ZARZĄDZANIE MEDIAMI
Tom 10(4)2022, s. 281–297
doi: 10.4467/23540214ZM.22.019.17963
www.ejournals.eu/ZM

Malwina Popiołek https://orcid.org/0000-0002-9566-2773
Jagiellonian University

Barbara Cyrek https://orcid.org/0000-0002-3270-6548
Jagiellonian University

Maciej Giermak https://orcid.org/0000-0002-5219-8747

Marzena Barańska https://orcid.org/0000-0002-0026-9803
Jagiellonian University

TECHNOLOGICAL, SOCIAL AND LEGAL ASPECTS OF THE METAVERSE IN THE LIGHT OF THE LITERATURE REVIEW*

Abstract

In this paper, we have reviewed selected issues related to the metaverse concept, taking into account selected social, technological, and legal aspects. We focused on reviewing the newest literature on the metaverse topic published in the years 2020–2023. The database was gained through Google Scholar search, in order to check if any specific publishers or research areas are dominant among results provided by this search engine. The qualitative content analysis of the literature within the scope of technology, social sciences, and law, revealed the most promising and most threatening aspects of metaverse development and dissemination.

Keywords: metaverse, virtual reality, augmented reality, virtual worlds, digital twin technology

JEL: O3, K2, K4

* The article was developed within the framework of the project "Experience and immersive technologies – from creative practice to educational theory" in partnership with Jagiellonian University, Łódź Film School, University of Malta and University of Athens (project ID number: 2020-1-PL01-KA226-HE-095891).

Introduction

The discussion of developing virtual reality, from the new media perspective, lasts relatively a long time. Virtual worlds, as platforms that replicate a 3D environment, where users take the form of personalized avatars and can interact with each other as in real life, were classified as a part of the social media group. According to Kaplan and Haenlein (2010), we should consider them as the ultimate manifestation of Social Media, since they provide the highest level of social presence and media richness of all of the applications discussed so far. In their crucial work, the authors distinguished two forms of virtual worlds: virtual game worlds and virtual social worlds. The second reflects the real world, and the best example of this type of medium is the site Second Life (SL), launched in 2003, developed and owned by the San Francisco-based firm Linden Lab (Kaplan, Haenlein, 2009).

Although the Second Life has always been a curiosity, especially for technology enthusiasts, it has never gained widespread popularity. It has aroused great interest from the perspective of its potential possibilities. A few years after its launch, the site experienced quite rapid growth, and in 2013 it had about one million of regular users (Linden Lab, 2013). Second Life has been discussed, investigated, and applied in many fields, ranging from entertainment, through education, to advertising and various forms of social participation (Wang, Burton, 2013). However, it never achieved the interest or real significance of other social media platforms, such as Facebook, Twitter, or YouTube. Statistics show that by the end of 2022, Second Life had over 70 million registered accounts (Galov, 2022), while YouTube's and Facebook's active users were counted in billions (Kemp, 2022a, 2022b).

The discussion about virtual worlds came back with the term metaverse in October 2021, mainly due to Mark Zuckerberg's decision to rebrand Facebook, Inc. to Meta Platforms, Inc. With the rebranding, Zuckerberg heralded the upcoming era of the next-generation internet. According to his declarations, the change means a fundamental redefinition of the business model (Kraus et al., 2022). It is worth mentioning that this decision correlates with a great change of the valuation of the company, as its stock price diminished from around USD 378.69 at the beginning of August 2021 to around USD 130.02 at the beginning of 2023 (Yahoo! Finance).

The concept of the metaverse appeared much earlier, and the name itself comes from a 1992 science-fiction novel *Snowcrash* by Neal Stephenson. However, the current discussion on virtual reality, as the upcoming new generation of the internet, flared up very intensively after the rebranding of the technological giant. This issue seems to be present today primarily in the public debate, although there is also a heated discussion on the subject in the scientific discourse. At the same time, there is a debate taking into account the pragmatic dimension of virtual reality.

Today's digital culture[1] requires caution about its digital presence, but it also obliges governments and international organizations to step up their efforts to implement new comprehensive solutions that take account of technological change.

The definition of the concept itself has different variants, as noted by Dolata and Schwabe (2023):

> […] metaverse can carry several related and overlapping meanings. (1) It can be something that transcends physical reality described in terms of time and space. (2) It can denote a universe distinct from the physical universe but referring to it by summarizing, condensing, or depicting its various aspects. (3) It can refer to one or more potential possible alternatives to the existing universe.

As the authors indicate, it generates many challenges, ranging from misunderstandings to attempts to impose or appropriate this concept[2].

In this paper, we would like to present a literature review of the metaverse ideas, as well as a critical analysis of the concept of an integrated metaverse, referring in turn to selected technological, social and legal aspects. Evidence available at this point suggests that the idea of a metaverse, which has a strong cultural background, has the potential to be a fundamental change in a way people access digital content. It is however apparent that the vision put forward by tech companies, researchers, innovators and commentators vastly differs in the most basic concepts. This leads us to believe that right now, however pervasive the idea, it may just be a storm in a teacup.

Materials and methods

In the following article, we present a comprehensive literature review, based on Google Scholar search engine. While Google Scholar has both strengths and weaknesses (Jacsó, 2008), it has been recognized as a valuable tool for faculty in promotion decisions (Marsicano, Braxton, Nichols, 2022). Although guides for Google Scholar positioning has already been published (Kulczycki, 2013), and even the term "Academic Search Engine Optimization" (ASEO) has been coined (Beel, Gipp, Wilde, 2010), Google Scholar remains "both one of the most frequently used, yet also one of the least understood and validated" (Gusenbauer, 2018) academic search engine. The study by Michael Gusenbauer (2018) revealed, that "Google Scholar, with 389 million records, provides by far the greatest volume of scholarly information" (p. 194).

[1] "Digital culture" understood as culture defined by ubiquity and importance of digital technologies (Gere, 2008).

[2] A detailed overview of the various definitions can be found later in the paper.

The data corpus, obtaining 200 first results, has been created on 1st February 2023, on the basis of a single search term: "metaverse" without any other search filters. We did not search for terms specific for given field or discipline. Our goal was to answer the following research questions according to Google Scholar "metaverse" search:

– which publishers occur most often?
– which research areas are dominant?

To provide more than just a study on Google Scholar positioning, we focused on the content of the articles to pay attention to three aspects of metaverse: technological, social and legal. To keep the results up to date, we only analyzed sources published from 2020 to 2023 – the detailed process of data selection is described further in the article. The goal of content analysis was to answer following research question:

– what technological, social and legal aspects of metaverse are discussed in the latest literature on that topic?
– what kind of challenges and threats of the metaverse are discussed in these works?

The content analysis presented in this study is supplemented by some news portals commentaries, since academic publishing process happens to be long, so newest mentions and comments help to update and verify previously published academic ideas.

The study covered first 20 sites of Google Scholar results, yielding 200 sources. We classified them according to three features: a) year of publishing, b) publisher, and c) main research area. Results are presented in table 1.

Table 1. Number of "metaverse" search results in Google Scholar according to years (time spans) and publishers

	Number of results							
Year of publishing	CEEOL: Addleton Academic Publishers	Emerald Insight	IEEE Xplore	MDPI	Science Direct	Springer	Other	Total results
2023	–	1	1	–	2	1	–	5
2022	19	5	31	17	19	8	52	151
2021	–	–	2	4	1	–	20	27
2003–2020	–	–	1	–	2	2	12	17
Total results	19	6	35	21	24	11	84	200

Source: own study.

The oldest result was published in 2003, latest four were published in 2023. Only up to two results were given from years 2004-2020, so this period resulted with only 17 items. There was an increased number of publications from 2021 – 27 results. Most of the results given by search engine were published in 2022 (75,5%, which is 151 items). Such a phenomenon may prove the overall increase of academic interest in metaverse after Facebook rebranding, or result of search engine's ways of results validation. A similar trend can be found in the Scopus database, where the oldest paper was indexed in 2006, then until 2020, each year there were only a few more papers, while in 2022 a significant increase in publications is visible (578 items). According to Weinberger (2022), the Facebook/Meta shift is the reason.

Research has shown that there are several publishers which are most often suggested by Google Scholar in their first 20 sites of results. Such phenomenon may suggest, that those publishers are handling the Academic Search Engine Optimization (ASEO). Another reason may be rooted in the popularity of articles published there. The problem of whether the publishers grant better visibility for authors, or the authors promote publishers, requires further studying. In four cases results linked straight to the new file, which was opened after entering the link, omitting the publisher's site.

For researchers investigating new phenomena, lack of literature to rely on seems to be one of the basic problems. Therefore we wanted to check, whether researchers seeking for sources in Google Scholar could find items from their field without extending their search over the 20th site of search engine results. In the chart (1) we present research areas which occurred most often. Besides them, we recognized such research areas as: power & policy (Egliston, Carter, 2021), theology (Bolger, 2021), philosophy (Van der Merve, 2021), transportation (Pamucar et al., 2022), accountancy and audit (Al-Gnbri, 2022), psychology (Shin, 2022), methodology (Kozinets, 2023), cognitive science (Riva, Wiederhold, 2022), environment (Rillig et al., 2022), as well as theoretical deliberations on the definition of metaverse (Buchholz et al., 2022).

Yet, it has to be underlined, that every book or article investigating metaverse, is undertaking the technological issues out of necessity. For new, emerging technology, indication and even basic characteristics of provided features are crucial to underline the novelty, specificity and uniqueness, which are provided by the researched environment. Maybe in the future such description will not be obligatory, as we observe in studies on radio or television. As for now, research on metaverse is always intertwined with technological issues. Yet, some of the sources we studied were dedicated to technological issues only or focused on them, mentioning potential advantages in other fields – and those were recognized as technology research areas.

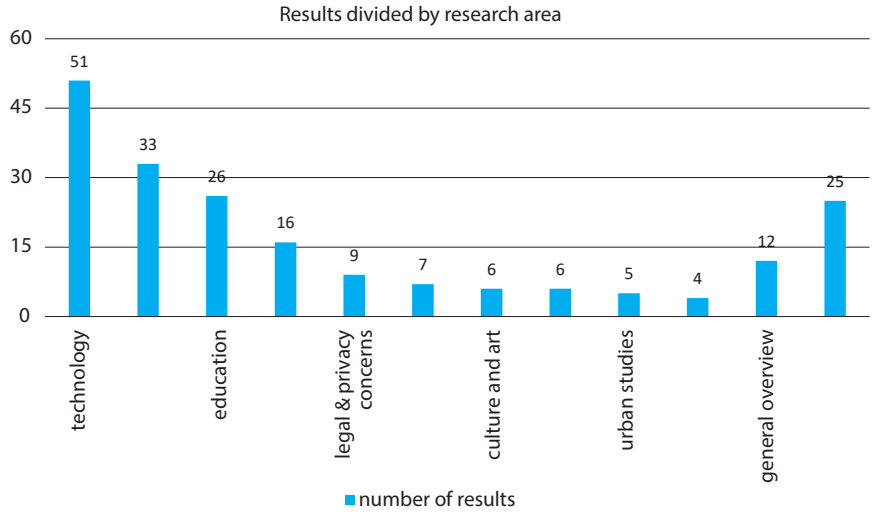

Chart 1. Number of "metaverse" search results in Google Scholar according to their main area of interest

Source: own study.

Results show that over 25% of all results presented by the Google Scholar search engine for the search term "metaverse" are dedicated to technological issues. The second most common areas of interest are economy, business and market analyses, which usually come together, so they were assigned as one in the study. After COVID-19 pandemic, issues such as remote education and work, healthcare and medicine gained overall more academic interest, so the authors started to research metaverse's potential in facing problems such as the necessity to stay at home.

The analysis of Google Scholar's first 200 answers to "metaverse" term searching, revealed that the search engine provides mostly items published in 2022, the majority of which published by IEEE Xplore. Thus, most of the results are dedicated to technological issues of metaverse, followed by articles concerning economy/business and education issues. Moreover, among 200 results we studied, only 2 were written in a language other than English. We cannot reveal, what did the Google Scholar hide from us, yet, publications provided by the search engine are not in contradiction with Achenbach et al. (2022) stating that "prevailing scholarly resource platforms like Google Scholar limit discovery by focusing only on publications, and favouring through their algorithm well-cited papers, English content, and discipline-specific resources".

Recognizing most frequent areas of research undertaken in papers proposed by Google Scholar, we decided to conduct literature review based on three axes: technological, social and legal aspects of metaverse. Our study covered only latest

publications, from the period of 2020–2023. Due to the need for a concise elaboration, we have selected only a few aspects which will be described in more detail below.

Selected aspects of metaverse discussed in the literature

Technological aspects

Defining metaverse

Metaverse is sometimes discussed as the next stage of technological development, where it is considered in the context of the fourth wave of computer innovation, which is developing around spatial, immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR). In the simplest terms, the metaverse can be understood as a kind of post-reality universe, an eternal and permanent multi-user environment that combines physical reality with digital virtuality (Mystakidis, 2022). The first difficulty to be overcome from a technological perspective is the lack of a universally accepted definition of a metaverse. In the public debate, this phrase is used as if its meaning was obvious. In the discourse (both, scientific and media) there are different definitions that can be given as an example of inconsistency in defining the metaverse. In his book, Matthew Ball presents his detailed definition of a metaverse as follows: "The Metaverse is a massively scaled and interoperable network of real-time rendered 3D virtual worlds and environments which can be experienced synchronously and persistently by an effectively unlimited number of users with an individual sense of presence, and with continuity of data, such as identity, history, entitlements, objects, communications, and payments" (Ball 2022, p. 48). Every element of this definition is discussed in detail, but the most important thing is that Ball differentiates between the metaverse and virtual worlds.

In comparison to this definition, Mark Zuckerberg's idea seems a lot less ambitious and demanding. In the Founder's Letter of October 28, 2021, he described his idea as:

> The next platform will be even more immersive – an embodied internet where you're in the experience, not just looking at it. We call this the metaverse, and it will touch every product we build. [2021]
>
> The defining quality of the metaverse will be a feeling of presence – like you are right there with another person or in another place. Feeling truly present with another person is the ultimate dream of social technology. [2021]

Main accent was put on the experience and feeling of a presence. The Metaverse (spelled with a capital M) focuses currently mostly on the virtual reality (in which the user has access to digital content through screens, e.g. Oculus VR) and/or

augmented reality (in which the user can see some digital interface or objects, superimposed on the real-life view that he observes). It is currently unknown if the Metaverse will be experienced with more senses, though at the moment it is used only to transfer audio-visual data, with animated avatars of users.

In most basic form the Metaverse can be seen as a next logical step in the pursue of achieving tele-presence. The user can be anywhere in the physical world, but by connecting to the Metaverse he can appear on a screen of another user, as if he was physically present at their fingertips. This approach is being reasonably criticised, as anyone who has experienced tele-work can attest, people tend to minimalize their presence during online calls and meetings (Flynn, 2022).

Buchholz et al. (2022) contextualised the term "metaverse" on the basis of the 30 years of defining this term in the literature. The authors states that:

1. A Metaverse is a combination of virtual worlds and augmented real worlds. They are not closed systems but linked with each other and with reality.
2. A Metaverse is a social medium in which people can interact, communicate, collaborate, but also trade and own property.
3. A Metaverse is persistent and long-lasting but it can also include temporally limited sessions.
4. A Metaverse is an integrated system that entails and utilizes XR and other technologies. This requires utilized components to be as open and interoperable as possible, ideally using open standards.
5. In addition to getting immersed in virtual worlds (VR) and augmented real worlds (AR/MR), capturing the state of the user and the real environment are key actions for the Metaverse applications.
6. Metaverse-participation is multi-modal and can be accomplished with varying intensities and representations, such as embodiment through avatars. Participants can seamlessly change the form and intensity of their participation.
7. A Metaverse is tightly coupled with reality. Information, actions, and interactions can be exchanged between both worlds, real and digital, and can influence each other. Using digital twins allows for cooperative interactions with things in the real and virtual world.

Buchholz et al. (2022) brought to the discussion another interesting view: that there could be more than just one metaverse. They propose the plural form "metaverses" while Zyda (2022) uses the term "metaversi". Zyda (2022) suggests technological solutions for coexisting of "Metaversi". This leads straight to the technological challenges of metaverse sustention and development.

Technological challenges

The literature found in Google Scholar abounds with articles regarding technological issues. Since technology forms the basis for the existence of the metaverse, it is impossible to avoid technological threads when discussing the environment itself.

Most of the technological approaches to metaverse were regarding, out of necessity, blockchains and digital twins. Blockchains serve for the safe usage of data, while digital twins are digital representations of physical items or systems. Some authors focus precisely on blockchains (Xu et al., 2022; Ryu et al., 2022) and digital twin solutions (e.g. Han et al., 2022; Van Huynh et al., 2022; Lv et al., 2022), while others concentrate on the usage of this technology in different areas of life, such as tourism (Zaman et al., 2022) or online shopping and live commerce (Jeong et al., 2022). Simulations provided by digital twins are also the subject of interest in publications focused on education, which will be mentioned in the discussion on social aspects.

Since the metaverse is an online environment, social interactions, and legal aspects will be somehow determined by the technology that will provide this environment. Even though technological determinism has been criticized (Green, 2022), the cultural lag hypothesis (Ogburn, 1964), as well as history so far, has shown that sometimes it is impossible to figure out the criteria of a fair use for the upcoming technology. That's why it's crucial that the metaverse will be ethically programmed and at the same time useful, easy to maintain and capable, no matter how much data it will have to operate on.

Sending more and more data will probably enforce more investments in the physical infrastructure of the internet (e.g. cables, satellites), unless a technological shift will occur. During the 2020–2021 period it was easily noticeable how much bandwidth is required for a simple Zoom meeting. Data transfer and latency are crucial if users will be able to affect the environment of a virtual world and have interactions with each other. A simple handshake requires that three devices (two users and a server) reach an agreement, which is currently mostly visible in fast-paced online shooters. What is more, the metaverse is presented as a way to connect with people around the world, not taking into consideration that it takes up a significant amount of time to pass the data from, for example, Europe to South East Asia (Ball, 2022).

This leads us to an observation that not every part of the world has the infrastructure to allow most of its citizens access to a fast and affordable internet connection. This can mean that, excluding technological breakthrough, the metaverse eventually will be divided into little pieces. This does not include the issue, noticed by many, that political and economic factors may result in further division, especially between US and China areas of influence (Thompson, Bremmer, 2018).

Social aspects

Digital inequalities and social interactions

In the context of the idea of widespread use of the metaverse, researchers indicate various challenges regarding the social aspects of this type of technology. In the literature there are mentioned several issues, such as trust building, social interactions, social inequalities, and disinformation (Dwivedi et al., 2022). It is worth

noting here that all of these problems apply to the social media group in general and have not been adequately addressed so far. The problems in all these areas show that technology platforms are unable to deal effectively with these threats, because tackling them is often against the interests of these companies. In the context of the growing threats in the social media space, the desire to introduce the metaverse seems to be a source of further difficulties and challenges.

The problem of the digital divide appears first. Internet access and appropriate equipment are necessary to enable full participation in the metaverse environment. As we already know, the condition of equal access to this technology is currently impossible to meet. In addition, assuming that the metaverse will reflect the real world, there is a high risk of inequality being transferred from the offline world to the online world (Deveci et al., 2022). Democracy, freedom and equality have been already recognized as crucial issues of metaverse usage (Bibri, Allam, 2022). Opportunities, as well as user experience, may depend to a large extent on their social status and already possessed resources.

The use of the metaverse will certainly not be without psychological effects. The social media affordances require actualization for metaverse environment, and such actualization has been carried out by Donghee Shin (2022). The case of online presence is recognized as key to successful treatment or training (Wiederhold, 2022). Therefore the quality of avatars seems to be crucial for the "presence" in metaverse, in terms of self-creation and communication, including non-verbal communication. As Wiederhold (2022, p. 2) noticed, "Avatars will need to be able to mimic the cognitive abilities of a human. […] Sophisticated virtual characters such as these will enhance the experience for users, creating a desire to continue to engage with a virtual world. This level of immersion may be the key to the ultimate success of the metaverse. (The continued development of avatars is a universe unto itself)". In terms of inequality, one's budget may be a crucial factor in avatar creation and sustenance, and therefore the experience itself would vary according to the financial investment.

The meaning of avatars leads to discussion on the possibility of identity theft in terms of metaverse's identity. There is a great need to be prepared for avatar-kidnapping, both in terms of technological secure of own value, as well as a legal code of conduct for such a possibility.

Education

The COVID-19 pandemic forced new educational reality both for teachers and learners. Shifting to digital environment, although made out of necessity, showed lots of advantages of remote education, but also weak spots of such. The metaverse's potential in developing education seems to be unlimited. Thanks to the digital twin technology, new digital universe may provide great simulations for learners. The literature we reviewed pointed out the advantages of metaverse in physical education (Yu, 2022; Li et al., 2022), dental education (Locurcio, 2022), medical

education (Almarzouqi et al., 2022, Sandrone, 2022), English teaching (Guo, Gao, 2022), and even getting aircraft skills (Lee et al., 2022). Simulations are already proven to be efficient tool in training, but metaverse, thanks to its accuracy in reflecting reality, massive scalability and lag-free syncing seem to be new learning experience (Upadhyay, Khandelwal, 2022; Hwang, Chien, 2022).

Metaverse will allow for more than just simple digitalization of the classroom. It is planned to be more than just enhanced Zoom or MS Teams. Researchers are already developing technologies for a better experience, both for teachers and learners. Just a few decades ago, during biology classes students used to learn about the cell structure from drawings on the blackboard. Then the photos shown up in course books. Today they may see cell structure in 3D digital models, presented by teachers on the screens (both during online or on site classes). In the near future we may be able to get a real-time virtual tour inside the cell to know its structure. Studies on education experience in metaverse are already carried out (Lee, Hwang, 2022) as well as research on lifelogging in educational metaverse (Tlili et al., 2022), spatial technologies (Dahan et al., 2022) and gamified collaborative learning (Jovanović, Milosavljević, 2022) which are developed to improve such experience. Sungjin Park and Sangkyun Kim (2022) carried out a bottom-up approach based on real cases. As the result of their research, they identified five world types used for metaverse-based education: 1. survival, 2. maze, 3. multi-choice, 4. race/jump, and 5. escape room. These results show the educational potential of more-than-a-classroom, which may be one of the biggest advantages of metaverse-based education.

Legal aspects

As we pointed out above, currently there is limited information on probable implementation of the idea of metaverse. We can use this time to consider if and how we should regulate the functioning of the metaverse.

The most important is the aspect of applicable law. Currently, the major companies involved in the development of technologies related to the metaverse (e.g. virtual reality, artificial intelligence) are located in the USA, China and Japan (Ball, 2018, pp. 310–321, 343–344). From this perspective, European Union has zero or little power over development of a metaverse. Similarly with the development of social networking sites, the EU has the chance to influence this process from the legal standpoint, relying on the so called Brussels effect. If the EU regulates e.g. consumer rights in the metaverse, companies providing services to consumers will have to comply or decide to leave the European market. This however requires the EU to be an important market to the technological giants, which is not so sure in a longer perspective.

Nevertheless, the first attempts to adjust the law to metaverse's digital reality have already been carried out. Jon Garon (2022) carried out the review of the U.S. state and laws regarding gambling, money transfer, and securities, as well

as regulation of unfair and deceptive trade practices used to enforce privacy and cybersecurity obligations. The author indicates the need for development of the Fourth Amendment protection against various possible threats.

The possible threats may derive from cryptocurrencies. Conducting ethnographic research in cryptocurrency Simon Mackenzie (2022) recognized a few types of scams, which may apply to metaverse, such as scam architecture ("indistinguishable from comparable legitimate entities or offerings"), or psychological mechanisms ("gambler's fallacies", "you can't cheat an honest man", "an offer seeming too good to be true", "if you pass up the chance to get involved, someone else will surely take it"). Publicly discussing such threats will raise the (potential) users awareness and may help protect them against scams. Moreover, bringing those issues to public discussions may prevent metaverse's victim shaming. As Mackenzie (2022) states, victims may feel complicit for what has been done to them, and therefore less likely to report scams to the police.

More troublesome is the issue with copyright. If the vision that most of our lives will transfer to the metaverse will prove to be correct, there are at least two instances, that would have to be addressed. Let's remember that each country of the EU has different regulations regarding copyright (or, more precisely, author's rights). If the experience of being truly present in this digital world is to be achieved, all users have to have access to the same content. Currently, there is no legislation ensuring this, and observing the practice of e.g. streaming platforms, it can be assumed that the opposite effect will be achieved. The second problem is more fleeting. In our daily lives, we create many works, some of which are eligible for copyright protection. This may include drawing sketches, writing down notes, humming melodies. These works of art now mostly disappear unnoticed, but in the metaverse it would be possible to store this information indefinitely. What if the entity behind the metaverse adopts similar rules as today apply to users of Facebook?

From another perspective, we believe that the copyright may prove to be one of the limiting factors for developing a single, unified metaverse. As we can currently see, there are many entities providing access to digital content, for the most part exclusively. For example, Microsoft Corporation and Sony Group Corporation are competitors, as the producers of the Xbox and PlayStation respectively. Both companies engage in activities that limit access to their games just for their users. The construction of copyright even supports the emergence of such situations, as the author may grant an exclusive license. Such action, dictated by the economic interest of the creator, may result in the creation of a natural monopoly.

Privacy concerns

In the context of threats to privacy, researchers raise a number of specific issues. They mainly relate to issues such as: 1) user data collection, profiling and tracking; 2) collecting and processing data about users in the context of the lack of uniform legal regulations; 3) external security threats to the collected data. Wang et al. (2022) described the particular problems in detail, distinguishing: pervasive data collection, privacy leakage in data transmission, privacy leakage in data processing, privacy leakage in cloud/edge storage, rogue or compromised end devices, threats to digital footprints, identity linkability in ternary world, threats to accountability and threats to customized privacy (Wang et al., 2022).

The metaverse can be used as a tool to amass even more information about its users. For example, using any augmented reality device requires access to spatial data. Giving this access to companies that already have access to too much information, may result in a widespread, perpetual observation. Access to this information will be available not only for platforms, but also to other users (Di Pietro, Cresci, 2021). Nair et al. (2022) carried out an experiment in which thirty participants were asked to play an "escape room" game in VR. In just a few minutes of gameplay "an adversarial program had accurately inferred over 25 personal data attributes, from anthropometrics like height and wingspan to demographics like age and gender" (Nair et al., 2022). Authors suggest, that such scenario may soon be typical for a VR experience, as companies' interest in metaverse is constantly increasing. Potential solutions for privacy concerns are already cautiously proposed by researchers (Zhao et al., 2022, Banaeian Far, Imani Rad, 2022). Fernandez, Hui (2022) point out, that the development of the metaverse should be based on an ethical design. Technology itself is ethically neutral, and humans behind it may use it in the right or deceptive way.

Conclusions

In this article we have proposed the revision of academic literature on the basis of the publications best positioned by the Google Scholar research engine. We have confirmed previously argued disadvantages of Google Scholar, as 25% of items were articles regarding strictly technological aspects of the phenomenon, almost all proposed publications were in English, and some publishers were much more visible than others.

Our goal was to discuss the most promising and most threatening aspect of the metaverse as indentified in the literature within the scope of technology, law and social sciences. Our research revealed that lots of authors focus on blockchains or

digital twins, both as their main point of interest or as the tool for improvement of particular aspects of life in metaverse.

The literature review exposed a lot of interest in social aspects of the metaverse usage, particularly in economy, education and healthcare. We have focused on education, underlying the issue of online social presence in advance, due to its crucial role in all of the (para)social interactions in digital environment. Our study revealed main potential threats, such as inequality (digital divide), identity theft (avatar kidnapping); as well as some most promising advantages, such as online training and great educational experiences for both teachers and learners. Our focus on legal aspects of metaverse revealed main concerns regarding online scams (in both legal and behavioral aspects), as well as data security and privacy issues. While the postulates of the ethical design of the metaverse are already visible on the Internet, our experience so far with data collection by social media platforms does not bode well, at least not without legal intervention of the authorities.

References

Achenbach K., Błaszczyńska M., De Paoli S., Di Donato F., Dumouchel S., Forbes P., Kraker P., Vignoli M. (2022). "Defining discovery: Is Google Scholar a discovery platform? An essay on the need for a new approach to scholarly discovery" [version 1; peer review: awaiting peer review].

Al-Gnbri M.K. (2022). "Accounting and Auditing in the Metaverse World from a Virtual Reality Perspective: A Future Research". *Journal of Metaverse*, 2(1), pp. 29–41.

Almarzouqi A., Aburayya A., Salloum S.A. (2022). "Prediction of User's Intention to Use Metaverse System in Medical Education: A Hybrid SEM-ML Learning Approach". *IEEE Access*, 10, pp. 43421–43434.

Ball M. (2022). *The Metaverse: And How It Will Revolutionize Everything*. New York: Liveright Publishing Corporation.

Banaeian Far S., Imani Rad A. (2022). "Applying Digital Twins in Metaverse: User Interface, Security and Privacy Challenges". *Journal of Metaverse*, 2(1), pp. 8–15.

Beel J., Gipp B., Wilde E. (2010). "Academic Search Engine Optimization (ASEO): Optimizing Scholarly Literature for Google Scholar & Co". *Journal of Scholarly Publishing*, 41(2), pp. 176–190.

Bibri S.E., Allam Z. (2022). "The Metaverse as a Virtual Form of Data-Driven Smart Urbanism: On Post-Pandemic Governance through the Prism of the Logic of Surveillance Capitalism". *Smart Cities*, 5(2), pp. 715–727.

Bolger R.K. (2021). "Finding Wholes in the Metaverse: Posthuman Mystics as Agents of Evolutionary Contextualization". *Religions*, 12(9), 768.

Buchholz F., Oppermann L., Prinz W. (2022). "There's more than one metaverse". *Oldenbourg Wissenschaftverlag*, 21(3), 3130323.

Buck L., McDonnell R. (2022). "Security and privacy in the metaverse: The threat of the digital human". *CHI EA '22: Proceedings of the 1st Workshop on Novel Challenges of Safety, Security and Privacy in Extended Reality, April 29 – May 5, 2022, New Orleans, LA, USA*.

Dahan N.A., Al-Razgan M., Al-Laith A., Alfakih T. (2022). "Metaverse Framework: A Case Study on e-Learning Environment (ELEM)". *Electronics*, 11(10), 1616.

Deveci M., Pamucar D., Gokasar I., Köppen M., Gupta B.B. (2022). "Personal Mobility in Metaverse with Autonomous Vehicles Using Q-Rung Orthopair Fuzzy Sets Based OPA-RAFSI Model". *IEEE Transactions on Intelligent Transportation Systems*, pp. 1–10.

Di Pietro R., Cresci S. (2021). "Metaverse: security and privacy issues" *Third IEEE International Conference on Trust, Privacy and Security in Intelligent Systems and Applications (TPS-ISA)*, pp. 281–288.

Dolata M., Schwabe G. (2023). "What is the Metaverse and who seeks to define it? Mapping the site of social construction". *Journal of Information Technology*, 9.02.2023, doi: 02683962231159927.

Dwivedi Y.K., Hughes L., Baabdullah A.M., Ribeiro-Navarrete S., Giannakis M., Al-Debei M.M., Wamba S.F. (2022). "Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy". *International Journal of Information Management*, 66, 102542.

Egliston B., Carter M. (2021). "Critical questions for Facebook's virtual reality: Data, power and the metaverse PDF Logo". *Internet Policy Review*, 10(4), pp. 1–23.

Fernandez C.B., Hui P. (2022). "Life, the Metaverse and Everything: An Overview of Privacy, Ethics, and Governance in Metaverse". *2022 IEEE 42nd International Conference on Distributed Computing Systems Workshops (ICDCSW)*. https://ieeexplore.ieee.org/abstract/document/9951378 (accessed: 1.02.2023).Wired's top editor: Metaverse 'feels like a terminological land grab'", https://edition.cnn.com/2022/01/03/media/wired-editor-gideon-lichfield/index.html (accessed: 4.02.2023).

Flynn K. (2022). "Wired's top editor: Metaverse 'feels like a terminological land grab'". Published 3rd Jan, Accessed 4th Feb 2023. https://edition.cnn.com/2022/01/03/media/wired--editor-gideon-lichfield/index.html.

Galov N. (2022). *18 Second Life Facts in 2022: What It Means to Live in a Virtual World*, https://webtribunal.net/blog/second-life-facts/#gref (accessed: 1.02.2023).

Garon J.M. (2022). "Legal Implications of a Ubiquitous Metaverse and a Web3 Future". https://ssrn.com/abstract=4002551 (accessed: 1.02.2023).

Gere Ch. (2008). *Digital Culture*. London: Reaktion Books.

Green L. (2022). "Technological determinism is wrong", https://iai.tv/articles/technological-determinism-is-wrong-auid-2218 (accessed: 1.02.2023).

Guo H., Gao W. (2022). "Metaverse-Powered Experiential Situational English-Teaching Design: An Emotion-Based Analysis Method". *Frontiers in Psychology*, 13, 859159.

Gusenbauer M. (2018). "Google Scholar to overshadow them all? Comparing the sizes of 12 academic search engines and bibliographic databases". *Scientometrics*, 118, pp. 117–214.

Han Y., Niyato D., Leung C., Kim D.I., Zhu K., Feng S., Shen X., Miao C. (2022). "A Dynamic Hierarchical Framework for IoT-Assisted Digital Twin Synchronization in the Metaverse". *IEEE Internet of Things Journal*, 10(1), pp. 268–284.

Hwang G.-J., Chien S.-Y. (2022). "Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective". *Computers and Education: Artificial Intelligence*, 3, 100082.

Jacsó P. (2008). "Google Scholar revisited". *Online Information Review*, 32(1), pp. 102–114.

Jeong H., Yi Y., Kim D. (2022). "An innovative e-commerce platform incorporating metaverse to live commerce". *International Journal of Innovative Computing, Information and Control*, 18(1), pp. 221–229.

Jovanović A., Milosavljević A. (2022). "VoRtex Metaverse Platform for Gamified Collaborative Learning". *Electronics*, 11(3), 317.

Kaplan A.M., Haenlein M. (2010). "Users of the world, unite! The challenges and opportunities of Social Media". *Business Horizon*s, 53(1), pp. 59–68.

Kaplan A.M., Haenlein M. (2009). "The fairyland of Second Life: Virtual social worlds and how to use them". *Business Horizons*, 52(6), pp. 563–572.

Kemp S. (2022a). *Facebook statistics and trends*. https://datareportal.com/essential-facebook-stats (accessed: 1.02.2023).

Kemp S. (2022b). *YouTube statistics and trends*. https://datareportal.com/essential-youtube-stats (accessed: 1.02.2023).

Kozinets R.V. (2023). "Immersive netnography: a novel method for service experience research in virtual reality, augmented reality and metaverse contexts". *Journal of Service Management*, 34(1), pp. 100–125.

Kraus S., Kanbach D.K., Krysta P.M., Steinhoff M.M., Tomini N. (2022). "Facebook and the creation of the metaverse: radical business model innovation or incremental transformation?". *International Journal of Entrepreneurial Behavior & Research*, 28(9), pp. 52–77.

Kulczycki E. (2013). *Jak dodać prace do Google Scholar i zwiększyć liczbę cytować oraz indeks Hirsha: poradnik dla początkujących*. Poznań: Stowarzyszenie EBIB.

Lee H., Hwang Y. (2022). "Technology-Enhanced Education through VR-Making and Metaverse-Linking to Foster Teacher Readiness and Sustainable Learning". *Sustainability*, 14(8), 4786.

Lee H., Woo D., Yu S. (2022). "Virtual Reality Metaverse System Supplementing Remote Education Methods: Based on Aircraft Maintenance Simulation". *Applied* Science, 12(5), 2667.

Li H., Cui C., Jiang S. (2022). "Strategy for improving the football teaching quality by AI and metaverse-empowered in mobile internet environment". *Wireless Networks*. https://link.springer.com/article/10.1007/s11276-022-03000-1#citeas (accessed: 1.02.2023).

Linden Lab (2013). *Infographic: 10 years of Second Life*, 20.06.2013. https://www.lindenlab.com/releases/infographic-10-years-of-second-life (accessed: 1.02.2023).

Locurcio L.L. (2022). "Dental education in the metaverse". *British Dental Journal*, 232, https://www.nature.com/articles/s41415-022-3990-7.

Lv Z., Qiao L., Li Y., Yuan Y., Wang F.-Y. (2022). "BlockNet: Beyond reliable spatial Digital Twins to Parallel Metaverse". *Patterns*, 3(5), 100468.

Mackenzie S. (2022). "Criminology Towards the Metaverse: Cryptocurrency Scams, Grey Economy and the Technosocial". *The British Journal of Criminology*, 62(6), pp. 1537–1552.

Marsicano Ch.R., Braxton J.M., Nichols A.R.K. (2022). "The Use of Google Scholar for Tenure and Promotion Decisions". *Innovative Higher Education*, 47, pp. 639–660.

Mystakidis S. (2022). "Metaverse". *Encyclopedia*, 2(1), pp. 486–497.

Nair V., Munilla Garrido G., Song D. (2022). "Exploring the Unprecedented Privacy Risks of the Metaverse". https://arxiv.org/abs/2207.13176 (accessed: 1.02.2023).

Ogburn W.F. (1964). *On Culture and Social Change*. Chicago & London: The University of Chicago Press.

Pamucar D., Deveci M., Gokasar I., Tavana M. Köppen M. (2022). "A metaverse assessment model for sustainable transportation using ordinal priority approach and Aczel-Alsina norms". *Technological Forecasting and Social Change*, 182, 121778.

Park S., Kim S. (2022). "Identifying World Types to Deliver Gameful Experiences for Sustainable Learning in the Metaverse". *Sustainability*, 14(3), 1361.

Rillig M.C., Gould K.A., Maeder M., Kim S.W., Dueñaz J.F., Pinek L., Lehmann A., Bielcik M. (2022). "Opportunities and Risks of the 'Metaverse' for Biodiversity and the Environment". *Environmental Science and Technology*, 56(8), pp. 4721–4723.

Riva G., Wiederhold B.K. (2022). "What the Metaverse Is (Really) and Why We Need to Know About It". *Cyberpsychology, Behavior, and Social Networking*, 25(6), pp. 355–359.

Ryu J., Son S., Lee J., Park Y., Park Y. (2022). "Design of Secure Mutual Authentication Scheme for Metaverse Environments Using Blockchain". *IEEE Access*, 10, pp. 9894–98958.

Sandrone S. (2022). "Medical education in metaverse". *Nature Medicine*, 28, pp. 2456–2457.

Shin D. (2022). "The actualization of meta affordances: Conceptualizing affordance actualization in the metaverse games". *Computers in Human Behavior*, 133, 107292.

Tlili A., Huang R., Shehata B., Burgos D. (2022). "Is Metaverse in education a blessing or a curse: a combined content and bibliometric analysis". *Smart Learning Environments*, 9(24), pp. 1–31.

Thompson N., Bremmer I. (2018). *The AI Cold War That Threatens Us All*. https://www.wired.com/story/ai-cold-war-china-could-doom-us-all/ (accessed: 4.02.2023).

Upadhyay S., Khandelwal K. (2022). "Metaverse: the future of immersive training". *Strategic HR Review*, 21(3), pp. 83–86.

Van der Merwe D. (2021). "The Metaverse as Virtual Heterotopia". *3rd World Conference on research in Social Sciences*. https://www.dpublication.com/wp-content/uploads/2021/10/41-20250.pdf (accessed: 3.02.2023).

Van Huynh D., Khosravirad S.R., Masaracchia A., Dobre O.A., Duong T.Q. (2022). "Edge Intelligence-Based Ultra-Reliable and Low-Latency Communications for Digital Twin-Enabled Metaverse". *IEEE Wireless Communications Letters*, 11(8), pp. 1733–1737.

Wang F., Burton J.K. (2013). "Second Life in education: A review of publications from its launch to 2011". *British Journal of Educational Technology*, 44(3), pp. 357–371.

Wang Y., Su Z., Zhang N., Xing R., Liu D., Luan T.H., Shen X. (2022). "A survey on metaverse: Fundamentals, security, and privacy". *IEEE Communications Surveys & Tutorials*.

Weinberger M. (2022). "What Is Metaverse? – A Definition Based on Qualitative Meta-Synthesis". *Future Internet*, 14(11), 310.

Wiederhold B.K. (2022). "Sexual harassment in the metaverse". *Cyberpsychology, Behavior, and Social Networking*, 25(8), pp. 479–480.

Xu H., Li Z., Zhang X., Sun Y., Zhang L. (2022). "Metaverse Native Communication: A Blockchain and Spectrum Prospective". *IEEE International Conference on Communications Workshops (ICC Workshops)*. https://ieeexplore.ieee.org/abstract/document/9814538 (accessed: 1.02.2023).

Yahoo Finance (2023). *Yahoo! finance META Interactive Stock Chart | Meta Platforms, Inc. Stock*, https://finance.yahoo.com/chart/META/ (accessed: 6.02.2023).

Yu J.E. (2022). "Exploration of Educational Possibilities by Four Metaverse Types in Physical Education". *Technologies*, 10(5), 104.

Zhao R., Zhang Y., Zhu Y., Lan R., Hua Z. (2022). "Metaverse: Security and Privacy Concerns". *Journal of Latex Class Files*, 14(8).

Zuckerberg M. (2021), *Founder's Letter, October 28, 2021*. https://about.fb.com/news/2021/10/founders-letter/ (accessed: 21.06.2023).

Zyda M. (2022). "Let's Rename Everything 'the Metaverse!'". *Computer*, 55(3), pp. 124–129.