"Metaverse" : Origins and Pathways: Conceptual Definition, Development Logic, and Risk Concerns (Postprint)

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Abstract

Since the outbreak of the COVID-19 pandemic, the social distance between individuals has continued to increase, and the "network-to-network" communication model has gradually become the daily landscape of interpersonal communication. During this process, the concept of the metaverse has emerged as a hot topic and gained widespread global attention following Facebook' s rebranding as Meta. The metaverse concept did not arise out of thin air; rather, it was generated under the long-term drive of technological development. This paper will ground itself in the technical conditions and practical motivations underlying the emergence of the metaverse concept, and specifically analyze the substantive connotation and future development of the metaverse from three aspects: conceptual definition, developmental logic, and risk concerns, with the aim of clarifying the crux and misunderstandings existing in the development of the metaverse.

Full Text

Preamble

Tracing the Origins and Pathways of the "Metaverse" : Conceptual Definition, Development Logic, and Risk Concerns

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Abstract: Since the outbreak of COVID-19, social distancing among people has continued to increase, and the "network-to-network" communication model has gradually become the daily landscape of interpersonal interaction. The concept of the metaverse has emerged as a hotspot in this process and gained global attention following Facebook' s rebranding to Meta. The metaverse concept

did not arise out of thin air but was generated under the long-term drive of technological development. This paper will analyze the substantive connotation and future development of the metaverse based on the technical conditions and practical motivations for its emergence, examining three aspects: conceptual definition, development logic, and risk concerns, with the aim of clarifying the crux and misunderstandings in metaverse development.

Keywords: metaverse; virtual reality; NFT; internet; extended practice; technology ethics

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Internet technology has fundamentally changed the ways in which people communicate, interact, and share information. However, after years of computer development and evolution, its basic working modes and operational logic have not undergone significant transformation. Currently, the essence of internet usage remains the traditional model of user terminals and interfaces connecting to the internet, merely converting original keyboards and mice into touch, voice, and other behaviors, which ultimately has not departed from limited-modal usage patterns.

The most common misunderstanding of the metaverse is equating it with virtual reality. In fact, virtual reality is only one way to experience the metaverse. Equating virtual reality and its derivative technologies with the metaverse is tantamount to equating applications with the internet [2]. Therefore, this paper will begin by clarifying the metaverse concept, elucidating its connotation and extension from perspectives of origin, characteristics, and practice.

Although innovative practices such as virtual reality, extended reality, and mixed reality have emerged during the development of the internet, their practical effects remain at a "chaotic" stage. Since the outbreak of COVID-19, social distancing among people has continued to increase, and the "network-to-network" communication model has gradually become the primary mode of interpersonal communication. This is called the "Untact Era," a situation expected to continue even after the pandemic ends and become a breakthrough for systematic innovation in new technologies [1]. On October 28, 2021, Zuckerberg announced the renaming of Facebook to Meta, signaling a shift toward focusing on metaverse ecosystems in future development. This marked a turning point that officially triggered global attention to the metaverse concept. Since then, exploration forms related to the metaverse—such as virtual currency, social models, and sandbox games—have emerged in large numbers, encompassing both reasonable expectations and practical implementations of metaverse tech-

nology and concepts, as well as irrational capital speculation and conceptual misuse. Therefore, standing at this turning point in metaverse development, it is particularly important to frame and clarify its essential concepts, development logic, and risk concerns—this constitutes the starting point and necessity of this paper.

1. Returning to Stability: Conceptual Definition of Metaverse Practice and Research

The metaverse concept did not emerge out of thin air but was organically generated under the long-term drive of technological development. From the prehistoric history of cave-exploration games in Europe and America to the in-depth development of computer technology and its graphical applications, the metaverse has already established a realistic foundation in terms of conceptual design and technical reserves. What the metaverse represents is a technological evolution from Web 1.0 to Web 2.0 and then to the mobile internet. The metaverse envisions a future evolution that represents a new breakthrough for the currently relatively stagnant internet industry.

In 1992, the concept of the metaverse (Metaverse) was first proposed in American author Neal Stephenson' s science fiction novel *Snow Crash*, which depicted a vision of humans living in a virtual world through digital avatars. This virtual world, parallel to the real world, was called the "metaverse." Etymologically, metaverse can be decomposed into "meta" and "universe." Meta derives from a Greek morphological element meaning "higher, beyond," but the modern meaning of "higher, beyond" refers to Metaphysics as "the science beyond physics," which has led to erroneous extensions of the term in modern usage [3]. Due to space limitations, conceptual corrections will not be elaborated here. Universe originates from the Old French *Univers*, meaning "the whole world, cosmos, sum of existing things." Based on this etymological interpretation, the metaverse can be understood as a cosmic space beyond the physical material world—a space generated by computers and representing a metaphysical concept distinct from the physical world.

In current practice and research, the metaverse actually refers to a fully immersive multi-dimensional digital environment, which differs from the definition of cyberspace—cyberspace reflects only partial characteristics of the metaverse' s early development stage [4]. Although current exploration of the metaverse remains at the three-dimensional digital space level, creating a "vacuum zone" with blurred boundaries with previous virtual reality technologies, as technology evolves deeper, the metaverse will gradually advance toward a continuous dimensional upgrading process. In 2007, the Metaverse Roadmap project provided multifaceted concepts of the metaverse, including "simulation technologies for creating physically persistent virtual spaces (such as virtual and mirror worlds)" and "technologies for virtually augmenting physical reality (such as augmented reality)—that is, technologies connecting network information and computational intelligence to physical objects and spaces" [5]. This early ex-

ploration is worthy of reference, but its consideration of metaverse technology remained at the primary sensory level, without exploring deeper immersion and realism.

Unlike early explorations, the metaverse is now considered a new internet application and social form integrating multiple cutting-edge technologies. Professor Shen Yang' s team at Tsinghua University proposes that the metaverse provides immersive experiences based on augmented reality technology, creates mirrors of the real world based on digital twin technology, and builds an economic system based on blockchain technology, tightly integrating the virtual and real worlds into economic, social, and identity systems that allow each user to generate content and edit the world. This definition divides the metaverse into five components: embodied interaction, virtual-real integration, unified identity, economic system, and UGC, demonstrating a development process from "mono-verse" to "meta-verse." Overall, the metaverse remains a continuously evolving concept, with different participants enriching its meaning in their own ways.

Extending from the metaverse concept to practical implementation, the metaverse's impact on future network communication is mainly manifested in communication models, communication discourse, communication forms, and communication concepts. Through its multi-technology superimposed and integrated mechanism, it profoundly transforms traditional "point-to-point" and "many-to-many" communication forms, with humans playing a more central role in the entire media system. The transformation of communication models will specifically manifest in the transition from basic digital twins to higher-stage virtual-real integration, with communication activities evolving from information transmission between real-world entities to information transmission between "hyper-real" entities. The specific development logic will be detailed later.

Since becoming a global focus, the metaverse has already achieved many new developments and practices worldwide, with new policies providing important reference value for further understanding its development prospects [6]. Chinese enterprises are conducting diversified explorations in the metaverse field. Tencent has made multiple investments in metaverse ecosystems, such as "Avakin Life" and "Spotify," and has registered two metaverse trademarks: "Tianmei Metaverse" and "Honor of Kings Metaverse." In 2021, ByteDance acquired Chinese VR equipment company PICO, actively laying out its metaverse industry. American companies are also making remarkable explorations. Besides the important milestone of Facebook' s rebranding to Meta, the Roblox platform supports users in creating virtual spaces and game modes autonomously and allows multi-platform, multi-modal access, thus being called one of the "worlds" closest to the metaverse. Disney has announced plans to build a "metaverse theme park," which will be a key direction for Disney' s future development. Meanwhile, Microsoft maintains a cautious attitude toward metaverse development and has proposed two initiatives– "Dynamics 365 Connected Spaces" and "Mesh

for Microsoft Teams" —adopting a more interventionist and accessible approach to entering the metaverse field. These concrete practices are gradually clarifying future directions, with development logic becoming increasingly clear through practice.

2. Exploring Fluidity: Development Logic of Metaverse Practice and Research

The metaverse is exploring a new, flexible, and inexpensive method to design future joint immersive environments. Related concepts, technologies, and system iterations are gradually moving toward the center of the development "stage," such as currently developing scalable, self-calibrating immersive displays. The metaverse' s development logic lies in creatively conducting technology development and application under the support of extended practice as a philosophical category, forming a technological constellation related to the metaverse ecosystem, and thereby creating economic, cultural, and interactive systems for information transmission between "hyper-real" entities.

2.1 Extended Practice: Evolutionary Path from "Manual Control" to "Mind Control"

The philosophical research turn to practice has long provided a new theoretical outlet for the abstractness and one-sidedness of traditional philosophy. For practical philosophy, technological development brings new systems and concepts, with extended practice as a philosophical category becoming the core direction for studying this issue. With the continuous development of internet and other technologies, the connotation, characteristics, and other elements of related practices are undergoing structural changes. As a transcendent technological product, the metaverse has a profound impact on human practical activities.

Specifically, extended practice in the metaverse is manifested in the process from "manual control" to "mind control." Manual-control extended practice refers to information transmission practices occurring in the interaction between the human brain and body, which can be decomposed into visible clicking/touching behaviors and invisible neural transmission behaviors. Mind-control extended practice, however, refers to achieving practice without bodily assistance. Professor Xiao Feng from South China University of Technology points out that the essence of extension is the unloading of human functions as material-energy means from the human body, while advanced extended practice (mind-control extended practice) is the result of unloading human tangible behaviors (including tangible information behaviors) [8].

The goal of metaverse development is to create a new world where the boundaries between virtual and reality are fused. In this world, advanced extended practice is realized through technology, with logging in and logging out becoming the most essential manifestations of extended practice. Although McLuhan'

s statement that "the medium is the extension of man" provides an intermediary approach to understanding media, its foundation remains at the level of manual-control extended practice. In this sense, mind-control extended practice, like the metaverse concept itself, possesses characteristics that transcend materiality. The transformation of social operation logic brought by the metaverse requires innovative exploration of paths to achieve mind-control extended practice beyond the Web 2.0 technical system and real-world practice. Currently, academia and industry have already developed an embryonic technological constellation for this path.

2.2 Technology Constellation: Development Leap from "Gene" to "Gene + Bit"

The metaverse is a cumulative product of information technology innovation, essentially an organizational form of interaction between technology and humans. Mind-control extended practice represents the ideal form of the metaverse. To achieve practical and effective metaverse development, academia and industry have gradually explored a technological constellation supporting metaverse development, demonstrating a development leap from "gene"to "gene + bit."“Gene" represents traditional intermediary information transmission modes and components, while "gene + bit" represents the essential connection between humans and information, corresponding to the virtual-real integration stage of metaverse development.

In the discussion of *Metaverse Passport*, the metaverse possesses six supporting technologies: blockchain technology, interaction technology, electronic game technology, artificial intelligence technology, network and computing technology, and Internet of Things technology. Under each major technology category, there are "multi-tree" technical subdivision structures involving comprehensive, multi-modal functional elements, thereby constituting the technological constellation supporting metaverse development. This constellation starts from the "gene" technical logic, focusing mainly on the development path of the technology industry, with corresponding enterprise technology R&D practices under different technologies attempting to bridge the development gap from "gene" to "gene + bit."

Professor Shen Yang' s team at Tsinghua University divides the metaverse technology constellation into five levels: network environment, virtual-real interface, data processing, authentication mechanism, and content production, jointly constituting the technical foundation toward the metaverse. Unlike the star topology of the previous technical constellation, this one mainly follows a bus topology structure, where technical subdivisions jointly constitute a bottom-up technical foundation. For instance, extended reality, robotics, and brain-computer interface technologies involved in the virtual-real interface, and artificial intelligence and digital twin technologies involved in content production, show significant divergence from the previous technical map. The latter represents a technical logic closer to "gene + bit."

Facing future metaverse development, although the two technology constellations have different emphases, their essence is the pursuit of an ideal state of essential connection between humans and information. In this ecosystem, the imaginative exhaustion of the material world is endowed with new space. Communication that truly spans the divide, as described in Peters's *Speaking into the Air*, and the resulting economic, cultural, and interactive systems will become the inexhaustible internal driving force for metaverse development.

2.3 Creative System: Specific Directions from Traditional to Future Systems

From abstract extended practice to concrete technology constellations, the foundational elements of metaverse development have gradually formed a system, requiring further clarification and prospecting of specific practical applications derived therefrom. In 2020, COVID-19 accelerated the "absence" of interpersonal communication, with deep digital existence shifting from "exception" to "norm." The virtual-real integration envisioned by the metaverse creates new economic, cultural, and interactive systems, and the innovation of these systems will effectively catalyze new development models, forming a continuous development process with interconnected and overlapping progression.

The impact of the metaverse on economic systems is a key focus of current academic and industry attention. Regarding the reshaping of economic systems, the metaverse provides a path for the virtual world to transcend the real world. For example, in offline retail and e-commerce fields, originally clear and difficult-to-fuse online and offline boundaries will move toward more immersive sales models driven by metaverse practices. This represents a shallow-level prospect of the metaverse. For deeper-level practice, non-fungible tokens (NFT), which emerged concurrently with the metaverse, are expected to become the decentralized, transparent, and tamper-proof "legal tender" of the metaverse economic system. The metaverse is not merely a replication of the real material world and its economic system; its most prominent feature is that it does not require consideration of controlling entities during communication and transmission processes. This will lead to the complete dissolution of boundaries between virtual and reality, where the original economic system is not replaced but highly strengthened by the metaverse and integrated into a higher-level economic system.

The metaverse also has a profound impact on media development, most notably in the systematic innovation of social media. The metaverse development has a vivid metaphor: the movement from a "single galaxy" to a "super galaxy." This process begins with a "single galaxy"of a single virtual world without cross-world transmission capabilities, gradually developing into a "super galaxy" involving multiple virtual worlds where users possess cross-world transmission capabilities. The metaverse provides a new outlet for social media transformation. Improvements in computer graphics and hardware resolution bring real-time immersive experiences exceeding 30 frames per second, making "gamification + transcendence" the future characteristic of social media. Simultaneously, the dual con-

straints of time and space will be replaced by the metaverse, with social media transitioning from "asynchronous" to "synchronous," a process worthy of early research and layout by media. The aforementioned non-fungible tokens (NFT) will also have a structural impact on media content production. For example, the NFT column of *The New York Times* has conducted frontier exploration of this technology, and the metaverse creative system is gradually revealing its outline in practice.

3. Rethinking Ecology: Risks and Concerns in Metaverse Practice and Research

Metaverse practice and research present a vibrant development landscape but are also accompanied by highly uncertain industrial risks. Building upon the previous theoretical analysis of metaverse concepts and 梳理 of development logic, this section reflects on the disorder risks and radical patterns in the process of metaverse ecosystem construction from the perspective of current development realities.

3.1 Conceptual Hype: Reflecting on Irrational Phenomena in the Metaverse Field

As a technical and abstract concept, metaverse-related practice remains in the exploration stage, with most existing achievements still at the conceptual and virtual reality levels. However, in current practice, "Metaverse +" has become a hot direction in capital markets, with numerous companies entering the metaverse field, attempting conceptual expansion and corporate operations through cross-integration thinking. In this process, the metaverse concept has not gradually clarified but has instead moved toward an increasingly ambiguous conceptual state through different actors' self-expression. This concern reflects the explicit risk of conceptual hype following the emergence of new concepts or fields.

Specifically, anticipating optimal solutions for future development in the initial stage of metaverse development may not ultimately focus on metaverse development itself but rather on pursuing exposure in capital and traffic markets. In response to this reality, numerous experts and media have begun reflective inquiries, attempting to return metaverse development to an orderly track. Reflective inquiry on the metaverse represents the externalization of rational voices, but it also carries certain risk concerns—namely, the total negation of metaverse development. This situation, like metaverse conceptual hype, constitutes "self-talk" that fails to understand the concept' s essence. The metaverse itself is a systematic technical concept involving an entire industrial chain development. The collision between traditional and emerging fields may promote industrial development but may also hinder the layout of emerging industries. Additionally, social 舆论 itself exhibits division and rejection toward emerging fields. Therefore, facing metaverse development, academia and industry should maintain a

rational state at all times, avoiding the adverse situation of conceptual hype while also avoiding direct rejection of emerging fields to ensure that technological development can potentially drive the entire social system.

3.2 Structural Imbalance: Reflecting on Internal Tensions in Metaverse Technology Development

Emerging fields mostly face structural imbalances in their early development stages, and different technological path explorations will achieve organic balance through continuous trial and error. Metaverse practice and research similarly face this issue, with different technological routes growing "wildly," forming a field landscape similar to "chaotic warfare." Structural imbalances in metaverse development can be mainly divided into two aspects: disorderly competition and giant monopoly, representing universal patterns of technological development worthy of further reflection.

Disorderly competition in metaverse development is mainly manifested in the independent construction of metaverse ecosystems by different enterprises and entities, with incompatible technical focuses and standards between different ecosystems, and inconsistent concepts for entering the metaverse without unified protocols. Additionally, content production and copyright protection under the metaverse concept also face risks of disorderly development. The equality of content production is still actually regulated by external capital, with content products remaining within traditional systems. Regarding copyright protection, although blockchain technologies such as non-fungible tokens (NFT) are being explored in the metaverse, copyright protection spanning virtual and real worlds faces a "vacuum state"without regulations to follow, which also constrains further metaverse development.

Giant monopoly in metaverse development is mainly manifested in industrial and technological involution, with certain monopoly risks. Consistent with the logic of disorderly competition mentioned earlier, giant monopoly emphasizes the "technical walls" built by large enterprises during disorderly competition, forming structures centered on large enterprise technical standards. The metaverse' s decentralized vision faces challenges from its centralized reality. The metaverse technology constellation also indicates that its deep development requires coordination across the entire industrial chain to truly achieve the development leap from "gene" to "gene + bit," thereby avoiding short-sighted metaverse development caused by structural imbalances.

3.3 Technical Ethics: Reflecting on User Risks in Metaverse Development

A large portion of metaverse development will act upon user subjects. Examining metaverse technical ethics from the user perspective is significant for promoting its future sustainable development. Analyzing metaverse technical ethics can be approached from three angles: macro perspective, meso rights,

and micro experience, leading to a depiction of the ideal metaverse vision.

The macro perspective of metaverse technical ethics refers to the metaverse' s pursuit of a highly decentralized virtual-real integrated world, where the relationship network of the real material world is dissolved by the metaverse' s transcendence, and different subjects will freely and flexibly conduct various activities within it. This also means that behaviors in the metaverse are difficult to regulate by centralized institutions, with uncertainties regarding the proliferation of content such as terrorism and rumors. The meso rights aspect refers to the equality of resource flow and privacy protection risks. Although the metaverse pursues a decentralized vision, weight and pressure in resource flow will continue to exist. Additionally, as a virtual-real integrated space, the metaverse will require users to transfer biometric data beyond limits, with large amounts of privacy data based on "gene + bit" entering metaverse space, making privacy protection and management directions requiring vigilance and strengthening. The micro experience aspect refers to users' "addiction" to immersion and presence. The dissolution of virtual and real boundaries will deepen technology dependence risks, and due to the metaverse' s decentralized characteristics, users' moral norm disorder cannot receive external restrictions. The issue of technology for social good will be raised to a new historical height in this process.

Overall, reflecting on metaverse risks and concerns is not "doomsaying" about the metaverse itself but a necessary path to promote its healthy and orderly development within norms. Tracing the origins and pathways of the metaverse requires understanding its essential connotation amidst constant change. New technology development requires a process of incubation and growth, a process full of high uncertainty. However, once its core essence is grasped, valuable essentials for reality can be extracted from complex practices and research. This is true for the metaverse and will also be true for new technologies that may emerge in the future.

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Note: Figure translations are in progress. See original paper for figures.