

Entre la alquimia y el arte científico: demos voz a las cosas

Between Alchemy and Science Art: Let's Give Voice to Things

Stanislav Milovidov

HSE University/ National Research University Higher School of Economics (Russia)

herminiapagola@gmail.com

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Abstract:

The research focuses on how science art has changed under the influence of the philosophy of science and socio-cultural attitudes towards scientific knowledge in Russia. The closure of several vital galleries and the opening of new spaces reflect broader political and social shifts. Science art projects typically combine scientific methods and artistic experiments, often challenging traditional boundaries and exploring interdisciplinary innovations. Recent exhibitions have shifted their emphasis from philosophical themes to technological ones, mirroring contemporary trends in art and science. This article examines the evolving landscape of science art, its intersection with technology, and its implications for understanding human cognition and the complex problem of consciousness.

Keywords: Science art, alchemy, exhibitions, technological art, artificial intelligence.



Resumen:

La investigación se centra en cómo el arte científico ha cambiado bajo la influencia de la filosofía de la ciencia y las actitudes socioculturales hacia el conocimiento científico en Rusia. El cierre de varias galerías clave y la apertura de nuevos espacios reflejan cambios políticos y sociales más amplios. Los proyectos de arte científico suelen combinar métodos científicos y experimentos artísticos, desafiando a menudo los límites tradicionales y explorando innovaciones interdisciplinarias. Las exposiciones recientes han cambiado su énfasis de temas filosóficos a tecnológicos, reflejando las tendencias contemporáneas en el arte y la ciencia. Este artículo examina el paisaje en evolución del arte científico, su intersección con la tecnología y sus implicaciones para la comprensión de la cognición humana y el complejo problema de la conciencia.

Palabras clave: Arte científico, alquimia, exposiciones, arte tecnológico, inteligencia artificial.

Introduction

The research focuses on studying the transformation of scientific art (sci-art) under the influence of the philosophy of science and the socio-cultural attitudes in society towards scientific knowledge. In this case, such processes can be observed in Russia, as over the past three years, one can not only speak of the development of this type of art and the audience's interest in it but also of a change in historical periods associated with places, institutions, and the names of artists. Since the middle of 2021, the main exhibition venues in Moscow were the New Tretyakov Gallery (Laboratoria Art&Science), Electromuseum, GRAUND Solyanka galleries, Khodynka, and Multimedia Art Museum. Still, by 2023, the cultural landscape has significantly changed. In November 2021, the Electromuseum closed; at the beginning of 2022, the Art&Science space in the New Tretyakov Gallery closed, and the Multimedia Art Museum has been under renovation for over a year. New halls are opening, such as the MARS and Krasnokholmskaya Galleries and ArtTECH cluster based on MISIS University.

Contemporary art directions relevant to today's world address the tension and conflicts inherent in human relationships, reject conventional forms of perception, and critique established social norms that are, in turn, cultivated by the state. Thus, artists are experiencing increasing ideological pressure from society's conservative and traditionalist segments. From this perspective, science art represents a promising direction because it primarily engages with scientific knowledge, making it less politicized and, in some cases, even advantageous for the goals of popularizing science. At the same time, innovations and discoveries presented in art objects attract the public's attention, who are tired of

academic expositions. The layer of Western-centric philosophy associated with "dark phenomenology" (J. Tucker), the sociology of science and technology (B. Latour), and the critique of anthropocentrism is being replaced by other cultural attitudes. Artists seek the foundations for these new attitudes through scientific communication with academic institutions.

The Intersection of Nature and Technology in Science Art

Retrospectively, artistic practice has changed over the last three years, evident even in the names of exhibitions. "May the Other Live in Me" appears as a direct manifestation of the theme of the "other" within a person — the "non-human." Among the key motifs of the "Ominous Dreams" exhibition, the main one is sleep as a state of anxious premonition of constant changes in the world and the instability of the future. The title also resonates with the well-known phenomenon of the "Uncanny Valley," in which more significant emotional rejection by viewers towards objects almost resembling humans compared to less anthropomorphic ones is observed. "Open Set" is a mathematical allusion to set theory and the topology of space, where abstract categories of elements and the surrounding area forming beyond their boundaries also pose the issue of borders, with the visitors being one of such elements. "New Elements" directly speaks of new elements constructing the materiality of the physical world and the world of information society and digital data. In any case, the concepts of exhibitions, addressing the theme of transcending human boundaries, touch upon the crisis of the Anthropocene. From this perspective, the conceptual exhibitions of science art in 2023 demonstrate a





movement towards traditional science and technology, as reflected in the titles: “Frequencies 3.0: The Magic of Super-Technologies” and “The Quantum Path” (Khodynska Gallery), “Digital refractions” (Yandex museum), “Space of Message: From Sign to Sensation,” “Biohacking” and “AI and? Neural networks and the creative process” (Krasnokholmskaya Gallery) or “Clipboard” (GRAUND Solyanka Gallery).

This art practice was conceptualized in the first half of the 20th century, although there has yet to be a consensus on its history within the scientific community. Ideas about the interconnection of science and art are found, for example, in the works of American philosophers S. Alexander and J.W. Servos. According to one version, “science art” originated from the term “sci-art,” coined by physicist Bern Porter, who believed in humanizing science and wrote his manifesto. “Porter’s main text—his farewell to physics—is futuristic reflections with a certain amount of irony and sarcasm about improving the world, a mixture of art and science with social issues.” (Gromova, 2022)

Science art projects typically consist of experiments at the intersection of science, technology, and art, unified by a typical thematic content, yet often self-sufficient on their own. On the one hand, these are art experiments utilizing scientific methods and tools, and on the other, they strive to overcome rationality, contrary to the scientific approach, according to D.Kh. Bulatov, “Rationality is the main limitation instilled in young scientists or engineers during the process of education and specialization” (Bulatov, 2022). Thus, research moves from the laboratory to art galleries, and artistic practice penetrates science, bringing poetics into the discussion of the “emotional universe and intuition”

(Akhromeeva et al., 2019, p. 121) and the politics of contemporary art. For instance, decolonialism represents “imperial science,” which “exalts reason above all other approaches to knowledge, suggests that reality is not holistic and that nature can and should be conquered” (Renk, 2012, p. 25). In turn, science art attempts to bridge this gap in our perception of the differences between the two realms. Science art projects typically represent a series of experiments at the intersection of science, technology, and art, united by a typical thematic content. However, they are often self-sufficient, each in their own right. A common element of each such experiment is the attempt to go beyond a specific scientific paradigm accepted in a particular area of human knowledge. As a result, many works in this direction are speculative, as scientific statements’ logical and factual validity are constructed in grammatical interaction (Latour, 2017). The artist includes the exhibition visitor in the experimental process and suggests a direction of thought, often trying to go beyond the capabilities of human intellect or the form of scientific knowledge or finding themselves in the space of “hard problems” of modern science to which they must propose their answer.

Thus, the artist’s primary tool becomes objects belonging to the broad category of things that can be conditionally designated as scientific equipment. However, the question arises as to how this category forms artistic means. The purpose of many objects, such as computers, defectoscopes, or flasks, is much broader and can extend beyond just scientific activity. In this case, to more precisely define this category, we turn to the sociology of science, particularly the works of Bruno Latour, who conducted a detailed study of laboratory practices. Analyzing the ways of producing scientific knowledge in la-

laboratories, he concludes that the main result of the activity of a modern scientist becomes an “inscription” (Latour, 2017). The scientist transforms experimental data, measurements, graphs, and tables into written text (scientific article, report, monograph, etc.) through which communication with other researchers occurs. Thus, the category of scientific equipment is structured by two factors: place, i.e., location in the space of an institution where scientific knowledge is produced (for example, a laboratory), and the documentation (“inscription”) of the scientific experiment.

Objects transfer from the laboratory to the art gallery and sever their connection with the place where scientific knowledge is produced. Moving into the exhibition space, the material world of the scientific experiment, while changing its rules, conditions, and ways of existence, should simultaneously lose the prefix “science” and become an artwork. However, within the context of science art, this does not happen because the second foundation that constructs the belonging to the field of science is preserved – the written document or record. This role is taken on by an explication or curatorial text, in which objects, now located in the gallery space, reestablish their connection with the world of science.

For example, the work of Austrian artist Thomas Feuerstein, “Poem,” at the “New Elements” exhibition, addresses research into the origins of life on planet Earth. The curatorial text details the scientific approach and looks like this:

The biotechnological installation POEM captures the “primordial soup of life” from the air exhaled by exhibition visitors and distills it into alcohol. Referring to the 1950s experiment to recreate the first forms of life, conducted by biochemist Stanley Miller in support of Darwin’s theory of evolution, Feuerstein shows that the body’s boundaries are blurred and merge with the surrounding world.

Approach the microphone and utter a phrase; the moist air condenses and freezes, forming ice crystals on the microphone. With each new phrase, the layer of ice becomes thicker until dewdrops begin to fall. When the condensate accumulates, it initiates a chemical synthesis process that uses water to prepare Ursuppe (“Primordial Soup”), in which inorganic molecules are transformed into organic ones—in the form of amino acids, the foundation of all living things, and simultaneously produces alcohol without fermentation.

The more people talk about art, the more art is created in ice, water, and alcohol. Furthermore, the more people drink, the more talkative they become. (Feuerstein, 2022)





Figura 1.
Thomas Feuerstein, "Poem", 2010. New Elements,
New Tretyakov Gallery. Source: Personal archive

The description of this experiment suggests its proximity to metaphysics rather than to the practice of scientific experimentation. However, it is necessary to decode the experiment's description to reveal the artist's statement.

As the text indicates, Thomas Feuerstein's work is based on the experiments of American biochemist Stanley Miller, who, in the mid-20th century, confirmed several hypotheses about the origin of life on Earth through empirical research. His experiment supported the "primordial soup" theory of

Alexander Oparin and John Haldane. According to them, in prehistoric times, a dense, heated liquid on the Earth's surface, under the influence of the Sun's ultraviolet radiation, caused reactions that synthesized the first organic substances (amino acids). From this "soup," the first reproducing entities were created. Harold Urey and Stanley Miller subsequently modeled the ocean-atmosphere state of primordial Earth with a continuous stream of steam from a mixture of methane, ammonia, and hydrogen. This chemical reaction continued for a week, after which Miller discovered amino acids. Since amino acids are the primary structural and functional components of cellular life, the experiment demonstrated the possibility of natural organic synthesis for the origin of life on Earth.

By addressing actual research, this art involves the viewer in a scientific act being played out. Meanwhile, the text references alchemical practices: transmutation, the search for the prima materia (the first matter). *"Inorganic molecules are transformed into organic ones – in the form of amino acids, which are the basis of all living things."* The search for quintessence (prima materia) was vital in the practices of alchemists, guided by the ideas of Aristotle. For example, according to a 15th-century treatise on quintessence, which has reached us in an edition by the British philologist Frederick Furnivall, its extraction involves "sevenfold distillation of alcohol." Thomas Feuerstein's installation also resembles a distillation apparatus, and one of the experiment's results (besides the "primordial soup") is alcohol. The artist transmutes inorganic compounds, which become the basis of all living things, humanity, and art.

The artist describes the chemical experiment as "preparing Ursuppe." Such anthropomorphism, ac-

cording to Bruno Latour, "simultaneously allows us to speak about technologies as human constructs, about artifacts replacing human actions, and about non-humans shaping human actions through their inherent prescriptions." (Vakhshstein, 2006) The German term "Ursuppe" directly reveals the essence of the experiment and contributes to the accretion of new knowledge. However, at the same time, it is illustrative and suggests an affective and symbolic immersion in the world of science, evoking associations with Latin names in biology and concepts in German philosophy, like Martin Heidegger's "Dasein." Similar techniques are found in other artists' works. For example, in Sasha Spačal's work "Earthlink," decoding the Latin names *Trifolium pratense* and *Cupressus sempervirens* reveals common clover and cypress oil. Thus, the text should evoke an image of what is happening in the viewer's mind, creating a scientific-magical ritual.

Science art is akin to alchemy, not confined within any scientific direction, but instead exists in the space of ontological search, connected with the complex problems of its time, where mythological thinking merges with science. *"Take the green lion without dissolution in vinegar (as sometimes the custom is), put it in a large earthen retort, which can endure the fire, and distil the same way as you distil aqua fortis... and so you will have the blood of the green lion, which we call secret water, and acetum acerrimum, by which all bodies are reduced to their first matter"*, wrote the 15th-century English alchemist George Ripley about the method of preparing the philosopher's stone. Later, in the 19th century, Jean-Baptiste André Dumas translated this recipe into the language of the science of his time, discovering, behind the veil of metaphors and artistic images, lead, its oxides, chemical salts, and other elements.





This approach in science art bridges the enigmatic language of ancient alchemy and the empirical methods of modern science, illustrating the ongoing dialogue between our historical understanding and contemporary scientific inquiry.

Thus, according to the philosopher and science historian Thomas Kuhn, the scientist of the Modern Era “ceases to be a bearer of a special consciousness and a discoverer of truth, and instead engages in ‘puzzle-solving.’” Alchemists were in search of the *prima materia*, the first matter of all that exists, and the transformation of scientific knowledge into a mythological text served, in part, a protective function. If the success criterion for a modern scientist is international recognition, requiring the publication of research results, the alchemist’s path is individualistic, where he becomes the keeper of the secret of the cosmos. According to Katarina Vons, the conceptual return to alchemy, simultaneous with the emergence of quantum physics, confirms the deeply rooted human need to turn to a spiritual, creative approach to knowledge creation when faced with previously unexplained natural phenomena. Could alchemists have understood something about the nature of matter that 19th-century scientists missed? (Vones, 2020)

From Alchemical Paradigms to Technological Integration

Therefore, new exhibition projects are about something slightly different. “Frequencies 3.0: The Magic of Super-Technologies,” “Biohacking,” “The Quantum Path” (Khodynska Gallery), “Space of the Signal: From Sign to Sensation,” “Programmable Art” (Krasnokholmskaya Gallery), “Clipboard” (GRAUND Solyanka Gallery) - all these titles seem



Figura 2.
Gleb Ivanov. “Metrology”, 2023. Clipboard,
GRAUND Solyanka Gallery. Source: Personal archive

to shift the focus from philosophy to science and technology. There is a departure from the alchemical paradigm in favor of the so-called “progressive” one, which contributes with its knowledge to the historical progress of civilization. A science artwork without a philosophical foundation is essentially a puzzle, which can also be traced in curatorial texts and explications.

This shift reflects a broader trend in contemporary art and science. While drawing on the rich symbolic and speculative heritage of alchemy, today's science art seeks to ground itself more firmly in empirical methods and technological innovation, embracing the possibilities and challenges of the modern world.

New projects primarily aestheticize the scientific method. For instance, Evgeny Averin interprets *the process of destruction during tensile tests according to GOST¹ 1497 on proportional cylindrical samples made of 20GL steel*, referencing Kazimir Malevich's ideas that "art as an aesthetic will disappear, leaving only practical mechanical realism." In his installation "Metrology" (2023), Gleb Ivanov presents *a kinetic sound and light object created based on a decommissioned GS-5 goniometer at the VNIIMETMASH enterprise. The data on refraction and shape of the studied object served as the basis for sound generation.*

Alternatively, artists turn to areas of science where there is no established conceptual apparatus yet, and the existing knowledge is a subject of discussion, remaining in the focus of methodology. For example, the goal of Anna Kabirova's work "One Artsapiens ID" is *various forms of dialogue with non-human agents. The experiment involves studying the kinesthetic experience of the artist through the exploration of the dialogue between the human brain and artificial intelligence in the Digital space, based on a new principle of sound extraction. The research was conducted on the artist's cerebral cortex using EEG to identify brain areas responsible for color perception and its reaction when exposed to primary colors (yellow, red, blue), sound, and aroma simultaneously.*

These examples illustrate a trend in which science art is not just about demonstrating or applying scientific principles but rather about profoundly integrating them into artistic practice, challenging traditional boundaries between disciplines, and exploring new realms of understanding and experience. Science art thus becomes a fertile ground for interdisciplinary innovation, where the pursuit of knowledge and aesthetic expression coalesce.

Fundamentally, the reasons for such a change in the character of science art can be explored in several directions.

Firstly, Western artistic tradition introduced the alchemical approach into the Russian exhibition space, drawing on its directions associated with the critique of anthropocentrism and dark phenomenology (Bruno Latour, Graham Harman, Eugene Thacker, James Lovelock). In Russian history, alchemy was almost absent, except for the touring Count St. Germain and legends about Yakov Bruce, a companion of Peter I. So, historians Y.L. Khalturin, V.V. Kuchurin and Y.F. Rodichenkov note that alchemy came to Russia only in the 18th century from Great Britain, "almost exclusively due to Freemasonry" (Khalturin, 2015, pp. 55-58). Modern scientific culture, especially in its natural science part, which forms the basis of science art, was shaped under the influence of the myth about the Soviet scientist, from socialist realism to science fiction novels. Scientists in Soviet culture "always adhered to high moral standards. They were not just atheists, but active opponents of the religious worldview" (Teplinskiy, 2006, p. 118), which set a Marxist vector of anthropocentrism where the world is viewed solely from the perspective of human knowledge.



¹ Russian international technical standards



Secondly, such a shift is a logical result of attempts to overcome the distance between science and art, which has become vital for science and art in recent years. As a result, the artist claims the role of philosopher and scientist, whom Bruno Latour unites in his interpretation of Plato's myth of the cave. "Indeed, it is the tyranny of the social, public life, politics, subjective sensations, vulgar vanity, in short – the dark Cave that the Philosopher, and later the Scientist, must eradicate if he wants to reach the truth." (Latour, 2004) Latour laments the rupture between the real world, not endowed with the gift of speech, and the social world, which was bridged by philosophy and science until they fell under the power of the social. Now, it is the turn of art to try to give a voice to natural objects capable of determining what truly exists.

Thirdly, computer technologies, especially machine learning, which is often attributed to the status of artificial intelligence today, have become an integral part of modern scientific research and revolutionary breakthroughs. Researchers are applying artificial intelligence to combat antibiotic resistance. Recent publications note that AI can accelerate the discovery of new antibiotics effective against drug-resistant bacteria. In another study conducted by MIT, a deep neural network was used to analyze data on more than 39,000 compounds, which led to the identification of two promising antibiotic candidates (Wan et al., 2024). Additionally, scientists used artificial intelligence to analyze data collected over a decade ago, discovering over a hundred new galaxies with neutral carbon absorbers. These chemical substances are critical indicators of galactic evolution, as they can reveal much about how galaxies change over time (Ge et al., 2024).

At the same time, the turn to artificial intelligence research technologizes the natural phenomenon of the human mind, which developed through biological evolution. In a published study on fundamental models, a team of scientists from Stanford University dedicated a separate paragraph to the phenomenon of understanding and its philosophical interpretation. The researchers highlight different approaches to what is meant by understanding the process of human communication (Bommasani et al., 2020). A group of researchers from the University of California addressed the fundamental capabilities of human intelligence – abstraction and analogical reasoning. They analyzed the ability to "reason from scratch without direct learning" in humans and the GPT-3 and GPT-4 algorithms, discovering that these mechanisms are similar in biological and machine intelligence (Webb et al., 2023).

Thus, research on the principles of neural network functioning revolves around issues related to perception, solving analytical and creative tasks, and imitating cognitive functions (including self-learning, problem-solving without a predefined algorithm, and achieving insight), comparable, at least, to the results of human intellectual activity. All these questions, in turn, touch upon the hard problem of consciousness, a recurring theme in all creative practices associated with artificial intelligence technologies.

Even the well-known DeepDream algorithm, through which artists have declared machine learning a creative tool, represents a metaphor for cognitive processes within a neural network. For scientists, however, it is a method conceptualized in articles by author A. Mordvintsev and numerous research-

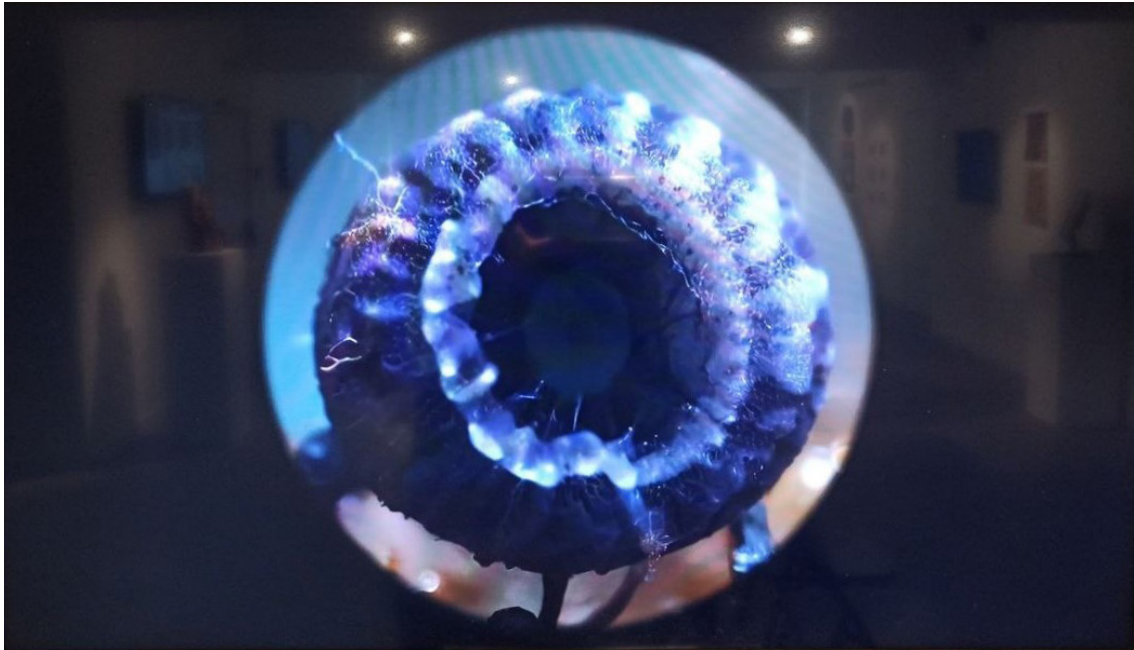


Figura 3.
Andrey (Inv4r3d) Maksimov. "Microworld in Neural Network Perspective," 2023. AI
and? Neural networks and the creative process, Krasnokholmskaya Gallery.
Source: Personal archive

chers who came later. The method amplifies hidden patterns in images by repeatedly passing them through a neural network, revealing the responses of specific network layers, and, in this way, layers and neurons are visualized, highlighting how the network "sees" various objects and shapes. In this way, developers can understand how the neural network interprets different objects, which in turn helps improve its architecture and verify what it has learned during training (Mordvintsev et al., 2015).

Thus, the theme of the interaction between the natural and the technological, or the techno-organic collage, becomes relevant again. By using intellectual technologies and addressing the hard problem of consciousness, artists and scientists are searching for its quintessence. As functionalist neurobiologists say, they are searching for the neural correlates of consciousness, both biological and artificial. The lack of practical and well-founded theoretical solutions to this scientific problem



brings the creativity of artists in the field of science art back to an alchemical paradigm. So, in the work “Microworld in Neural Network Perspective” (2024) by Andrey (Inv4r3d) Maksimov, a visualization of various biological processes was developed, generated by a neural network trained on real natural phenomena. In the piece “BioLogos” (2024), artist Maria Saakyan creates a living book of sacred images. Cell structure formations were filmed in a laboratory under a microscope, and then, with the help of a neural network, symbols of ancient cultures and civilizations were added to the cell silhouettes. Both projects were created with the Institute of Biomedical Engineering of MISIS University.

Conclusion

In recent years, a key theme for scientific art has been the attempt to present the surrounding world as a material, open, dynamic, and discursive system. Materiality implies that these systems embody very different types of material couplings, can change their boundaries and properties, and we can trace the history of the relationships among the elements of this system. While the Western tradition of this art direction is based on the foundations of modern philosophy, in Russia, due to the severance of ties with European art institutions, science art has turned to domestic scientific institutions, which have their traditions formed throughout the 20th century.

The leaders in Russian science have traditionally been institutions associated with exact and engineering sciences (MSU, MISIS, ITMO University, Skoltech, etc.), which directly influence the interaction with artists. Skoltech is an institute created in the image of Massachusetts Institute of Technology

(MIT), ITMO is the university of Information Technologies, Mechanics and Optics, and MISIS is a technological institute (ex-university of Steelmaking and Metallurgy). Such cooperation sets a different vector towards technology rather than philosophy. Thus, while maintaining critical ideas related to the critique of anthropocentrism and object-oriented ontology, artists, in their search for the Other, find themselves in the problematic field of modern technologies, including artificial intelligence technologies.

Despite its remarkable capabilities, human cognition has certain limitations in understanding complex mathematical and computational processes. Humans can grasp high-level concepts and abstractions, but our cognitive system evolved in a three-dimensional world with linear time, influencing our intuitive and mental models and mechanisms. For example, while people easily visualize and understand two- and three-dimensional spaces, they need help with higher dimensions. The brain excels at recognizing patterns over time, but the volume and speed of data processing by machine learning algorithms far exceed our cognitive abilities.

These cognitive limitations directly affect our understanding of the mechanisms and processes within artificial neural networks. As previously mentioned, neural networks are probabilistic models. For instance, a deep neural network may have millions of neurons organized into dozens of layers, performing computations in a multidimensional space beyond human comprehension. Additionally, these models often rely on complex mathematical operations, such as matrix multiplication, multidimensional optimization, and nonlinear transformations, which are far removed from our everyday

experiences. One must trace the network of connections and nonlinear transformations to understand how a decision is made in a deep learning model, which exceeds our cognitive capabilities.

Moreover, modern neural networks are opaque and uninterpretable systems. Developers lack a direct understanding of the model’s workings, which contains billions of parameters and is viewed as a “black box” (Arrieta et al., 2020). The artist’s work transforms into technological art experiments similar to a scientific-magical ritual, and the use of artificial intelligence as a non-human agent brings the artist back to the problems of anthropocentrism.

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