DOI https://doi.org/10.30525/978-9934-26-469-6-16

THE SPECIFICS OF THE PHILOSOPHICAL INTERPRETATION OF NATURAL-SCIENTIFIC AND SOCIO-HUMANITARIAN KNOWLEDGE. INTERDISCIPLINARY RESEARCH. SCIENCE, TECHNOLOGY, AND ENGINEERING. PHILOSOPHY OF ARTIFICIAL INTELLIGENCE

Ushno I. M.

INTRODUCTION

The modern world is unimaginable without the scientific and technological influence on all spheres of human existence. Each step of civilizational progress unveils new technical possibilities and provides numerous reasons for reflection on the consequences of humanity's increasing dependence on technology and technological systems. Philosophy emerges as a unique space for exploring such a phenomenon as modern technology. The diverse tools of philosophical reflection help form a holistic understanding of science, technology, and engineering, yet their development and contemporary achievements are deeply rooted in historical-philosophical analysis. It is this analysis that allows us to engage with the vast body of interdisciplinary theoretical accomplishments in the technical domain, provide a consistent framework, and derive conclusions for further contemporary research.

The historical-philosophical analysis of the development of technology and technological systems raises a wide range of questions related to the ontology of technology: the study of the very nature of technology, its essence, functions, and role in shaping reality, as well as its autonomy from humans; anthropocentrism and technocentrism: inquiries into the place of humans in the world of technology, the role of technology as an instrument of civilizational development, and the possible shift toward a technocentric worldview, where technology assumes the status of an independent subject; social transformations: examining changes in societal structures associated with automation, digitalization, and the dynamics of labor markets, as well as the impact of technology on social equality; ethical dilemmas: addressing ethical aspects of the implementation of new technologies, including artificial intelligence, genetic engineering, and autonomous systems, which pose challenges to traditional moral norms and regulatory frameworks; and the interaction between humans and nature: investigating the impact of

technological progress on the natural environment, the possibilities and limitations of "green" technologies, and humanity's responsibility for the ecological crisis.

The historical context enables the analysis of how the technical achievements of each epoch reflect its cultural and ideological paradigms while influencing the formation of new philosophical concepts. However, the ultimate goal lies in addressing future challenges – analyzing the prospects and risks associated with technological developments, such as space colonization, advances in bionics, the creation of transhumanist technologies, and global management systems. Expanding this discourse allows not only a deeper understanding of the historical and cultural evolution of technical thinking but also the development of a value-based and ethical foundation for future progress.

In contemporary engineering and technical practice, there is a prevailing association with rational thinking, precise calculations, and algorithmic approaches to problem-solving. However, the role of imaginative and aesthetic perception in engineering creativity is frequently underestimated. Intuitive engagement with form, harmony, and aesthetics exerts a significant influence on the processes of design, development, and the implementation of innovative technologies. The core issue lies in the insufficient integration of imaginative cognition within engineering education and practice. Many engineering solutions require not only technical precision but also a creative approach that transcends formal logic. The neglect of aesthetic and conceptual dimensions can result in limitations of design and a diminished intuitive grasp of how technological solutions will function in real-world contexts.

The aerospace dimension underscores the specificity of this kind of research, providing an opportunity to demonstrate, through the example of one of the most science-intensive and technologically complex fields of human activity, the retrospective development of the philosophy of technology and technological systems. The historical-philosophical analysis of aerospace engineering sheds light on such questions as the dream of flight into the heavens and the inspiration drawn from its earliest successes. Investigating the preconditions for the development of aerospace engineering from a historical-philosophical perspective gives the philosophy of technology and technological systems a more focused and nuanced character, paying particular attention to the unique features and specificities of this field.

1. Philosophy of Technology: Historical and Philosophical Context

The philosophy of technology, as a direction of philosophical thought, emerges as a relatively "modern" approach to theoretical and practical inquiry. Despite the long history of humanity's use of technical tools, philosophers did not originally perceive "technology" as an independent object of investigation.

Technological progress was regarded merely as a factor influencing social, cultural, and political existence. "Technology" was subject to analysis in terms of its positive and negative factors that contributed to societal changes. Only over time did the realization emerge that "technology" could become an autonomous phenomenon of philosophical reflection. In contemporary academic literature, an active debate persists regarding what should constitute the subject of inquiry in the philosophy of technology and which conceptual and categorical framework should be employed. The complexities arise from contradictions ranging from fundamentally different perspectives on historical and philosophical legacies to the "difficulties of translation".

Before delving into the study of the emergence of the philosophy of technics and technology, it is necessary to define the term "technnics". Technics (from the Greek – art, skill, mastery) is a historically evolving form of transformative human activity carried out according to a particular rational scheme to meet human needs, enhance human capabilities, and liberate humanity from the dominance of external forces of nature and society.

Starting in the 19th century, continental Europeans began to use terms such as *technik* (German) or *tehnica* (French) to denote a "method of activity", while *technologie* (both German and French) referred either to an academic discipline studying "the methods of arts and crafts" or to a political discipline aimed at "legislatively regulating the functions of arts and crafts". Previously, this term was rare in the English language and primarily referred to academic disciplines, as exemplified by the Massachusetts Institute of Technology. In the 20th century, as a result of scientific progress and the Second Industrial Revolution, "technology" ceased to be regarded as a separate academic discipline and acquired its modern meaning: the systematic application of knowledge for practical purposes. Since the distinction between the terms does not exist in English, both were translated as "technology".

In contemporary Ukrainian, the interpretation of the term "technics" is not limited to a total enumeration of technical means such as airplanes, rockets, or satellites. "Technics" also encompasses scientific research, educational processes, culture, and everyday life, as well as piloting techniques, aircraft maintenance procedures according to regulations, engine replacement techniques, and post-accident control techniques. In this understanding, technics intersects with the concept of "technology" in English. "Technics" = "technology", understood as a systematic approach to practical activity, emphasizes the systematic nature of a given practice.

This broader interpretation underscores the interconnectedness of technology not only with mechanical devices but also with the systemic processes that underpin scientific, cultural, and technical endeavors. Consequently, the philosophical study of technology requires both historical

and contextual analysis to elucidate its multifaceted nature and its role in shaping modern human existence.

In philosophical discourse, these two paradigms coexist in parallel and are more closely associated with the nuances of translation. The first paradigm is based on the term "philosophy of technics", which was first proposed by the German philosopher Ernst Kapp in his work *Grundlinien einer Philosophie der Technik: Zur Entstehungsgeschichte der Cultur aus neuen Gesichtspunkten* (Foundations of a Philosophy of Technics: Toward a History of the Origins of Culture from a New Perspective) in 1877. Kapp's central idea of the philosophy of technics was that tools are projections of human organs (*Organprojektion*). For example, railways were seen as a projection of the circulatory system, while the telegraph was a projection of the nervous system. At the end of the 19th century, Kapp's ideas were supported by the prominent German philosopher Fred Bon in 1898 (in one chapter of his book *On Duty and Goodness*) and the Russian engineer Peter Engelmeier in 1898 (in his pamphlet *The Technical Results of the 19th Century*). This approach, deeply inspired by Hegelian philosophy, viewed technics as a projection of human organs. For the first time in the history of philosophy, the activity of engineers and their influence on societal development was brought into focus.

The second paradigm, formed in the 20th century, revolves around the term "philosophy of technology". This paradigm was rooted in the ideas of Benjamin Franklin and Karl Marx and took a more materialistic stance toward technology. In English-language literature, this term is presented as "philosophy of technology". Five prominent philosophers of the early 20th century who directly examined the impact of modern technologies on humanity were John Dewey, Martin Heidegger, Herbert Marcuse, Günther Anders, and Hannah Arendt. All of them considered technology a central element of modern life.

The paradigm shift in scientific influence during the 20th century, particularly the linguistic transition from German to English, accounts for the existence of these two schools. For instance, Soviet philosophy became a successor to Western 19th-century philosophy concerning the "philosophy of technics". Contemporary Ukrainian authors predominantly rely on the works of Soviet philosophy of science and technic. Meanwhile, American and European scholars construct their concepts within the English-speaking framework of the "philosophy of technology", where there is no semantic distinction between the terms "technics" and "technology".

It is essential for Ukrainian scholars to take these international distinctions into account and to develop their philosophical inquiries with a perspective that includes the translation of academic works into various languages and consideration of differing scientific and cultural traditions. Such an approach

will ensure that Ukrainian philosophical research aligns with global discourses while preserving its unique historical and cultural legacy.

In a broad sense, technology is not merely a tool that humanity may choose to use or not; it is a reality that arises from the coevolution of the physical-cosmic, biological spheres, and the sphere of human creative activity. The study of the phenomenon of "technology and technics" in historical retrospect must begin with an outline of the key periods of scientific and technological development in human history, which correspond to the major historical epochs: the Ancient World, the Middle Ages, the Modern Era, and Contemporary History.

In the first stage, the creation of technical tools can be described as largely accidental, with the process involving all members of society without distinctions of professional identity. In the second stage, the increasing complexity of technical objects is evident, necessitating the development of tools to create these objects as well as a prolonged period of training to acquire the skills required for such work. This complexity leads to the emergence of a new class of artisans.

The third stage marks a decisive transformation in the scientific and technical realm – he transition to the machine as a substitute for the "muscular" strength of humans. The direct relationship between humans and technical tools in artisanal production is severed, and under industrial production, these relationships become mediated. As a result, the technical function and the purely executive function, previously combined in a single individual – the artisan – are now divided. Many roles in machine-based technology are distributed among different individuals, with engineers assuming responsibility for design and construction.

The fourth stage of technological development can be characterized as a time when not only the "muscular" strength of humans but also their intellectual capacities are being replaced by natural forces, systems, and processes. This transformation, initiated at the end of the 20th century, is now gaining widespread momentum. For instance, professions anticipated to be in demand in the near future include neuro-artists, prompt engineers, AI creators, and content moderators. Humanity is no longer a mere physical extension of the technological process but instead finds itself in conditions that enable the free and creative application of its abilities. The evolution of technology itself now carries not only anthropocultural significance but also cosmological significance, as it transforms humanity into a cosmogonic force capable of altering not only our planet but also the near Cosmos.

Let us now focus on the works of philosophers from each of these periods, as understanding contemporary developments requires a clear grasp of the factors that have shaped this reality. Throughout history, philosophers have pondered the development of humanity and the influence of technology on it.

By examining their contributions, we gain the tools to analyze and interpret the present and the future within the broader trajectory of human thought and technological evolution.

A common theme in Greek views on *techne* is that it arises as an imitation of nature (for example, weaving developed from observing spiders). In his *Physics*, Aristotle agreed that such imitation often occurred but also asserted that *techne* can transcend nature and complete what nature cannot bring to an end. Aristotle further argued that *physis* (nature) and *techne* are ontologically distinct, as natural things possess an internal principle of generation and motion, as well as an inherent teleological final cause. In contrast, *techne* is shaped by an external cause and an external *telos* (goal or purpose) that defines it. Natural things strive toward a goal and reproduce themselves, while *techne* does not.

In Plato's *Timaeus*, the world is depicted as the creation of a divine craftsman (Demiurge) who fashioned the cosmos according to eternal forms, much like an artisan creates objects based on blueprints. Moreover, in *Laws*, Plato asserts that the artisan imitates this divine craftsman. This connection between theology and technology would captivate thinkers throughout history. In modern times, this link is exemplified by the work of Michał Heller, a Polish philosopher, theoretical physicist, cosmologist, theologian, and Roman Catholic priest.

Medieval scholastic philosophy largely upheld the traditional view of technology as the imitation of nature. During the Renaissance, Francis Bacon became one of the first modern authors to reflect on the impact of technology on society. In his utopian work *New Atlantis* (1627), Bacon proposed an optimistic worldview in which a fictional institution, the House of Solomon, uses natural philosophy and technologies to extend humanity's dominion over nature – improving society and living conditions in the process.

From the Early Modern period onwards, with the rise of experimental science, reflections on the influence of mechanics on all spheres of existence gained prominence, notably in the works of Robert Boyle. A remarkable figure, Boyle distinguished himself across various domains, from founding the Royal Society of London to managing the East India Company. However, it is his book *Mechanical Qualities* (1675) that interests us most. In this work, Boyle attempted to formulate a mechanistic philosophical framework, making mechanics the foundation of all existence. Drawing from the principles of mechanics, Boyle sought to explain phenomena such as cold, heat, magnetism, mutability and stability, oxidation and reducibility, among others. Boyle's contributions would serve as the foundation for his successors, who began working with concepts such as the "philosophy of production", as explored by Scottish chemical engineer Andrew Ure (1778–1857), and the "philosophy of technics", developed by the German philosopher Ernst Kapp (1808–1896).

The Early Modern period produced a remarkable array of scholars deeply engaged in practical endeavors. The necessity of transmitting knowledge in experimental science became a catalyst for the development of philosophical thought. Johann Friedrich Beckmann, a German scholar, introduced the term "technology" to denote the "science of craft". He was the first to teach technology and to write about it as a scientific subject. His work, *A History of Inventions, Discoveries, and Origins*, established Beckmann as the founder of "scientific technology" (a term he first used in 1772). At that time, no one in England was producing comparable works. Beckmann was also the first to write historical and critical analyses of the technologies of crafts and manufacturing, publishing a classification of technologies. His goal was to conduct research that would inspire others to further advance science.

However, the optimistic view of technology began to shift in the second half of the 19th century. A turning point in the evaluation of technology as a sociocultural phenomenon was Samuel Butler's *Erewhon* (1872), a work heavily influenced by the Industrial Revolution and Darwin's *Origin of Species*. The book describes a fictional country where all machines are banned, and the possession of a machine or an attempt to construct one is a capital crime. This policy stemmed from the population's belief that continuous technological advancements could lead to a "race" of machines that would eventually replace humanity as the dominant species on Earth.

Throughout the last quarter of the 19th century and much of the 20th century, critical attitudes toward technology prevailed in philosophy. Many of these critics primarily held backgrounds in the humanities or social sciences, with little to no direct knowledge of engineering practices. While Francis Bacon had written extensively on the scientific method and conducted physical experiments himself, Samuel Butler was a clergyman. Ernst Kapp, the author of the first text to use the term "philosophy of technics", was a philologist and historian. Most of the 20th-century authors who critically reflected on technology and its sociocultural role were philosophers with broad, general worldviews (e.g., Martin Heidegger, Hans Jonas, Arnold Gehlen, Günther Anders, Andrew Feenberg). Others came from disciplines within the humanities or social sciences: Jacques Ellul studied law; Langdon Winner, political science; and Albert Borgmann, literary studies. Carl Mitcham (1994) referred to this type of philosophy of technology as "humanities philosophy of technology"[1].

According to contemporary philosophers, since the 1960s, a form of the philosophy of technology has emerged that can be viewed as an alternative to

[1] Mitcham C. Thinking through technology: the path between engineering and philosophy. Chicago: University of Chicago Press. 1994. URL: https://philpapers.org/rec/MITTTT

the humanities-oriented philosophy of technology. This approach has gained momentum over the past decade and is now becoming the dominant form of the philosophy of technology worldwide. This form of philosophy of technology can be termed "analytical". It is less concerned with the relationship between technology and society and more focused on technology itself. "Analytical" philosophy of technology views technology primarily as practice – chiefly as engineering practice – and analyzes this practice, its aims, its concepts, and its methods, while connecting these issues to various themes from general philosophy[2].

Carl Mitcham identifies the most significant traditions of critical analysis of technology: the engineering approach, which assumes the centrality of technology in human life, and the humanities approach, which addresses its moral and cultural boundaries. Mitcham bridges these two traditions by analyzing discussions of engineering design, distinctions between tools and machines, and the nature of engineering science itself. He examines technology in everyday life – has material objects (ranging from kitchen utensils to computers), as knowledge (including recipes, rules, theories, and intuitive "know-how"), as activity (designing, constructing, and using), and as volition (the knowledge of how to use technology and the awareness of its consequences). By elucidating these multiple aspects, Mitcham establishes criteria for a more comprehensive analysis of ethical issues in the application of science and technology[3].

Contemporary Polish authors P. Polak and R. Krzanowski (2023) employ a similar dual approach to their analysis, contrasting "philosophy of technology" and "philosophy in technology". They emphasize that philosophy in technology is a research program that examines the philosophical roots of technique and technology. However, engineers assert that the limitations and aims of technology, the dangers and opportunities it presents, as well as its impact on society and humanity, are exclusively technological problems to be resolved solely within the domain of technology. In contrast, philosophy in technology contends that resolving these problems must be grounded in an understanding of their philosophical foundations.

Actualizing the comparative analysis of the concepts of "philosophy of technology" and "philosophy in technology", it is noted that the philosophy of technology can be approached from multiple perspectives. For example, it can be considered as:

[2] Franssen M., Lokhorst G-J., Van de Poel I. Philosophy of Technology: The Stanford Encyclopedia of Philosophy. Edward N. Zalta & Uri Nodelman eds., 2023. URL: https://plato.stanford.edu/archives/spr2023/entries/technology/

[3] Mitcham C. Thinking through technology: the path between engineering and philosophy. Chicago: University of Chicago Press. 1994. URL: https://philpapers.org/rec/MITTTT

1. The systematic elucidation of the nature of technology as an element and product of human culture.

2. The systematic reflection on the implications of technology for human life.

3. The systematic investigation of practices related to invention, design, development, and the production of technological artifacts.

In contrast, philosophy in technology:

1. Seeks the implicit philosophical foundation of technology and technique and its role in shaping technological decisions.

2. Explains the ontological, metaphysical, axiological, and methodological dimensions of technology.

3. Clarifies the semantic gap between technical and philosophical concepts, attempting to unify them under a single perspective.

The latter includes concepts such as agency, autonomy, intelligence, reason, ethics, justification, responsibility, phenomenology, personhood, knowledge, wisdom, privacy, power, right versus wrong, ontology, truth conditions, verification, and so forth – a list that is virtually infinite[4].

The methodology for studying the philosophy of technology is analogous to that of the philosophy of science. It proposes tracing the presence and role of major classical philosophical questions in technology, such as the nature of free will, mind, and autonomous agents, so that references to classical philosophical notions like matter and time can be identified and analyzed. Furthermore, philosophy in technology examines how classical philosophical concepts can be adapted to meet the needs of technology. For instance, Aristotle's concept of *phronesis* in ethics has been adapted for machine ethics, while utilitarian and deontic ethical schools have been applied in the context of artificial intelligence.

Alberto Romele (2020) turned to the study of the "philosophy of technology" by isolating the concept of technological capital and its three states: objectified, institutionalized, and embodied. According to him, a third approach is possible (in addition to the humanistic and analytical or empirical approaches), which involves articulating an empirical perspective with an interest in the symbolic dimension into which technologies and technological mediators are always already embedded. Pierre Bourdieu's sociology of symbolic forms represents an important and largely unexplored resource in

[4] Polak P., Krzanowski R. Philosophy in Technology: Objectives, Questions, Methods, and Issues.Conference: *Workshop on Philosophy in Technology: The Philosophical Challenges for Technology from Various Points of ViewAt*: April 28–29, 2023. Wrocław University of Science and Technology URL: https://www.researchgate.net/publication/370653723_Philosophy_in_Technology_Objectives_Questions_Methods_and_Issues

this regard[5]. This marks a new perspective on the methodology for studying the phenomenon of the "philosophy of technology".

2. From Image to Innovation: Philosophical Grounds of Artistic Thinking in Engineering Practice

Artistic and imaginative perception constitutes one of the most essential mechanisms of cognition, accompanying humanity since the dawn of its history. It plays a pivotal role in the formation of knowledge, as it enables the structuring of experience, the envisioning of novelty, and the generalisation of phenomena. Images created by the imagination not only assist the individual in orienting themselves within reality but also serve as a foundation for the further development of scientific thinking.

Imaginative perception is likewise crucial to the construction of models of reality. It is precisely through images that scientists formulate conceptions of phenomena which cannot be directly observed – such as molecular structures or hypothetical events in the universe. Artistic and imaginative perception constitutes an indispensable element of scientific creativity. Conceptions of symmetry, harmony, and aesthetics influence the formulation of scientific hypotheses. The idea that nature strives for simplicity and harmony proved fundamental to thinkers such as Isaac Newton and Albert Einstein.

Scientific discoveries are frequently inspired by artistic images. For instance, the double helix model of DNA proposed by Watson and Crick was based on a notion of structural symmetry that emerged through imaginative thinking. Similarly, numerous technical solutions, engineering constructions, and software designs have been the outcome of artistic imagination.

In the contemporary world, artistic and imaginative perception is becoming ever more pertinent. Engineering, medicine, design, and cybernetics – all these fields actively employ imagery in the development of models, simulations, and forecasts. In virtual reality, for example, artistic images provide the foundation for the creation of environments that enable the modelling and investigation of complex systems. Moreover, the development of artificial intelligence (AI) relies significantly on imaginative perception. Modern algorithms for image generation or text synthesis are based on principles of artistic and imaginative interpretation. This symbiosis of art and science enables the creation of novel technologies that influence all aspects of human life.

Philosophy, as the foundation of human worldview, has always sought to comprehend the nature of thought, imagination, and creativity. Artistic and imaginative perception, as a form of intuitive yet structured cognition,

[5] Romele A. Technological Capital: Bourdieu, Postphenomenology, and the Philosophy of Technology Beyond the Empirical Turn. *Philosophy and Technology.* 2020. 34 (3):483-505. URL: https://philpapers.org/rec/ROMTCB

possesses deep philosophical roots, extending back to the ancient Greek tradition and continuing within contemporary philosophical theories. Thus, ancient philosophers such as Plato and Aristotle were the first to address the role of imagination and imagery in knowledge. Plato regarded artistic images as "reflections of reflections" that produce the illusion of reality. In his theory of Ideas, he emphasised that true knowledge is attainable only through reason, whereas images represent but a shadow of the truth. Aristotle, by contrast, recognised the value of artistic and imaginative perception. He maintained that imagination (*phantasia*, in Greek) is an essential mediator between sensory perception and understanding. In his works, such as the *Poetics*, images and metaphors are regarded as instruments that facilitate the communication of complex ideas and the structuring of knowledge.

In medieval philosophy, artistic and imaginative perception assumed a theological character. Symbols and metaphors became the primary means of expressing spiritual ideas. Theologians such as Augustine the Blessed and Thomas Aquinas held that images enable the human being to ascend to higher realms of being and to apprehend divine truth. The artistic symbol was conceived as a "key" to the understanding of the sacred. The medieval tradition laid the foundation for symbolism, wherein images were interpreted not merely as aesthetic phenomena but as profound significations reflecting universal truths. This approach continues to exert influence upon modern philosophy.

From the advent of the modern era, philosophers began to devote greater attention to the role of imagination in both scientific and artistic cognition. Rationalists such as Descartes considered imagination a subsidiary tool of reason, capable of forming images that aid logical analysis. In contrast, representatives of Romanticism, such as Schelling and Nietzsche, viewed imagination as a source of intuitive knowledge, capable of revealing truths that transcend the limits of rational categories. Romanticism accentuated the unique role of the artist as a creator of new images that disclose hidden dimensions of reality. This approach significantly influenced the development of modern aesthetics and the philosophy of art.

In the twentieth century, artistic and imaginative perception became the subject of intensive philosophical scrutiny. Edmund Husserl and representatives of phenomenology emphasised that images constitute a form of intentional consciousness through which the human being apprehends the world in its phenomenological manifestation. Martin Heidegger, in his reflections on art, highlighted the importance of images in the revelation of "being". He argued that art is a mode of interpreting the world that transcends conventional rational thought. Jacques Derrida, through his concept of deconstruction, drew attention to the polysemy of artistic images, which foster the emergence of new interpretations and meanings. This approach

underscores the significance of symbols and metaphors in the construction of knowledge.

Contemporary philosophy underscores the interdisciplinary nature of artistic and imaginative perception, which unites art, science, and technology. Engineering, architecture, design, and even artificial intelligence employ images to visualise complex ideas and processes. Philosophers such as Gilbert Simondon and Donald Schön consider artistic and imaginative perception as a foundation for design and innovation. They emphasise that imagination constitutes a necessary condition for the creation of models that enable the resolution of complex problems. Thus, in his work *On the Mode of Existence of Technical Objects*, Simondon writes: "In labour, man shapes matter through form; he arrives with this form, which is a kind of intention, a projection of the result, something prefigured, that which must be achieved according to pre-existing needs. This form – the intention – is not part of the material upon which labour is exerted; it expresses usefulness or necessity for the human being, but it does not originate from nature itself"[6]. In this context, intention becomes a design, an image, which helps to orient human activity toward a technical object. Artistic and imaginative perception is thus expressed in concrete form, according to Simondon. This form is an intention, particularly when one refers to engineering and technical practice. What remains debatable is the primacy of either the image or the form as such: what precedes what in the consciousness of the engineer – the image, or the form already mentally imposed upon the technical object? At what point does the intention transition into form, or does it, perhaps, never exist independently of it? Simondon's reflections contain sufficient material for further philosophical analysis.

Through a series of thematic case studies, Donald Schön demonstrated that the patterns of thought, discourse, and interaction typical of various professional groups – identified as designers (architects, urban planners, engineers, psychoanalysts, scientists, and business managers) – are comparable in the way they engage in strategic moves resembling a "conversation with the situation", to which the situation then "responds"[7]. The influence of imagination and metaphorical reasoning on the work of engineers illustrates not only the need to acknowledge such faculties but also to actively cultivate them. Schön's work substantiates the growing importance of artistic and creative disciplines in the education of technical and engineering professionals.

[6] Simondon G. Du mode d'existence des objets techniques / Nouvelle éd. revue et corrigée. Paris: Aubier, 2012. (Philosophie). 367 p. URL: https://monoskop.org/images/2/20/Simondon_Gilbert_Du_mode_d_existence_des_objets_techniques_1989.pdf

[7] Bolan Richard S. Urban Planning's Philosophical Entanglements: The Rugged, Dialectical Path from Knowledge to Action. Oxon: Taylor & Francis. 2017. p. 245.

At the intersection of art and science, the artistic image emerges as a powerful epistemological instrument that unites the aesthetic and logical dimensions of thought. Representations, metaphors, and aesthetic categories – such as harmony and symmetry – play a crucial role in the formation of scientific theories and engineering solutions. Imagination is a central component of scientific thinking; it contributes to the generation of innovative ideas and conceptual frameworks. The renowned physicist Albert Einstein remarked that imagination is more important than knowledge, for knowledge is confined to what is already known, whereas imagination opens the path to new possibilities. The representations that arise within the scientist's mind facilitate the creation of new models, hypotheses, and theoretical structures. For instance, the image of planets orbiting the sun served as a conceptual basis for Niels Bohr's atomic model. Imagination enables the execution of thought experiments, which are essential in disciplines such as physics and chemistry, particularly when empirical experimentation is either impossible or excessively complex. Moreover, imagination functions as a tool of interdisciplinary cognition, allowing the transposition of ideas from one domain to another – such as the application of natural forms to engineering design, known as biomimicry.

Metaphor is one of the most potent instruments of artistic and imaginative comprehension, and it plays a pivotal role in both scientific and technical reasoning. It enables the transfer of meaning from one domain of experience to another, rendering abstract and complex ideas intelligible through familiar imagery. For example, the metaphor of the "genetic code" allowed the mechanism of hereditary information transmission to be readily understood by likening it to a computer program. Similarly, the concept of a "black hole" in astronomy became conceivable through the metaphorical description of a gravitational field so intense that not even light can escape it. Metaphors also function as vital tools of communication between scientists and the public. They render sophisticated scientific concepts comprehensible to broader audiences, thereby facilitating the dissemination of knowledge and garnering support for scientific inquiry.

Aesthetic categories such as harmony, symmetry, simplicity, and proportion play a foundational role in the construction of scientific theories. Scientists are frequently guided by aesthetic principles, aspiring to create theories that not only explain phenomena but also exhibit "beauty" in terms of logical coherence and structural elegance. Harmony is integral to the natural sciences, as nature itself demonstrates harmonic patterns – from the symmetry of flowers to the spiral forms of galaxies. The study of such harmonious structures not only inspires but also enables the discovery of fundamental natural laws. Symmetry, in particular, is a central category in contemporary physics, where it facilitates the formulation of foundational laws.

The principles of symmetry were instrumental in the development of the Standard Model of particle physics, while the breaking of symmetry explains numerous significant phenomena, such as the origin of mass. Aesthetic principles also influence the advancement of mathematics. The distinguished mathematician Henri Poincaré noted that the "beauty" of a mathematical formula can be felt intuitively, and that this very beauty often guides the mathematician towards the correct solution amidst countless alternatives.

Engineering, commonly perceived as a precise and rational discipline, in fact possesses a substantial artistic dimension. Processes of technical design, conceptual development, and visualisation demand not only technical knowledge and skill but also creative perception. Technical design and artistic creativity share numerous commonalities, as both involve the generation of a new image or form directed toward a specific objective. However, there are also significant differences between the two.

Commonalities:

- Creative process: Both technical design and art require imagination, inspiration, and the capacity to perceive possibilities that others may overlook.
- Orientation towards innovation: Each discipline aspires to produce something novel and unique, diverging from existing solutions.
- Use of imagery: In both processes, the formation of images is central to the expression of the creator's intent.

Differences:

- Purpose: The principal aim of technical design is practical application – the creation of a product or system that addresses a specific problem. Art, by contrast, is oriented towards aesthetic impact and emotional experience.
- Constraints: Technical design is constrained by the laws of physics, economic feasibility, and technological capabilities, whereas artistic creation enjoys greater freedom.
- Criteria of evaluation: In design, functionality, efficiency, and reliability are paramount, whereas in art, aesthetic value and subjective resonance are central.

Design within engineering constitutes a process of modelling a future object or system. This modelling bears many similarities to artistic activity, as it is grounded in imagination, abstraction, and imagery.

Stages of artistic modelling in engineering:

1. Ideation: Much like an artist, the engineer begins with an idea, responding to the question: what should be the form, function, or mechanism of the new object?
2. Visualisation: During the design process, sketches, technical drawings, or digital models are created to render the idea in concrete visual terms.

3. Optimisation: The engineer, akin to the artist, seeks a harmonious solution that satisfies technical, aesthetic, and practical requirements.

Whereas artistic modelling is primarily concerned with the expression of emotion and abstract ideas, engineering modelling is based upon precise calculations and physical principles. While the artist creates a singular and often non-reproducible work, the engineer designs systems intended for mass production and consistent application.

Visualisation constitutes an indispensable component of the engineering process, enabling the transformation of abstract ideas into comprehensible images and conceptual frameworks. This process encompasses several stages, each characterised by its own specificities. The sketch represents the initial form of visualisation, allowing for the rapid expression of an idea. Although often spontaneous and lacking in detail, the sketch serves as the foundational basis for subsequent project development. Furthermore, it functions as a communicative tool among team members, facilitating the articulation and transmission of conceptual intent.

Following the sketch, precise technical drawings and schematics are produced, incorporating all necessary specifications for the future object. These serve as an intermediary phase between conceptual design and actual production. Contemporary engineering is increasingly reliant on digital modelling, supported by specialised software. Such models allow for three-dimensional visualisation; they enable simulations that replicate real-world system behaviour, and permit the early identification of design flaws – thereby conserving both time and resources. Digital technologies are thus reshaping the very nature of engineering thought, allowing for the realisation of more intricate and unconventional ideas.

Artistic and imaginative perception also plays a significant role in biomimetic design, where technological solutions are inspired by natural forms and processes. Engineers and designers, by observing the structures of the natural world, adapt these to the development of efficient and harmonious technical objects. For instance, the aerodynamic principles of modern aircraft are based on the form of avian wings, while robotic technologies frequently emulate the locomotion mechanisms of various fauna.

Equally pertinent is the question of the aesthetic dimension of technical solutions. The visual appeal of a product influences not only consumer perception but also operational efficiency. In contemporary engineering design, aesthetic principles – such as proportion, symmetry, and rhythm – are integrated into technical development, ensuring a synthesis of functionality and harmony.

Artistic and imaginative perception in engineering is not limited to visual representation alone. Imagination becomes especially indispensable in domains that lack a pre-existing cultural or empirical precedent. Not all

engineering and design practices can draw inspiration from visual culture or the natural world. Aerospace engineering, for instance, seeks conceptual models in extra-terrestrial contexts. The development of aviation and space exploration, the invention of new materials, and the construction of technologically complex mechanisms all require modes of conceptual thought that transcend empirical experience. In such cases, artistic and imaginative thinking facilitates the design of futuristic models, enabling the visualisation of structures and devices that do not yet exist but may become real through engineering creativity.

The idea of human spaceflight, for example, long existed as a product of artistic fantasy, represented in literary and cinematic imagery. These images became sources of inspiration for scientists and engineers engaged in the development of spacecraft, orbital stations, and interplanetary missions. The influence of science fiction upon engineering is among the most vivid examples of the synthesis of artistic imagination and scientific methodology.

Aerospace science fiction constitutes a significant cultural phenomenon expressed through various forms of art, including literature, cinema, and graphic novels. It serves not merely as entertainment, but as a conceptual medium shaping perceptions of future technologies – particularly within aerospace engineering. The history of science demonstrates that many innovations now realised as technological facts first appeared in the imagination of science fiction writers. In this context, science fiction is not merely a literary genre, but a form of intellectual activity conducive to the modelling of possible technological, societal, and ethical futures.

As science fiction becomes more complex as an artistic genre, new challenges emerge – chief among them the need to comprehend the socio-cultural and philosophical dimensions of technological development. One of the principal questions posed to contemporary thinkers concerns the ethical implications of implementing advanced technologies. Science fiction can no longer be confined to dystopian narratives depicting the dominance of machines or the collapse of civilisation resulting from the uncontrolled proliferation of robotics. Current discourse increasingly leans toward a philosophical interrogation of the prospects for harmonious coexistence between human beings and artificial intelligence.

Science fiction not only anticipates technological discoveries but also acts as a medium for the popularisation of science and a platform for interdisciplinary communication. A notable example of the rational use of science-fictional concepts is the collaborative project by David Raitt, Patrick Gyger, and Arthur Woods – Paper IAF-01-IAA.8.2.02, presented at the 52nd

International Astronautical Congress (1–5 October 2001, Toulouse, France)[8]. This study illustrates a systematic approach to the analysis of science fiction as a source of innovation. The authors developed a digital resource through which enthusiasts and engineers from across the globe analysed approximately 250 potentially innovative predictions found in science fiction works – many of which have subsequently become the basis for research and funding proposals within the field of aerospace engineering. This case constitutes a compelling example of how science fiction can be integrated into the processes of technological forecasting and strategic planning.

An important dimension of contemporary discourse is the interrelation between science fiction and the philosophical analysis of technology. Modern philosophy of science and technology highlights the necessity of ethical reflection upon scientific discoveries. In this context, the speculative scenarios proposed by science fiction authors can serve as a framework for contemplating the potential risks and benefits associated with specific scientific directions.

The formation of innovative concepts within aerospace engineering is, to a significant degree, dependent on artistic and imaginative thinking. Notions such as interplanetary travel, the colonisation of Mars, the utilisation of antimatter, or the development of quantum propulsion systems originated as the imaginative constructs of speculative literature. Today, these ideas are increasingly discussed within the domain of scientific hypothesis and experimental research. Science fiction functions as a predictive tool through the mechanism of hypothetical reasoning. Within this context, the role of the philosophy of technology becomes essential, as it explores the dynamic interrelations between humanity, technology, and the environment[9]. Speculative scenarios make it possible to anticipate potential challenges and to seek solutions at the stage of theoretical modelling.

The significance of science fiction for aerospace engineering also resides in its capacity to popularise and disseminate knowledge. Given the highly specialised nature of the aerospace field, which is not always accessible to the general public, science fiction serves as a cultural ambassador, attracting public attention and cultivating a positive image of science.

Artistic and imaginative perception is a vital component of the cognitive process, forming the foundation of knowledge creation. Its significance lies in the capacity to produce images that mediate between the world of phenomena

[8] Raitt D., Gyger P, Woods A., Paper IAF-01-IAA.8.2.02 presented at the 52 International Astronautical Congress 1-5 Oct 2001 / Toulouse, France.

[9] Ushno I. Aesthetics in the «man-machine-environment» system: the search for harmony "Visnyk NIuU imeni Yaroslava Mudroho". Seriia: Filosofiia, filosofiia prava, politolohiia, sotsiolohiia, 2(61). 2024. S.91-102 .

https://doi.org/10.21564/2663-5704.61.304639

and the world of concepts. Without artistic and imaginative perception, the advancement of science, technology, and culture would be inconceivable. In the contemporary world, the integration of art and science opens new horizons for knowledge, fostering innovation and progress. The artistic image, imagination, metaphor, and aesthetic categories form a unique bridge between aesthetics and logic, between art and science. They enable the human subject not only to comprehend the world but also to create new realities, thereby expanding the boundaries of cognition. The study of these mechanisms is key to a deeper understanding of how knowledge and scientific theories are formed, and how innovation may be creatively represented.

Engineering, as the art of constructing images, synthesises logic and creativity, technical precision and artistic vision. From the sketch to the digital model, engineering design is a process through which unique concepts are generated – concepts capable of transforming the world. Recognising the artistic nature of this process allows for a more profound understanding of the significance of engineering in contemporary society. Thus, artistic and imaginative thinking is not merely an auxiliary instrument within engineering practice; it is a necessary factor in innovative development. Its integration into technical education and practice can contribute to the formation of new design approaches that incorporate both functional and aesthetic dimensions of technological processes.

Science fiction is a vital intellectual and philosophical phenomenon that plays a significant role in forecasting scientific and technological advancement. It not only shapes visions of the future but also facilitates interdisciplinary dialogue between philosophy, engineering, and the natural sciences. International research demonstrates that the systematic analysis of science-fictional ideas can serve scientific planning and strategic development, particularly in the aerospace domain. In Ukraine, large-scale studies on this subject have yet to be conducted, presenting an opportunity for the future advancement of scholarly inquiry. The integration of artistic and scientific thinking may become a key factor in fostering an innovative approach to aerospace engineering and technological foresight.

3. Historical and philosophical retrospective of humanity`s dream of flying

Since ancient times, a person has looked up into the sky and tried to imagine himself in flight. The desire to break away from the land has always provoked many questions about one’s capabilities, the answers to which could not be obtained through one’s own experience. Watching the flight of birds, a person could only dream, picturing in his mind his own sense of flight, constantly feeling his limitations. It was the feeling of unaccomplished experience, the desire for the impossible, and superhuman abilities that gave

dreams of flight a supernatural essence. Various secret signs were attributed to this superpower, surrounded by magical attributes and formed a rather stable attitude – a ban. The dream of flying into the sky is a very secret, personal, existential dream, and it was impossible to talk about it, maybe only in a metaphorical sense. But it was impossible to avoid such a dream.

These dreams were pushed out of reality into the space of myths, religious beliefs and cults. By giving them the status of supernatural, unrealistic and unrealisable, people could avoid them to the point of taboo as the most dangerous and destructive. In the history of space and sky exploration, such dogmas were very strong and influential, backed by a large number of rules, regulations, and laws. Obeying the instinct of self-preservation, humanity had to protect itself from such dreams and aspirations. Any interest, any manifestation of curiosity in exploring the possibility of flight was seen as an unnatural desire that was punishable by the sky itself. The paradigm – the dream of flying into the sky will be punished by the sky itself – has existed for millennia.

The sky has always been a symbol of the Divine. Despite the difference in religions, a person raised his face up, hoping for the supernatural, and said the words of prayer. These dreams of the sky are different from the subject of our research. These are the dreams about karma, punishment, petitions, prayers, etc. Dreams about the intervention of the sky in the earthly life of a person below. Such dreams do not imply flying, but rather confirm that the sky is not a space for humans, it is only for the non-human. In this context, dreams about exploring the sky are rather an exception, an incredible story that only reinforces the paradigm that "the sky is only for the powerful God", only He can come down to a human from the heavens to the earth to govern.

The human desire to fly can be observed in Mesopotamia at the dawn of civilization. Sumerian cylindrical seals of the third millennium B.C. depict images of humans flying, and in the early second millennium B.C. there was a Simian-Akkad (Sumerian poem) in which King Etana composed a poem about a journey through the sky on an eagle. More detailed description of the journey can be found in a very interesting work by Mozgovyi, Ivan. "Paleoastronauts" in the Near East: Esoteric in the Tradition[10], but we are not interested in aliens, but in dreams of flight. Etana had a good reason, he wanted to have a son. The gods accepted the first flight quite positively, and the king even returned alive. The question is why he flew the second time. What was his motivation? We can only guess, because the legend describes that it was the fear of rising

[10] Мозговий І. Палеоконтакт: міф чи реальність: монографія. Суми: Сумський державний ун-т. 2017. 237 p. URL: https: //sumdu.academia.edu/IvanMozgovyi%D0%86%D0%B2%D0%B0%D0%BD%D0%9C%D0%BE%D0%B7%D0%B3%D0%BE%D0%B2%D0%B8%D0%B9

above the sky caused the tragedy. Rather, the first attempt impressed Etana so much that he saw our planet from a height that he could not resist a second attempt. The Gods did not appreciate the desire to fly for the second time, and a tragedy happened. This fact proves our assertion that the dream of flying into the sky will be punished by the sky itself (by the Gods). Modern researchers emphasise the influence of this legend on strengthening of power and belief in the gods, and the punishment of the idea of flying into the sky. Nothing was to give hope for human power, for his ability to master the heavenly spaces.

Later, the idea of a breakthrough into the heights is manifested in the ancient Greek myth of Icarus and Daedalus, a unique artist and engineer whose name comes from a verb meaning "to make art". This myth is very popular and it is even studied at school. In it, too, the first reason for flying is not a dream, but a strict necessity, the idea of liberation: "Minos may have blocked my way across the sea, he may own everything – the water and the land – but the heavens are not his domain, the sky is free! I must learn to fly from the birds"[11]. The analysis of the myth of Icarus and Daedalus even has a historical and philological basis. According to Tamara Shevel, the original interpretation of the myth is found in Ovid's Metamorphoses, however, for the antiquity the main character was the father, Daedalus. But European art pays more attention to Icarus, romanticising and heroising the image, in particular, starting with the sonnets of Renaissance poets. The age of Romanticism shows a special interest in the image of Icarus; this ancient image, though with a different name – Euphorion – appears in Faust by Goethe, associated with the image of the romantic Byron. Charles Baudelaire's poem "The Laments of an Icarus" ends by singing the premonition of the hero's tragic death, as in Renaissance sonnets. Baudelaire presents the metamorphosis of oblivion, and his Icarus becomes a symbol of the birth of decadence[12]. This interpretation still prevails today. Icarus is a symbol of freedom, dream and protest. Did Icarus have a dream of the sky? He did not create the wings, he did not develop the technology of flight, and he could not even master the safety precautions. Psychologists emphasise that Icarus had a teenage dream of self-determination and independence from his father and circumstances. The tragic end, the death of Icarus is created to emphasise the conclusion that the impossible cannot be done. The heavens will punish those who try.

[11] Шевель Т.О. Інтерпретація міфологічного образу в поезії м. Вороного «Ікар». *Філологія і лінгвістика в сучасному суспільстві: м*атеріали ІІ Міжнародної науково-практичної конференції (м. Львів, 30-31 жовтня 2015 року). Херсон : Видавничий дім «Гельветика», 2015. С. 66–69. URL: http: //molodyvcheny.in.ua/files/conf/fil/07oct2015/07oct2015.pdf

[12] Ibid, p. 68.

The historical retrospective of dreaming about the sky can be continued with the 15th and 16th century dreamer Leonardo da Vinci: "He who knows everything, can do anything. If you know, you will have wings!". Da Vinci was a vivid example of a man who dreamed of heaven. His famous work "The Codex on the Flight of Birds" impresses with its scientific novelty for its time. Unfortunately, the life turned out in such a way that such developments remained on paper. It is not only the specific proposals for the creation of aircraft that are surprising, but also his genius ability to analyse the world around him and the sky in general.

Leonardo da Vinci was the first to describe the nature of a unique celestial phenomenon that can sometimes be observed during the sunset, when there is a crescent Moon on the horizon, but the outline of the full Moon is visible. This effect of the ghostly full Moon, called the Da Vinci Glow, is caused by the light emitted by the Earth even after the Sun has set. It turns out that the Earth is the source of light, which is about 50 times brighter than the light from the full Moon. When Leonardo da Vinci theorised about this, Copernicus had not even published the theory that the Earth revolves around the Sun. But through his artistic understanding of light and shadow and his engineering understanding of geometry, Leonardo was able to find out where the ashy glow around the crescent Moon came from and the reason why the outline of the full Moon could be seen[13].

The historical and philosophical analysis allowed us to trace the paradigm shift in dreams of the sky from "the dream of the sky will be punished by the sky itself" and "the sky is only for the powerful God", through "a flight as a fact of transformation" to "a flight is real and it is nice to make it successful". The modern paradigm gives us many areas for research. The search for inspiration in the field of science and technology, especially for the aerospace community, is a complex issue that is relevant for interdisciplinary research. In this article we will focus on the phenological dimension of the process of dreaming about flying into the sky as an inspirational factor for people in the aerospace sphere. Perhaps we should start with the type of thinking, with the special qualities that are inherent in dreamers of spaceflight. In modern humanitarian science, this area is quite developed – the philosophy of imagination. As an example, we can refer to the modern collection The Routledge Handbook of Philosophy of Imagination, which consistently presents the European tradition in the study of imagination.

Aristotle, in his treatise "About the Soul", pointed out the key role ofimagination in combining the sensory and semantic, i.e. in generating

[13] Holcombe M. Here's when you can see the moon in the Da Vinci glow. *CNN*: 22 may. 2023. URL: https://www.cnn.com/2023/05/18/world/da-vinci-glow-crescent-moon-scn/index.html

thought. According to Descartes, this deceptive, unreliable ability is "second-rate" compared to the intellect, but it is important and interesting precisely because it ensures contact between the soul and the body, and is the basis of human vitality. Hume, reflecting on the sensuality, imagery of thought and its essential dependence on imagination, concluded that we can imagine and, therefore, think. Kant played a key role in the development of modern concepts of imagination, proposing to distinguish between reproductive imagination, which relies on existing experience, and productive imagination, which makes new experience possible. Sartre studied imagination as the key to human freedom: the ability to withdraw from the real flow, to distance oneself from it, to determine possible actions[14]. All of these interpretations are more in line with the nature of the phenomenon we are studying – the dream of flying in the sky. In other words, a future aerospace engineer needs imagination, but what kind of imagination will contribute to our main idea – space exploration.

The aforementioned collection contains repeated references to the typology of imagination (creative and recreational) was proposed by Gregory Currie and Ian Ravenscroft. "Creative imagination involves a "leap into novelty" provided by an unusual, unconventional combination of ideas, while recreational imagination involves a shift in the perspective of perception by changing the "optics" and view". It is the recreational imagination that is the basis of the dream of flying. Let's take a closer look at this term. So, recreational imagination means that when we see but we have no experience, we recreate our experience by watching someone else's. In their dreams of the sky, people looked at the flight of birds and recreated their own flight in their imagination. Kant wrote about such a criterion as experience in the evaluation of imagination, using the term reproductive. When we talk about space exploration, the imagination cannot rely only on the experience of birds. Mankind did not have anyone else's experience to recreate the experience of flying to the Moon. The dream of space exploration requires a creative or productive imagination, which is not developed by the modern philosophy of imagination. Such imagination, according to Sartre, implies freedom, distancing oneself from existing experience. Further works in this area are moving out of the realm of philosophy and into the field of psychology and psychotherapy. According to Maria Popova, "Freud asserted that daydreaming is essential to creative writing – something a number of famous creators and theorists intuited in asserting that unconscious processing is essential to how creativity works, from T. S. Eliot's notion of "idea incubation" to Alexander

[14] Kind Ed. A. The Routledge Handbook of Philosophy of Imagination. London; N.Y.: Routledge, XX, 2016. 481 p.

Graham Bell's "unconscious cerebration" to Lewis Carroll's "mental mastication"[15].

An intermediate conclusion can be formulated: imagination as a main factor of invention in the aerospace community should be distinguished. For example, recreational or reproductive imagination is more typical for the aviation sphere, while creative or productive imagination contributes to developments in the space sphere. Imagination becomes a predicate of creative activity, pioneering, and is more closely related to the result of activity. A dream does not imply necessity; it has more freedom, deeper meaning, it can be called a predicate of desire. According to the laws of logic, a dream intersects with imagination where creativity is inspired by desire. Inspiration, which is very difficult to artificially construct, easily follows human desire. Inspiration needs the freedom to dream, space, air. Perhaps more space and air is needed for the aerospace community. Dreaming of flying is exactly this kind of phenomenon, an inspiration with great freedom of imagination, which in the aerospace sphere becomes an innovative, inventive and design activity.

Further phenomenological research should be focused on the typology of dreams. In this approach, the European and English-American literature presents three groups of dreams: dreams as constructive ideas during wakefulness, and night dreams and "mind wandering" when dreams are not directed towards any purpose. These types of dreams have no specific boundaries in real life. We can dream constructively about how to build a rocket, and then some design solution will come to us in a night dream. During the next day in our "mind wandering", we will try on and look for ways to use this design solution. Or it may happen that all three groups will be unrelated to each other, and their boundaries will be clearer. In our case, when the dream of flying becomes an inspiration, all the groups presented will be in a certain correlation. Even the process of mind wandering is no longer considered so senseless on the background of inspiration, because at this time the dream seems to gain strength, to reach a starting position similar to driving to the runway.

The main source of inspiration for the research on the philosophy of dreaming about flying in the sky is the works of Gaston Bachelard. After a career in philosophy, where he put forward the theory of the epistemological break, which was widely accepted by the scientific community, later Gaston Bachelard developed a phenomenology of dreams, in which he worked on the connection between art and science. The problem with science, according to Bachelard, is that new discoveries always need to be placed in

[15] Popova M. The Psychology of How Mind-Wandering and "Positive Constructive Daydreaming" Boost Our Creativity and Social Skills. 2013. URL: https://www.themarginalian.org/2013/10/09/mind-wandering-and-creativity/

the context of already acquired knowledge; thus, it is a retrospective way of thinking that prevents the appearance of novelty. On the other hand, to dream is to open oneself to what is unknown. Bachelard's reflections on the theme of the sky and the space are not specifically related to aerospace engineering, as he died a year after the first human space flight, but there is definitely a premonition in his work.

"Poetic reverie gives us the world of worlds. Poetic reverie is a cosmic reverie. It is an opening to a beautiful world, to beautiful worlds. It gives the I a non-I which belongs to the I: my non-I. It is this "my non-I" which enchants the I of the dreamer and which poets can help us share. Reverie helps us inhabit the world, inhabit the happiness of the world. The cosmic reverie ... is a phenomenon of solitude which has its roots in the soul of the dreamer.

Cosmic reveries separate us from project reveries. They situate us in a world and not in a society. The cosmic reverie possesses a sort of stability or tranquility. It helps us escape time. Cosmic images are possessions of the solitary soul which is the principle of all solitude. Reverie gives us the world of a soul [and] a poetic image bears witness to a soul which is discovering its world, the world where it would like to live and where it deserves to live... Poetry forms the dreamer and his world at the same time. Poets lead us into cosmoses which are being endlessly renewed"[16].

In a series of books about the elements of earth, air, water and fire, Gaston Bachelard explored dreams and night dreams in the context of the four elements. We are interested in air as a space for flight. The work has a number of ideas about dreaming about the sky[17]. Based on them, it is possible to provide a more detailed description, characteristic features of human dreams of flying into the sky.

For example, the feeling of lightness and weightlessness that appears when a person dreams of flying into the sky. Dreams in which a person is flying, according to the author, are a sign of high intelligence. The great influence of psychoanalysis by Freud and his followers is reflected even in daydreams, when a person loses the clear line between sleeping at night and dreaming during the day. Dreaming of the sky, seeing dreams in weightlessness, the feeling of weightlessness does not disappear when a person wakes up, it remains as an inner need to be free. The interest is caused by the polemic that dreams of human flying appeared even when the fact of flying did not exist, which indicates the irrationality of such dreams. The fact of resurrection in the

[16] Bachelard G. The poetics of reverie: childhood, language, and the cosmos. Boston, MA: Beacon Press. 1971. URL: https: //archive.org/details/peoticsofreverie00bach/page/n11/mode/2up

[17] Bachelard G., Farell E., Farell F. Air and Dreams: An Essay on the Imagination of Movement. Dallas Institute Publications. 1988. URL: https://archive.org/details/airdreamsessayon0000gast/page/n7/mode/2up

dreams of a religious person is associated with a flight into the sky. The fact of a successful flight of a balloon, aerostat, airplane or rocket gives a completely different meaning of dreams. This is the historical context that G. Bachard is talking about. Wings as a symbol of the rationality of flight, as a symbol of the desire to explore the airspace.

The dream of flying into the sky also conveys a sense of psychological strength and potential. Spiritual work on oneself, a transparent staircase of one's inner existential growth. In the context of aerospace engineering, modern dreams of the sky are about being worthy of flying. We understand subconsciously that "only the best of the best" can fly. The high standard of sky dreamers indicates personal internal self-sufficiency and high self-esteem.

The feeling of youthfulness in body and soul when flying is not limited by time, when time flows differently in space. Most artistic sources suggest that young people fly so that they have enough time to get there and back. Dreams of the sky do not leave place for experience, they need the energy of the discoverer, the peculiar nature of consciousness that is open to the new.

The feeling of monochrome, transparency, colourlessness is typical for dreams of the sky. Gaston Bachlard's work captures this perfectly: "We put forward the following thesis: if birds cause such a powerful impulse of imagination in our minds, it is not because of their bright colour. Initially, it is the bird's flight that is really beautiful. For a dynamic imagination, the flight is the prototype of beauty. We can see the beauty of the plumage only when the bird lands on the ground, when it no longer is a bird for dreams. It can be asserted that there is an imaginary dialectic that separates flight from colour, and movement from decoration. You cannot have it all at once: you cannot be both a lark and a peacock. A peacock is, to the highest extent, an earthly creature"[18]. During dreaming, visual perception seems to rest, does not focus on details, it is busy observing the outside rather than analysing its own image, and is not bewildered by earthly experiences of visuality and corporeality.

The feeling of purity, innocence and the bright hope of purification is also typical for dreams of flying into the sky. The duality of the human world, the eternal opposition of earth and sky, light and dark, elevates our dream of the sky, pleasing our ego. By dreaming of flying into the sky, we exalt ourselves, idealising space, and attribute the virtues of heaven to ourselves. The difficulty in these dreams, a kind of error, is caused by the night, by flying in the dark. Cosmos, the Universe, the space beyond the sun's rays, beyond the flight of birds complicates our idealised dreams of the sky.

[18] Bachelard G., Farell E., Farell F. Air and Dreams: An Essay on the Imagination of Movement. Dallas Institute Publications. 1988. URL: https://archive.org/details/airdreamsessayon0000gast/page/n7/mode/2up

The existential search for the inner motivation of people who dedicate their lives to space is, as we have already discovered, shrouded in romanticism, poetry and idealisation. The twentieth century of scientific and technological progress has given this self-reflection a constructive and purposeful character, but has left it irrational. The biographies of great engineers, pilots, designers and astronauts confirm the thesis that all the internal resources spent on exploring the sky cannot be completely rational and material. Rather the opposite, dreams of flying into the sky are not material because of the historical, cultural, religious paradigm and even the scientific and practical one. The irrational nature of the dream of flying allows the necessary freedom, which in turn contributes to inspiration. The infinite number of attempts, the very few of them successful, must rely on a very strong inner core that is not motivated exclusively by material stimulants. Of course, political issues, international relations, aerospace leadership, the race and the effect of competition cannot be ignored. However, the space sector depends on the personalities of the people who are inspired by it.

Another modern work [19] provides a thorough analysis of the phenomenology of dreams, also referring to Bachard, but with new researches and emphases. In the context of this work, it is important to note the importance of such theses: Rather than focusing on how to make dreams come true – in line with the "American dream" – what we call a "dream-catching" logic – this study shows us how important mundane daydreams can be as an organising practice. That is how we can make use of the verticalising forces in dream-making, where new beginnings can be born, and the particular will to act, through daydreaming, can be released. This is a deeply connected way of working, where the creation is happening in resonance with the place, the materiality at hand, and the dreaming body. Given this way of working, it is a way of getting deeper, and higher, in relation to that which matters most. Therefore, let us not automatically look down on intimate and "small" dreams as an escape from "real" organisational work.

This is a very different attitude to dreaming in general, and especially to dreaming in the process of active and productive work. These scientific studies show how dreaming helps you to move towards your goals. The main feature of dreaming is not just wasting time, but creating inspiration – potential spiritual energy, the power to realise your dreams. In turn, inspiration becomes the inner core, the very basis on which further actions, small or large, are based.

[19] Helin J., Dahl M., Monthoux Pierre G. The power of daydreaming: the aesthetic act of a new beginning. *Culture and organization.* 2022. vol. 28, no.1,P.64-78. URL: https: //www.tandfonline.com/doi/full/10.1080/14759551.2021.1986505

CONCLUSIONS

The digital world grants us freedom but also creates a new historical narrative. The techniques and technologies of the modern era differ significantly from those of previous epochs, particularly in their rapid pace and unprecedented speed. This study provides an analysis of three primary approaches: the "humanistic," "analytical," and "symbolic." It is reasonable to anticipate a growing interest among contemporary philosophers in the further exploration of the phenomenon of "technique and technology." Ukrainian academic thought in this domain is developing at the intersection of various approaches and traditions, offering a broad field for socio-philosophical research.

A new challenge in the philosophy of technology lies in the phenomenon of "synthetic philosophy," wherein artificial intelligence engages in philosophical inquiry by responding to questions. The works produced by computers can already be classified as philosophical texts of a unique category.

SUMMARY

The human dream of flying into the sky and space cannot be put into specific scientific and theoretical constructions, because the phenomenon we are studying has no boundaries, its speed is the greatest and its goal is immense. The unique human capacity for dreaming will always be a subject of much debate, in terms of the phenomenology that is meant when the term “dream” is used. In the aerospace community, dreaming about flying is a necessary necessity; the fact of flying is the main goal of this industry. In the history of mankind, the purpose of rising into the sky has faced various objections due to religious, cultural and social stereotypes. At that time, the dream of flying was irrational, very personal and even secret. The metaphysics of flight emphasises its transcendence; to dream of it means to be beyond human existence. Only the scientific and technological revolution has created a precedent for “successful flight”. The nature of dreaming about flying is becoming rational, the main criterion is always experience. If the dream is recreational, it is based on other experience (“flying of a bird”), if it is creative, it requires unusualness (space exploration). When humanity got the opportunity to dream of spaceflight, it already had a rather developed technosphere. In both the first flights and spaceflight, people were driven by inspiration, an inner driving force that comes from nowhere and goes nowhere.

Modern research on the dreaming process goes further, involving specialists from various scientific fields. We can already talk about two spectrums of issues. Firstly, how justified is the human desire to explore space, whether we are aware of all the consequences of such a dream, whether there is a limit or any restrictions, rules, agreements, norms or

laws. Such concerns relate not only to strictly technical or physical issues, but also to mental, ethical and spiritual ones. Secondly, dreaming as a human ability that needs to be developed; it is a major factor in the freedom of a person, his ability to be inspired, think creatively and be productively fulfilled. Aerospace engineering is a very difficult, knowledge-intensive and definitely high-cost sphere. People who work there have personal requirements and needs for life and they face constant risks and a high level of responsibility every day. Inspiration, an internal driving force, is essential for such activities. Inspiration is the key to a creative approach to work, promoting the energy of innovation and pioneering. Dreams of space exploration have a romanticised and idealistic character now, just as it was on the eve of the appearance of airplanes. Just as there are many people with realistic views who can see the uncertainty of this dream. But the history repeats itself, as mentioned above, scientific, technological and now digital progress cannot be stopped. Whether independently or in cooperation, humanity will gradually explore space, and the main task of philosophers is to actualise the issue, spread the discourse and look for ways.

References

1. Bachelard G. The poetics of reverie: childhood, language, and the cosmos. Boston, MA: Beacon Press. 1971. URL: https: //archive.org/details/peoticsofreverie00bach/page/n11/mode/2up

2. Bachelard G., Farell E., Farell F. Air and Dreams: An Essay on the Imagination of Movement. Dallas Institute Publications. 1988. URL: https://archive.org/details/airdreamsessayon0000gast/page/n7/mode/2up

3. Bolan Richard S. Urban Planning's Philosophical Entanglements: The Rugged, Dialectical Path from Knowledge to Action. Oxon: Taylor & Francis. 2017. p. 245.

4. Franssen M., Lokhorst G-J., Van de Poel I. Philosophy of Technology: The Stanford Encyclopedia of Philosophy. Edward N. Zalta & Uri Nodelman eds., 2023. URL: https://plato.stanford.edu/archives/spr2023/entries/technology/

5. Helin J., Dahl M., Monthoux Pierre G. The power of daydreaming: the aesthetic act of a new beginning. *Culture and organization*. 2022. vol. 28, no. 1, P. 64–78. URL: https://www.tandfonline.com/doi/full/10.1080/14759551.2021.1986505

6. Holcombe M. Here's when you can see the moon in the Da Vinci glow. *CNN*: 22 may. 2023. URL: https://www.cnn.com/2023/05/18/world/da-vinci-glow-crescent-moon-scn/index.html

7. Kind Ed. A. The Routledge Handbook of Philosophy of Imagination. London; N.Y.: Routledge, XX, 2016. 481 p.

8. Mitcham C. Thinking through technology: the path between engineering and philosophy. Chicago: University of Chicago Press. 1994. URL: https://philpapers.org/rec/MITTTT

9. Мозговий І. Палеоконтакт: міф чи реальність: монографія. Суми: Сумський державний ун-т 2017. 237 р. URL: https://sumdu.academia.edu/IvanMozgovyi%D0%86%D0%B2%D0%B0%D0%BD%D0%9C%D0%BE%D0%B7%D0%B3%D0%BE%D0%B2%D0%B8%D0%B9

10. Polak P., Krzanowski R. Philosophy in Technology: Objectives, Questions, Methods, and Issues.Conference: *Workshop on Philosophy in Technology: The Philosophical Challenges for Technology from Various Points of ViewAt:* April 28–29, 2023. Wrocław University of Science and Technology URL: https://www.researchgate.net/publication/370653723_Philosophy_in_Technology_Objectives_Questions_Methods_and_Issues

11. Popova M. The Psychology of How Mind-Wandering and "Positive Constructive Daydreaming" Boost Our Creativity and Social Skills. 2013. URL: https://www.themarginalian.org/2013/10/09/mind-wandering-and-creativity/

12. Raitt D., Gyger P, Woods A., Paper IAF-01-IAA.8.2.02 presented at the 52 International Astronautical Congress 1-5 Oct 2001 / Toulouse, France. URL: https://thespaceoption.com/innovative-technologies-from-science-fiction-for-space-applications/

13. Romele A. Technological Capital: Bourdieu, Postphenomenology, and the Philosophy of Technology Beyond the Empirical Turn. *Philosophy and Technology*. 2020. 34 (3):483-505. URL: https://philpapers.org/rec/ROMTCB

14. Simondon G. Du mode d'existence des objets techniques / Nouvelle éd. revue et corrigée. Paris: Aubier, 2012. (Philosophie). 367 p. URL: https://monoskop.org/images/2/20/Simondon_Gilbert_Du_mode_d_existence_des_objets_techniques_1989.pdf

15. Ушно І.М. Філософія техніки та технології: історико-філософський контекст. *Наукове пізнання: методологія та технологія. Філософія*. Одеса: Видавничий дім «Гельветика». 2023. № 2(52). С. 30–36. DOI: https://doi.org/10.24195/sk1561-1264/2023-2-4

16. Ushno I. Aesthetics in the «man-machine-environment» system: the search for harmony "Visnyk NIuU imeni Yaroslava Mudroho". Seriia: Filosofiia, filosofiia prava, politolohiia, sotsiolohiia, 2(61). 2024. S. 91–102. DOI: https://doi.org/10.21564/2663-5704.61.304639

17. Ушно І.М. Humanity`s dream of flying as inspiration for aerospace community. *Вісник Львівського університету*. *Серія філос.-політолог. студії.* 2024. Випуск 53. С. 130–138. DOI https://doi.org/10.30970/PPS.2024.53.15

18. Шевель Т.О. Інтерпретація міфологічного образу в поезії м. Вороного «Ікар». *Філологія і лінгвістика в сучасному суспільстві:*

*м*атеріали ІІ Міжнародної науково-практичної конференції (м. Львів, 30–31 жовтня 2015 року). Херсон : Видавничий дім «Гельветика», 2015. С. 66–69. URL: http: //molodyvcheny.in.ua/files/conf/fil/07oct2015/07oct2015.pdf

Information about the author:
Ushno Iryna Mykhailivna,
Candidate of Philosophical Sciences,
Associate Professor at the Department of Philosophy and Social Sciences
National Aerospace University «Kharkiv Aviation Institute»
17, Chkalova str., Kharkiv, 61070