the behavior patterns that people are always active in the real world, and there was also a story that the authentication process in particular is too complicated.

In addition, it is not necessary to implement all the real world as a virtual world, and it will not reflect all of the real world. On the other hand, AR and VR are widely used in games, education, simulations (transportation, aviation, safety, chemical and biological experiments), medicine, and construction, and are said to be the most persuasive means of communication between those who need them and those who implement them. talk about thinking Based on this, the future outlook was also positive.

5.2 Future research

Through this study, the current preference and future's outlook of Metaverse were measured. Future research is needed in three aspects. First, it is necessary to select a specific field of the metaverse and research to improve or advance it in the user-recognized area and technical area. In this study, negative perceptions about lifelogging and the mirror world are large. A study including detailed items on

this is needed. Second, it is necessary to study the content diversity and usability of augmented reality and virtual reality. In addition, in the field of application, it is necessary to expand not only daily life but also biotechnology, space exploration, climate crisis, and disaster risk. Due to the recent pandemic, the reality is that there are many tasks to be solved regarding social issues related to biotechnology. Researchers in this field will have to find a way to solve the global pandemic using augmented reality and virtual reality. Third, it is also necessary to study the convergence with the surrounding science and technology fields to realize the metaverse. Even if only virtual reality images are implemented, it is also necessary to study the technology of realizations such as operating sensors and robots at the same time. Through this, science and technology researchers, industrial workers, and everyday users should make it easy to recognize. The goal is to seize the opportunity to get various feedbacks from users. After collecting a lot of trial and error and refining data to make it intelligent, there is a need to implement an advanced metaverse by integrating the mechanisms of artificial intelligence other than the virtual world that is essential to the metaverse.

Ⅵ. Conclusions

Through this study, we would like to present the following conclusions to future researchers. First, it is necessary to develop technologies and services that people can recognize about the metaverse. In this study, the mirror world and lifelogging were evaluated negatively for future prospects. In the mirror world, research on convenience and security of use is required, and in lifelogging, privacy protection measures are needed. As suggested in the results of this study, through lifelogging, about other people's life content surrogate satisfaction was evaluated negatively. Overall, the current metaverse has developed basic technology and attempts to apply it to various fields have begun. It is necessary to focus on research on the most efficient way to solve complex social problems and issues.

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