ФИЛОСОФИЯ И МЕТОДОЛОГИЯ НАУКИ

COGNITIVE ARTIFACTS OF THE METUNIVERSE

© *A.I. Loiko*

Belarusian National Technical University, Minsk, Republic of Belarus

Abstract. The article describes the cognitive artifacts of the metaverse within the framework of digital anthropology. Their role in the formation of a new social environment is investigated. Conceptual definitions of a cognitive artifact based on the theory of L.S. Vygotsky and his follower M. Cole. The forms of response by users of digital ecosystems to the spread of the influence of technology in society have been studied and the difference in this response has been stated. The reasons for this different response, due to structural changes in society, are shown. Attention is paid to the influence of cognitive artifacts of the metaverse on the perception of the consequences of emerging technological trends. It is stated that the modification of technological determinism in the form of metaverses contains different intentions of individual consciousness. This is due to the fact that the classical Internet is gradually giving way to new communication technologies, in which avatars, digital twins and immersive space plays an important role.

Keywords: cognitive artifact; metaverse; technological determinism; technological trend; society; public consciousness; social network; avatar; digital twin; immersive space.

КОГНИТИВНЫЕ АРТЕФАКТЫ МЕТАВСЕЛЕННОЙ

© *А.И. Лойко*

Белорусский национальный технический университет, Минск, Республика Беларусь

Аннотация. В статье в рамках цифровой антропологии описаны когнитивные артефакты метавселенной. Исследована их роль в формировании новой социальной среды. Даны концептуальные определения когнитивного артефакта на основе теории Л.С. Выготского и его последователя М. Коула. Изучены формы реагирования пользователями цифровых экосистем на распространение влияния техники в обществе. Уделено внимание влиянию когнитивных артефактов метавселенной на восприятие последствий сформировавшихся технологических трендов. Констатировано, что модификация технологического детерминизма в форме метавселенных содержит разные интенции индивидуального сознания. Это обусловлено тем, что классический интернет постепенно

уступает место новым технологиям коммуникации, в которых важную роль играют аватары, цифровые двойники и иммерсивное пространство.

Ключевые слова: когнитивный артефакт; метавселенная; технологический детерминизм; технологический тренд; общество; общественное сознание; социальная сеть; аватар; цифровой двойник; иммерсивное пространство.

Traditionally, the term artifact refers to a material object made by man. M. Cole considers artifacts more broadly [1], as products of the history of mankind, including the ideal and the material, referring to the fact that in L.S. Vygotsky he understood language as cognitive artifacts [10]. In this context of understanding [12], all means of cultural behavior are accompanied by artifacts [6]. They are social in origin and development. Culture in this case is an integral set of artifacts accumulated by mankind in the course of historical development.

An artifact is a certain aspect of the material world, transformed in the course of the history of its inclusion in purposeful human activity. By the nature of the changes made in the process of their creation and use, artifacts are both ideal (conceptual) and material. They are ideal in the sense that their material form is produced by their participation in interactions of which they were a part in the past. They mediate them in the present. With this definition, the signs of artifacts are equally applicable in cases where language is involved, and in the case of more familiar forms of artifacts. They differ in material features, ideal aspects, and the kinds of interactions they allow. With this approach, mediation by artifacts applies equally to objects and people. There are ways in which ideality and materiality a combined in representatives of the two categories of existence, as well as the types of interaction in which they can be included.

This view establishes the original unity of the material and the symbolic in human cognition [8]. This is an important starting point for determining the attitude to the ongoing discussion in anthropology and related disciplines: should culture be considered external to the individual, that is, the totality of the products of previous human activity, or internal — the source of knowledge and ideas? The idea of artifacts as products of the history of mankind, which are both ideal and material, allows us to stop this dispute. A special property of human thinking, called the duality of human consciousness, comes to the fore [7].

Neither artifacts nor actions exist in isolation. They are intertwined with each other and with the social worlds of people, acting for them as intermediaries in the formation of a network of relationships. M. Wartofsky describes artifacts, including tools and language, as the objectification of human needs and intentions, already saturated with cognitive and affective content [11]. The first level consists of primary artifacts that are directly used in production. Secondary artifacts include primary artifacts and how to use them. They play a central role in the preservation and translation of beliefs and modes of action. They include prescriptions, customs and norms. The third level is represented by a class of artifacts that can become self-contained worlds in which rules, conventions, and outcomes no longer seem directly practical. These are imaginary worlds. Imaginary artifacts can color the vision of the real world to change current practice. Behaviors acquired through interaction with tertiary artifacts may extend beyond the immediate context of their use.

As secondary artifacts, M. Cole considers cultural schemes, models, scenarios, which he defines as cultural means [2]. Human experience is mediated by cognitive schemas that channel individual thinking, structuring the selection, retention, and use of information.

Secondary artifacts, such as cultural schemas and scripts, are components of the cultural toolkit. They are ideal and material. They are materialized and conceptualized in artifacts that mediate the joint activities of people. That the process of activity is mediated by artifacts is a fundamental characteristic of human psychological processes. Experience does not simply exist within the individual. The development of the human psyche in ontogenesis and in the history of mankind should be understood as a co-evolution of human activity and artifacts. Words that are spoken, social institutions in which people participate, equipment and technologies serve both as tools and symbols. They exist in the world around people. They organize their attention and action. In the process of the formation of human culture, mediation creates a type of development in which the activities of previous generations accumulate in the present as a specifically human component of the environment.

The social world influences a person not only through the actions of real people who talk, communicate, show an example or convince, but also through invisible ways of action and objects created by people in the world surrounding the individual. There are prescribed forms of social interaction: customs, patterns, rituals, cultural forms. There are artificially created objects that silently saturate the world with human intelligence: words, maps, television receivers, metro stations. To explain the cultural mediation of thinking, it is necessary to clarify not only the range of artifacts that mediate behavior, but also the circumstances in which thinking occurs.

D.N. Uznadze studied such a modification of a cognitive artifact as an attitude. It is completely unconscious and is a mode of an integral personality, expressed in readiness for a certain action. Attitudes bring to life both certain models of perception and certain models of action. The artifact determines both how the object is perceived and what actions it motivates [4].

Users of the metaverse can create things and interact with each other in a reality-based world where the possibilities are beyond ordinary life [9]. The metaverse is characterized by the presence of a public digital space with various customized avatars that represent users of the ecosystem; the presence of digital property rights, the level of which depends on the degree of decentralization of the chosen platform; the possibility of interaction with other users; the conditions for various actions within the digital world; the right to share leisure time with other participants ecosystems.

Different digital ecosystems offer users different opportunities and degrees of control over assets. If a digital platform takes a decentralized approach, it offers more opportunities for creating applications, as well as greater responsibility for users to develop the ecosystem and the digital world.

The metaverse is an online platform that creates the conditions for creating something within the digital world. It allows users to develop their avatars as well as define their lives based on what they are capable of. The metaverse mimics reality, allowing participants to build digital careers in the fashion world or look after animals and private property. The possibilities are limited only by the imagination.

Centralized versions of the metaverses are different from open source digital platforms that run on the blockchain. The key differences are control, the ability to create something and the platform management system.

What happens inside the centralized metaverses is completely controlled by one organization. Such a system is also characterized by internal servers and certain rules for regulating the virtual world. Community representatives can interact with each other and share experiences, but they do not have the right to control the digital environment and own certain components of it.

The decentralized metaverse platforms are open source, and their users determine their own actions and what happens. The platform is controlled by the community of participants, and the organization. Users have more control not only over their own individual assets, but also over the metaverse itself and how it works. Decentralized metaverses are associated with blockchain projects.

Metaverses offer unique features and yet depend to varying degrees on their own communities for governance. In some cases, users determine in which direction this or that online space will develop. The digital ecosystem is considered as consisting of organizations interacting with each other through digital technologies on the principle of modularity, as well as not managed by a hierarchical body (compared to the supply chain) [3]. Digital business ecosystems do not rely on the customer to integrate goods and services themselves or purchase them as a package from a single source, but to provide customers with the desired choice, i.e. the customer makes a choice according to the menu, which, in turn, is provided and managed by an ecosystem member. A digital ecosystem can bring together many diverse actors with different points of view and skills, sharing resources, experience and ideas, directly or indirectly creating economic value and meeting the needs of the end user. Participants create economic value jointly, therefore they are interdependent. At the heart of the digital ecosystem are application programming interfaces. They act as a means of exchanging data, functions and values throughout the digital ecosystem of the modern economy, provide interaction between disparate application systems and allow developers to repackage data and functions to perform new tasks in accordance with a modular approach.

Organizations can create and participate in their own internal, public, partnership and industrial digital ecosystems and derive economic benefits through these ecosystems due to the certain obligations of all participants and their joint efforts in order to achieve their own strategic goals, as well as to implement innovations. The strategies of business organizations for deploying a particular ecosystem should take into account, at a minimum, the following points: 1) taking into account the role that the company will play in the ecosystem. As practice shows, a company usually plays several roles in overlapping digital ecosystems at once; 2) specific local operational needs and characteristics, depending on many factors, among which can be noted geographical location, competition and regulations. A different level of influence of each of the factors determines the existence of many ecosystems. The typical roles of the subjects participating in the formation of the ecosystem include the organizer, the modular producer and the consumer. Organizers are institutions within which individual partners come together and create a common economic value for the participants. They provide a platform and enable others to produce goods or services and sell them through

the ecosystem. The modular producer is characterized by the fact that it can be effectively involved in many ecosystems.

An ecosystem user can be both an organization and an individual who uses the economic value created in this system. One of the main advantages of digital ecosystems is the fact of using innovations, as evidenced by a fairly large number of technology start-ups. The economic success of an ecosystem may depend on the amount of assistance provided to a partner to increase its level of innovation, since innovation tends to multiply throughout the ecosystem. On the one hand, this is facilitated by the possibility of a quick and low-cost exchange of digital resources, and on the other, by the expansion of traditional partnerships and access to a large network of colleagues and developers, each of which has its own infrastructure, resources, and promising ideas for integration. For external partners and customers, mutually beneficial conditions are created for the development of applications with the aim of new or more efficient use of organizational resources, i.e. new products and services for end customers. The key benefits of digital ecosystems are that they enable supply chain flexibility and market insights, are ready for regulation, best meet customer needs, drive revenue growth and minimize risk.

The technological basis of digital business ecosystems is cloud technologies. Members use common platforms and a common set of standards to ensure that their activities, products and services are compatible. The development of digital ecosystems is also driven by mobile technologies, artificial intelligence, big data technologies and big data analytics, as well as customized solutions. The main components of the technological infrastructure of the digital ecosystem are the platform and integrated software products. The platform is the foundation of the ecosystem, the means by which partners create their products or services. To support an economically successful ecosystem, the platform is expected to be open and modular. Openness creates the possibility of providing access to platform resources. This property allows ecosystem participants to develop their own products. Modularity gives different organizations the ability to create additional products and services.

The platform must also have features such as high availability, reliability, and security. With the help of integrated software products, the data flow is transferred from component to component of the digital ecosystem. It is based on a set of protocols that regulate the communication parameters between the software components of the system and thus provide interaction between various participants in the digital ecosystem. Integrated software products occupy a central position in the digital ecosystem and directly determine the platform, level of implementation of network effects, as well as market expectations. They contribute to the formation of new ecosystems, and the added value is obtained as a result of the creation of new products. For this purpose, common digital assets are used, combined according to certain principles.

Digital ecosystems, due to their structure, their elements are practically independent of each other and can be interconnected in various ways, make it possible to develop new business models based on a network of business partners, and coordinate economic activity in a different, more optimal way. Digital ecosystems bring together actors from different fields. Each of the subjects has its own traits, attitudes and abilities that are involved in the distribution of resources, experience and ideas and form a common value for the end client.

The foundation of digital ecosystems is based on common platforms and sets of standards due to scalability, flexibility and dynamism [5]. Eco systemization aims to streamline a growing number of services. A person needs to evaluate the feasibility of a purchase then choose a payment method and a payment system. Many are not able to spend time on this, and often overpay for goods and services. Multi-banking applications will help the client with a profitable choice, which will not become isolated within one ecosystem or bank. Potential customers of banks will be millions of units of artificial intelligence.

Virtual and augmented reality technologies have become a part of the metauniverse. In this reality, people work, study, relax, have fun, earn money, communicate and buy cars and real estate. Everything that a person acquires or creates in the metaverse belongs only to him.

Living in the metaverse is different from using digital services. If a user uses a real card in online services, then the metaverse has its own currency. In the metaverse, not only communicate, but also study and work. Brands and content creators will have more opportunities to develop and scale products. The content of the metaverse depends only on communities and users.

Companies and users see the metaverse as immersive forms of team collaboration; the emergence of digital colleagues with artificial intelligence; Accelerating learning through virtualization and gamification.

At the first stage, the metaverse will be an alternative to social networks, but eventually it will replace the World Wide Web. The Internet as we know it today may no longer exist.

In 2020, the adoption of virtual reality for work, collaboration and learning accelerated. Thanks to the metaverse, more employees will be able to transition to remote or hybrid work. Companies are forced to make concessions to professional staff, and they are in favor of hybrid work formats.

When the metaverses go main stream, there will be many opportunities for investment and e-commerce. Thanks to the metaverses, new jobs are being created. Within the metaverse, companies will create thousands of projects, and all of them must be compatible with each other. The existence of the metaverse will generate a huge amount of data. They need to be stored and protected so that user information is safe. The metaverses already have their own money, but at the moment they are incompatible with each other and, with rare exceptions, are not converted into familiar currencies.

Equipment plays a very important role. Virtual reality devices are quite expensive, and their presence is necessary for presence in the metaverses. New internet is coming. This is new devices, new surfing principlesand new spaces. This gives rise to a new economy, new cyber threats, new trends and new legislative regulation.

Among the cognitive artifacts of the metaverse, we can single out: the mirror world as a digital version of the real world, in which there are virtual analogues of people, places, objects; skeuomorphic design, in which virtual objects are as similar as possible to real objects; a digital twin as a virtual version of a real object or structure, such as a factory or an aircraft. And we can also highlight the avatar, virtual, augmented, mixed and extended reality. Sensitive biosensors will become commonplace. With the help of 3D printing, it will be possible to make products

indistinguishable from natural products. The environment will begin to understand human needs, and unmanned vehicles will become part of cities.

The effect of presence during communication is achieved. It will be possible to conduct work meetings from home, but sitting face to face with colleagues, or online. It will become customary to show an online apartment with a virtual design. You can communicate in any language with anyone thanks to the online translator. Accessible and cheap marketing is being updated: branding through an online presence in a virtual environment, distribution through e-commerce or virtual storefronts, sales using immersive technologies. New opportunities for online learning have emerged. Integration with various block chain applications takes place.

In development are software engines, tools for creating virtual content: and tactile technologies, virtual worlds, avatars, marketplaces and financial services.

A platform for the development of e-commerce using 3D digital and augmented reality has been created. Technologies have been developed that allow you to feel touch or smell. A personal wearable thermoregulation system has been developed. This is a miniature air conditioner that clings to the area of the shoulder blades and simulates cold and heat in digital reality. Another trend is self-driving cars equipped with 3D displays, odor simulation systems, and active suspension to prevent motion sickness. These include position, eye and gesture tracking technologies, startups offering head-mounted displays, image stitching and game engines, light field videography, medical education, headsets and augmented reality devices for industrial settings and field service.

NFT is a non-fungible token. This is a photo, video, picture, audio recording. It is created and stored on the block chain. It can be a set from a trading card to a piece of virtual land. As the infrastructure develops, merchants will be able to tokenize physical products and services to reduce online transaction costs and arbitrage risks.

The metaverse immerses a person in a new social and technological space of cognitive artifacts. In this space, the infrastructure of culture is actively represented, in particular, galleries and exhibitions of fine arts, theater, museums. This digital space is actively used by the game industry and the show industry. As a result, the entertainment components are actively combined with the cognitive components of the social space. With the positive qualities of new technologies, the risks that will accompany the adaptation of users to a new social environment remain relevant.

References

1. Cole M. Cultural psychology: A once and future discipline? *Nebraska Symposium*. 1989;37:279–335.
2. Cole M, Griffin P. Cultural amplifiers reconsidered. Olson DR, editor. *The social foundations of language and thought*. New York: Norton, 1980. P. 343–364.
3. Dwivedi YK, Hughes L, Baabdullah AM, et al. Metaverse beyond the hype: Multidisciplinary perspectives on emerging challenges, opportunities and agenda for research, practice and policy. *Int J Inf Manage*. 2022;66:102542. DOI: 10.1016/j.ijinfomgt.2022.102542
4. Hutchins E, Hollan J, Norman DA. Direct manipulation interfaces. Norman DA, Draper S, editors. *User centered system design: New perspectives in human computer interaction*. Hillsdale, New Jarcey: Lawrence Erlbaum Associates. 1986. DOI: 10.1201/b15703-5
5. Loiko AI. *Philosophy of cognitive technology*. Minsk: BNTU, 2022.
6. Luria AR. *The making of mind: A personal account of Soviet psychology*. Cole M, Cole S, editors. Cambridge, MA: Harvard University Press, 1979.

7. Mackinlay JD, Card SK, Robertson GG. *A semantic analysis and taxonomy of input devices*. Unpublished manuscript, Xerox Palo Alto Research Center, 1989.

8. Norman DA. *The psychology of everyday things*. New York: Basic Books, 1988. 140 p.

9. Smart P. Mind in the Metaverse: Extended Cognition Meets Mixed Reality. *Philos Technol*. 2022;35:87. DOI: 10.1007/s13347-022-00580-w

10. Vygotsky LS. *Mind in society: The development of higher mental processes*. Cole M, John-Steiner V, Scribner S, Souberman E, editors. Cambridge, MA: Harvard University Press, 1978.

11. Wartofsky MW. *Models Representation and the Scientific Understanding*. Dordrecht: D. Reidel Publishing Company, 1979.

12. Wertsch JV. *Vygotsky and the social formation of mind*. Cambridge, MA: Harvard University Press, 1985. 288 p.

Информация об авторе

Александр Иванович Лойко — доктор философских наук, профессор, заведующий кафедрой философских учений Белорусского национального технического университета, Минск, Республика Беларусь. **E-mail:** loiko@bntu.tut.by

Information about the author

Aleksandr I. Loiko — Doctor of Philosophical Sciences, Professor, Head of the Department of Philosophical Doctrines of the Belarusian National Technical University, Minsk, Republic of Belarus. **E-mail:** loiko@bntu.tut.by