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TRANSFORMATIONS OF IDENTITY AND SUBJECTIVITY IN SYMBOLIC PRACTICES OF RESISTANCE UNDER CONDITIONS OF WAR: A PHILOSOPHICAL AND PSYCHOLOGICAL INTERPRETATION OF THE INTERNAL FAMILY SYSTEMS MODEL

Introduction. The article examines the problem of identity and subjectivity under conditions of war through the conceptual framework of the Internal Family Systems (IFS) model. Particular attention is paid to the transformation of subjectivity under conditions of existential threat and symbolic violence, as well as to practices of resistance as mechanisms of psychological regulation and cultural resilience. **The aim and tasks.** The aim of the article is to provide a philosophical and psychological analysis of transformations of identity and subjectivity within symbolic practices of resistance under conditions of war through the lens of the IFS model. The tasks include analyzing the theoretical potential of the IFS model for interpreting traumatic experience and Self-leadership, examining symbolic practices of resistance as mechanisms supporting individual and collective subjectivity, and conceptualizing "unburdening" as a process of releasing traumatic meanings at personal and cultural levels. **Research methods.** The methodological framework combines phenomenological analysis, critical social philosophy, and systemic psychotherapy approaches. Practices of resistance are interpreted as symbolic and psychological processes of unburdening associated with the release of burdensome beliefs, emotions, and traumatic meanings that no longer correspond to changing reality. **Research results.** The study demonstrates that symbolic practices of resistance (linguistic, ritual, and visual) function not only as forms of social expression but also as mechanisms of collective processing of traumatic experience and preservation of collective subjectivity. The analysis shows that the IFS model provides a productive interpretive framework for understanding processes of self-regulation, differentiation, and integration under conditions of war and collective trauma. **Discussion.** The article conceptualizes the notion of "symbolic unburdening of culture" as a philosophical interpretation of resistance practices aimed at separating collective identity from imposed traumatic meanings. The analysis draws on Agamben's concept of "bare life," Butler's understanding of vulnerability and grievability, and Habermas's concept of post-conventional identity to interpret symbolic resistance as a process of re-subjectification. **Conclusions.** The proposed philosophical and psychological perspective expands contemporary interpretations of subjectivity, resilience, and identity transformation under conditions of war and collective trauma. The integration of phenomenological reflection with systemic psychotherapy approaches creates a conceptual basis for further interdisciplinary studies of identity and collective resilience.

Keywords: identity, subjectivity, resistance, Self, personality, ethnocultural psychology, Internal Family Systems therapy, IFS, symbolic practices, transgenerational legacy burdens.

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AEROSPACE MODELLING: A KINESTHETIC MODE OF HUMAN INTERACTION IN HOMO AEROSPACE

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Abstract*. This paper explores aerospace modelling as a specific mode of human interaction with the technical environment within the concept of Homo Aerospace. It is argued that modelling extends beyond an engineering procedure and functions as a kinesthetically mediated form of interaction that integrates bodily experience, cognition, and cultural practice. The study identifies three analytical perspectives of modelling: ontological-cognitive, bodily-existential, and cultural-communicative. It is shown that through modelling, the bodily-technical subjectivity of Homo Aerospace is formed under conditions of human integration with technical systems. The study concludes that aerospace modelling represents a distinctive way of human engagement with technical reality and opens new perspectives for understanding the transformation of human existence.*

Keywords: Homo Aerospace, aerospace modelling, kinesthetics, philosophical anthropology, human-technology interaction, bodily experience, aerospace engineering.

Introduction

The philosophical-anthropological interpretation of the aerospace domain as a space for the realisation of the ultimate possibilities of the human being remains insufficiently represented in contemporary research. At the same time, within this tradition, the question of the transformation of the mode of human existence under conditions of technological expansion of possibilities is acquiring increasing relevance. What is at stake is not merely activity within new environments, but rather a transformation of the philosophical-anthropological status of the human being, whereby technology ceases to function as an external instrument and acquires the status of a condition of existence. Despite the growing attention to the crisis phenomena of contemporaneity, the development of aerospace technologies demonstrates a stable dynamic and forms new horizons of human presence. Historically, this is associated with the exploration of the sky as a space of systematic aeronautical navigation, which opened the possibility of interpreting the human being within a philosophical-anthropological dimension. In this context, it is appropriate to speak of Homo Aerospace as a type formed as a result of technological, cultural, and bodily-anthropological preconditions, in particular the development of technical means of flight, the transformation of conceptions of space as a domain of exploration, and the reorientation of human thought beyond the terrestrial environment.

Within the present study, Homo Aerospace is understood as a philosophical-anthropological type of the human being formed under conditions of aerospace experience and characterised by a specific configuration of bodily-technical subjectivity. Of particular interest is such a form of human existence within which the capacities for action, cognition, and spatial orientation are realised through integration with technical systems that enable the transcendence of natural bodily limitations, primarily within the experience of flight. Homo Aerospace represents a contemporary type that has emerged in the course of the development of aviation and astronautics and continues to evolve under conditions of increasing technological complexity. The concept was first introduced in the article “Homo Aerospace: Philosophical Reflections on the Future of Humanity in Space” (Ushno, 2024).

In this study, the concept of Homo Aerospace is employed not as a completed theoretical system, but as a philosophical-anthropological horizon for interpreting modelling in aerospace engineering. Its full theoretical elaboration, including the systematisation of its features and internal structure, lies beyond the scope of this article and constitutes a subject for further research. The concept of Homo Aerospace should therefore be understood primarily as a heuristic philosophical-anthropological construct intended to interpret transformations of technologically mediated human experience rather than as a fixed anthropological category.

Contemporary studies in the philosophy of technology and engineering increasingly examine modelling as an epistemic and methodological instrument for the representation, testing, and construction of technical systems. At the same time, the bodily, kinesthetic, and philosophical-anthropological dimensions of modelling remain insufficiently conceptualised, especially in the context of aerospace engineering, where interaction with technical systems presupposes new forms of spatial orientation, embodiment, and technologically mediated experience.

Existing approaches primarily focus on the cognitive, computational, or instrumental functions of modelling, whereas its role as a bodily engaged mode of interaction with technical reality has received considerably less attention. In particular, the philosophical-anthropological implications of aerospace modelling for the formation of technologically mediated subjectivity remain underexplored.

The aim and tasks

The aim of this article is to provide a philosophical-anthropological interpretation of modelling in aerospace engineering as a specific mode of human interaction with the technical environment in the context of the formation, development, and transformation of the bodily-technical subjectivity of Homo Aerospace. The study proposes an interpretation of modelling as a bodily engaged form of cognition, one that presupposes dynamic feedback between the body, material objects, and the digital environment. In this context, modelling is considered as a factor that determines the structure of human activity and the transformation of its philosophical-anthropological status.

Research Methods

The methodological framework of the study is based on a philosophical-anthropological approach combined with elements of ontological, cultural-communicative, and interdisciplinary analysis. The study employs methods of conceptual interpretation, comparative philosophical analysis, and theoretical generalisation in order to examine aerospace modelling as a specific mode of human interaction with the technical environment. Particular attention is devoted to the analysis of bodily-technical interaction, kinesthetic experience, and the transformation of human subjectivity under conditions of integration with aerospace technologies.

Research Results

The origins of the philosophical interpretation of the phenomenon of “modelling” go back to antiquity. In Plato and Aristotle, one encounters the idea that the model is a mediator between ideal forms and the material world. In particular, in Plato’s Timaeus one may trace the way in which models assist in comprehending eternal ideas, since they appear as specific reflections of the ideal within the material (Plato, 2008). Similarly, Aristotle, for example in the Metaphysics, considered the model as an instrument that makes it possible to move from abstract essences to a concrete understanding of things (Aristotle, 2001). Thus, in their works the model appears as a philosophical instrument that connects the world of ideas with the material world, enabling us to understand the nature of things through modelling. This makes it possible to interpret modelling as a means of mediated cognition, which has direct significance for contemporary technical practices.

In the early modern period, Francis Bacon substantiated experiment as a kind of “creation of nature” under laboratory conditions, which constitutes a prototype of contemporary modelling. In his Novum

Organum, the philosopher emphasised that experiment makes it possible to “interrogate” nature and thereby create models that are an intermediate link between theoretical ideas and real processes. F. Bacon, in effect, described the method of experimental modelling, which allows the human being to “translate” ideal representations into the practical sphere. This became a prototype of our contemporary understanding of modelling as a kinesthetic channel of interaction with the technical environment (Bacon, 2000). Experiment and modelling form a specific type of interaction between the human being and reality, in which cognition is combined with practical intervention.

In the twentieth and twenty-first centuries, philosophers of science, in particular Ian Hacking, Nancy Cartwright, Peter Godfrey-Smith, and Mary Midgley, explained that models do not merely represent reality, but also construct it within certain limits. For example, in Representing and Intervening (1983), Ian Hacking shows that models are instruments not only for reflecting the world, but also for intervening in it; that is to say, they actively shape our perception of reality. Nancy Cartwright, in How the Laws of Physics Lie (1983), emphasises that models are rather instruments of manipulation and local explanation than mirrors of nature.

Peter Godfrey-Smith, in his works, for example Theory and Reality (2004), stresses that models in science are certain “lenses“ that make it possible to discern specific aspects of phenomena, intensifying some features while filtering out others. Mary Midgley, although better known in ethical philosophy, also touches in her essays upon the fact that our scientific models are not simply reflections of nature, but active constructions that shape our view of the world (1992). In the context of Homo Aerospace, modelling is not confined to a merely representative nature; rather, it appears as a form of active construction of technical reality.

Thus, the philosophical interpretation of modelling makes it possible to consider it not merely as a technical method, but as a specific form of mediated interaction between the human being and technical reality. In the context of aerospace engineering, such interaction acquires a communicative character and is realised through several channels by means of which Homo Aerospace enters into the technical environment.

Homo Aerospace as a subject of aerospace engineering possesses specific channels of communication through which professionally significant information is transmitted. The need to distinguish such channels is conditioned by the increasing complexity of technical systems and the interdisciplinary character of aerospace activity, where the transmission of information becomes a key condition for effective interaction. For a more systematic perspective, it is appropriate to identify three principal channels of communication, as proposed in classical communication theory: the visual, the kinesthetic, and the auditory (Chyzhska, 2012). These channels are responsible for shaping perception and interpretation of the surrounding world and incoming information. The visual channel is associated with sight, through which information is received via images, colours, drawings, diagrams, videos, and other visual elements. The auditory channel concerns hearing, whereby information is perceived through sounds, speech, music, intonation, and other audio elements. The kinesthetic channel is related to bodily sensation and movement; within this modality, information is perceived through touch, motion, physical sensations, and emotions. Although individuals typically employ all three channels, one may predominate. An understanding of these channels facilitates the selection of the most effective modes of communication and learning. In this context, communication channels may be interpreted as vectors of human incorporation into the technical environment, wherein perception and action are integrated into a unified experience.

In this sense, communication channels in aerospace engineering are not limited to information transfer, but participate in the formation of specific modes of human interaction with technical reality.

In aerospace engineering, communication channels likewise operate in the transmission of information, albeit with specific characteristics. By way of analogy, technical drawings may be considered as a visual channel, professional jargon as an auditory channel, and modelling as a kinesthetic channel.

Technical drawing as a visual channel constitutes the representation of thought through lines and geometry. It is one of the fundamental forms of technical thinking, conveying concepts in the form of spatial models. The visual channel remains among the most established and precise within technical activity. This issue has been examined by me in greater detail in the article “Technical Drawing as a Form of Visual-Graphic Communication in Engineering: A Philosophical-Anthropological Aspect” (Ushno, 2025).

Professional aerospace jargon functions as an auditory channel, in which language becomes a carrier of cultural and technological content. Specialised terminology is not merely a means of communication but a form of code that unites specialists within a shared professional space. The auditory dimension is significant insofar as language ensures the transmission of knowledge and experience, performing both communicative and identificatory functions, thereby constituting a community of subjects engaged in aerospace activity.

From a technical standpoint, modelling constitutes a method of investigation, testing, and forecasting the behaviour of complex systems through the construction of their physical, mathematical, and digital analogues. However, within the framework of the present study, aerospace modelling is interpreted not merely as an engineering procedure but, above all, as a kinesthetic mode of human interaction with the technical environment. It presupposes a bodily engagement in interactions with material and digital objects, in the course of which technical reality is not only represented but also experienced, appropriated, and transformed.

This distinguishes modelling from other channels of technical communication, since it presupposes not only perception and interpretation, but also bodily participation in the process of interaction with technical systems.

In this sense, modelling emerges as a multidimensional phenomenon that integrates the cognitive, bodily, and communicative dimensions of human activity. It functions not solely as an instrument for the verification of technical solutions, but also as a form of human incorporation into technical reality, within which the bodily-technical subjectivity of Homo Aerospace is constituted as that of a subject integrated with technical systems and oriented towards new conditions of existence.

In aerospace engineering, this means that the model is always an epistemic compromise between completeness of representation and convenience of use. It is created not in order to reproduce reality in all its details, but to solve specific engineering tasks. This underscores that modelling always presupposes selection and limitation, and therefore is the result of human choice rather than a neutral reflection of reality.

Modelling functions as a linguistic interface between different groups of participants in aerospace projects: engineers, programmers, pilots, psychologists, and biologists. In this sense, the model fulfils three key communicative functions: visualisation, that is, the transformation of abstract data into graphic images available for interpretation; standardisation, that is, the creation of a unified technical "slang" understandable to different specialists; and coordination, that is, the synchronisation of actions in real and virtual environments. For example, at NASA the use of digital twins of spacecraft makes it possible to integrate the work of design engineers, navigation specialists, and crew psychologists within a single simulation space (Allen, 2021). Such complexity of interaction determines the necessity of new forms of coordination, in which the model functions as the central element of communication.

Thus, modelling acquires significance not only as a technical instrument, but also as a communicative environment within which heterogeneous forms of knowledge, perception, and action become integrated.

Unfortunately, the philosophical interpretation of aerospace engineering is scarcely represented in the Ukrainian scholarly environment, although at the same time there exists a substantial body of English-language research. Thus, the international journal Philosophy and Cosmology has become one of the leading platforms for discussion of such themes, in particular the works of Oleg Bazaluk (2022). In the English-language literature, the book Engineering and Philosophy contains noteworthy reflections, specifically in the chapter "Philosophical Observations and Applications in Systems and Aerospace Engineering", where Stephen B. Johnson emphasises that there are several cases in which philosophical and social concepts have been used in engineering, whether implicitly or explicitly (2021). One important example is the growing significance of "goals" in the engineering of autonomous systems. Autonomous systems are designed with "intelligence" in order to be capable of changing goals on the basis of changes in the external environment or internal state. These goal-oriented approaches are inherently teleological. Another interesting case is the use of concepts of social communication and cognitive limitations, which are foundational principles in the newly emerging discipline of system health management and in the older field of systems engineering.

Engineers also develop axiomatic and model-based approaches to the disciplines of systems engineering. It is precisely this aspect that possesses value for the present study. Modelling functions as an instrument of verification during the creation of aerospace axioms. In the process of forming fundamental principles that will become the basis for subsequent decisions and approaches in design, an intermediate strip is necessary, a space that creates a precedent for the future. Modelling appears as such an "intermediate space" between idea and embodiment. Direct interaction with the invention becomes possible, a certain communication that provides the necessary information as to whether the designer is on the right path or on a false one. Modelling is communication between the aerospace engineer and the project. Modelling becomes a form of experience in which the human being not only creates an object, but also enters into interaction with it, and this changes his or her own perception and thinking.

The work Philosophies and Practices of the Design Process examines how, in aerospace engineering, the design process unites various principles and philosophical approaches in order to create effective aerospace products. Modelling functions as the central axis of the philosophy of design, especially in aerospace engineering. Since the creation of aerospace projects is extremely costly and requires enormous financial resources, the use of models makes it possible significantly to reduce risks and expenses. Through modelling, the philosophy of design acquires its practical foundation, becoming an instrument that makes it possible to test various concepts without excessive expenditure. "Design philosophy entails the use of physical models directed towards specific performance parameters or towards target characteristics inherited from existing systems. These models are heavily instrumented and tested across a wide range of conditions, after which they are driven to failure. Only a few of the tested models become the basis for the design of a new engine system" (Ryan, Blair, Townsend and Verderaime 1996, 4).

Here it is worth emphasising precisely the state of failure in the process of modelling, as though the model were created in order to be used to its utmost, without sparing it. Failure becomes the principal source of cognitive information. Thus, failure ceases to be a technical error and acquires the status of a cognitive result.

In this perspective, modelling becomes valuable not only because it confirms technical solutions, but because it enables cognition through correction, limitation, and failure.

In the article "The 'Model Philosophy' Used by Space Engineering Companies", the author analyses the so-called "philosophy of models" employed by companies in aerospace engineering for the staged development of technical systems, risk management, and the assurance of project reliability. Instead of creating the final product immediately, the process of construction unfolds as a sequence of models, each of which performs a distinct function within the overall logic of design. This makes it possible to consider Homo Aerospace as a subject functioning under conditions of a multi-level technical reality, one that is formed through a sequence of models.

At the initial stages, simplified engineering mock-up solutions are used, which make it possible to verify the basic functionality of the system without the use of expensive space-grade components. Such models are the most flexible with regard to change and serve as a space of experiment within which functional solutions may be repeatedly adjusted. Subsequent engineering models are already brought as close as possible in form and function to the future flight specimen, but still combine components of different levels of readiness, which makes it possible to optimise expenditure and gradually increase system reliability. At the stage of engineering qualification, the model undergoes a full cycle of tests that must confirm its compliance with the requirements of future operation. Thereafter, prototypes of flight models are created, which are subjected to analogous qualification loads and in some cases may be used in real missions. The final stage consists of flight models, which undergo acceptance tests and are directly operated in the space environment. The "philosophy of models" appears not as a purely technical procedure, but as a staged strategy of thought, within which the reliability, safety, and functionality of the system are formed gradually, through a series of controlled transitions from the possible to the real (Taylor, 2013).

Practical significance is accorded to modelling. The possibility of creating prototypes in the laboratory, whether it be testing a specially developed printed circuit board for a specific task (EBB in the above-mentioned philosophy) or a "model" consisting of Vero boards and an engineer's attempt at soldering, allows one quickly to determine whether a concept is viable or not (Chambers, 2010). The communicative property is decisive in the processes of substantiation and decision-making. Modelling as a kinesthetic channel makes it possible not merely to transmit information, but to show, prove, and demonstrate. It is precisely this capacity that may become decisive in the course of aerospace developments.

Modelling in aerospace engineering is closely connected with the kinesthetic and spatial communication channels, which play a key role in the processes of designing and operating aviation and space technology. The kinesthetic communication channel concerns the perception of movement, position, and muscular effort, which is critical for specialists working with physical models or simulators. Interaction with such models enables engineers and pilots to experience realistic conditions, thereby contributing to a deeper understanding of the behaviour of systems in real situations. This is especially important in rehearsing emergency procedures or testing new technologies. The spatial communication channel is connected with the perception of space and the arrangement of objects within it. In aerospace engineering, this is of decisive significance in the design of pilot cockpits, the placement of equipment, and the provision of ergonomics. Modelling makes it possible to visualise and optimise spatial components, ensuring convenience and safety of operation.

Thus, the integration of kinesthetic and spatial aspects into the modelling process ensures more precise and effective design, testing, and operation of aerospace systems, enhancing overall safety and productivity, while modelling functions not merely as a technical instrument, but as a key element in the development of the bodily-technical subjectivity of Homo Aerospace.

Within the framework of the author's philosophical-anthropological concept of Homo Aerospace, a systematic interpretation of modelling as a kinesthetic channel of human interaction with technical reality is undertaken for the first time. Proceeding from an analogy with the basic channels of human perception – visual, auditory, and kinesthetic – it is proposed that aerospace engineering be considered as a particular communicative system in which drawings function as the visual channel of conceptualisation, professional slang as the auditory channel of specialist communication, and modelling as the kinesthetic channel that allows the human being directly to "live through" technical reality in the process of its creation. Such an approach contributes to the transition of technical processes from simple description to a deeper interpretation within the framework of the philosophical-anthropological transformation of the human being.

The scientific novelty lies in the interpretation of modelling as a kinesthetically mediated form of human interaction with the technical environment, within which the formation and development of the bodily-technical subjectivity of Homo Aerospace takes place, while technical activity acquires the character of a bodily engaged experience that unites design, cognition, and practice. It is substantiated that modelling functions as a mode of unfolding this subjectivity and as one of the factors of its development under conditions of aerospace being.

In view of this, it is appropriate to distinguish several analytical perspectives that make it possible systematically to reveal the philosophical-anthropological nature of modelling: the ontological-cognitive, as a form of creating possible realities; the bodily-existential, as a process of pre-adaptation to the aerospace environment; and the cultural-communicative, as a mechanism for the transmission of cultural meanings and mastery in the technical environment. Taken together, these perspectives deepen the understanding of Homo Aerospace as a promising philosophical-anthropological type that emerges at the intersection of the human being and technology in aerospace experience.

Modelling in aerospace engineering should be considered not as a purely technical procedure or an algorithmic reproduction of processes, but as a special form of creative act, akin to artistic activity and craft. Such a process appears as a dialogue between imagination and material reality, within which technical thinking is not separated from the creative, but is formed on its basis. What is at issue is not the copying of that which already exists, but the disclosure of the possible, of that which does not yet exist, but is subject to construction. In this context, Homo Aerospace appears as a subject capable of thinking in categories of the possible, and not merely of the actual, which is of fundamental significance for aerospace design.

The representation of the world within modelling does not function as an abstract idea detached from practice. From the very beginning, it is oriented towards embodiment and gradually materialises in the form of mock-ups, three-dimensional models, and digital simulations. Imagination here is not an auxiliary or secondary faculty; rather, it appears as the ontological beginning of modelling, its primary space. It is precisely in imagination that the contours of the future model are first delineated, before it acquires geometric parameters and physical constraints. Imagination is primary because it realises the possibility of a new vision of reality before its material formation. This means that it functions as a precondition of modelling and as its inseparable component, one that determines the direction of technical development.

The transition of the imagined into the material through drawings, simulations, and experimental models is not a simple mechanical translation of an idea into form. It is a process in which imagination and being mutually shape one another. The material model not only realises the design, but also resists it, corrects it, and compels a reconsideration of the initial representations. In such tension between conception and realisation, modelling acquires ontological status; it becomes a process in which the possible gradually passes over into the real. The fact that, in the process of modelling, the human being not only creates objects but also transforms his or her own modes of thinking is precisely what determines its philosophical-anthropological context.

An important component of this process is kinesthetic thinking, which presupposes the understanding and solving of problems through physical interaction with objects. In the aerospace context, this means that engineers and designers work not only with abstract schemes, but also involve bodily sensations, movements, and spatial orientation in the process of creating and improving aircraft models. Such an approach contributes to a deeper understanding of spatial relations and the functional characteristics of objects. It is for this reason that creativity and innovativeness appear as key skills for designers and engineers of the twenty-first century, particularly in the aerospace sphere, where non-standard thinking and the capacity to generate new ideas are necessary conditions for solving complex technical tasks. This makes it possible to consider Homo Aerospace as a subject for whom bodily experience is an inseparable part of technical cognition.

The ontological aspect of modelling in aerospace engineering concerns not only the creation of technical objects, but also the formation of new modes of human being in interaction with technology. In this context, the ideas of Gilbert Simondon are especially indicative, for he considered technical objects as possessing their own mode of existence and as capable of influencing human being (1989). From this perspective, modelling may be understood as a process that goes beyond the limits of purely technical optimisation and appears as an act of creating a new reality that changes the very conditions of human existence. Each model is not merely a means of verifying constructive solutions, but also a way of projecting a possible future. In this sense, technical objects cease to be external to the human being and become components of his or her existential environment.

Of particular significance within this perspective is the transformation of the philosophy of space. Prior to the emergence of aerospace engineering, human being was predominantly interpreted within the framework of the horizontal logic of terrestrial existence, rigidly bound to gravity. The modelling of aerospace constructions opens another experience, namely, the experience of verticality, weightlessness, and the multidimensionality of space. This resonates with the ideas of Martin Heidegger, who considered being-in-space as a fundamental characteristic of human existence (2008). Through modelling, the human being begins to project his or her own possibilities beyond the limits of the Earth, forming not only new technology, but also a new type of subjectivity – Homo Aerospace as a new mode of being-in-the-world that transcends terrestrial limitation.

The reinterpretation of space becomes especially evident under conditions of microgravity, where such basic categories as “up”, “down”, and “distance” lose their self-evidence. In this context, the reflections of Bas van Fraassen are indicative, as he analyses the influence of gravity upon our understanding of spatial relations and emphasises the necessity of their reconsideration within contemporary physical theories (1970). Computer modelling used by NASA and ESA creates virtual environments in which astronauts may train for real missions, transforming their own understanding of space even before physically leaving the Earth. In this sense, modelling functions as a form of the cognitive and ontological attunement of the human being to cosmic reality.

In interaction with models of aerospace objects, the engineer or pilot is not confined to the intellectual analysis of technical parameters. Modelling engages the body as an active element of cognition, allowing the human being to experience the specificity of the cosmic environment even prior to actual presence within it. Through tactile, spatial, and motor interaction with models, a particular type of experience is formed, which may be defined as anthropological pre-adaptation, or the gradual entry of the human being into conditions of existence that differ radically from terrestrial ones.

Modelling goes beyond the function of technical testing and acquires existential significance. Biomedical simulations, virtual environments, and neurointerfaces make it possible not only to predict the influence of outer space upon the human organism, but also to form new modes of bodily experience. Research indicates that virtual reality and cognitive simulations play a key role in preparing the human being for new forms of bodily existence under cosmic conditions, in particular through the adaptation of sensory perception, motor functions, and spatial orientation (Harshita, Acharya, Shukla, Khare, &

Sachdev, 2023). Thus, modelling becomes a process not only of engineering but also of anthropological preparation for the cosmic future. It is precisely within this perspective that the traits of Homo Aerospace as a new philosophical-anthropological type are especially clearly manifested: readiness for bodily reconfiguration, acceptance of technically mediated experience, and the capacity to adapt to environments that are not natural for the human being.

This process acquires particular significance under conditions of microgravity, where habitual bodily schemes of movement, orientation, and physiological regulation are disrupted. Research demonstrates that such conditions require new forms of bodily adaptation (Archer, Möller-Levet, Bonmati-Carrion, Lane & Dijk, 2024). In this context, modelling functions as a transitional space in which the human body can gradually prepare for a new ontology of the environment. In the philosophical-anthropological sense, this means not merely functional adaptation, but a transformation of the mode of bodily presence that becomes one of the preconditions for the formation of *Homo Aerospace*.

At the same time, pre-adaptation is not a purely individual process. Modelling in aerospace engineering appears as the materialisation of collective imagination, within which the image of the future of human existence in space is formed. As Yuval Noah Harari emphasises, humanity's capacity for collective imagination is a key condition of civilisational development, in which shared models of the future allow people to coordinate actions and move beyond the limits of immediate experience (2017). Aerospace models function not only as technical objects, but also as carriers of existential scenarios, within which the human body is inscribed in advance into the cosmic context. This means that pre-adaptation in the aerospace context has not only a biophysical, but also a cultural-anthropological character.

The bodily dimension of modelling also requires a reconsideration of traditional conceptions of the human body. Conditions of microgravity destroy habitual schemes of movement, gestures, and the orientation of "up" and "down", which were formed within the framework of terrestrial culture. In this respect, the ideas of Marcel Mauss concerning "techniques of the body" as culturally conditioned ways of using bodily are especially indicative. In the cosmic environment, these techniques cease to function automatically and require reconfiguration. It is precisely modelling that becomes the space in which this reconfiguration occurs in advance, forming new bodily skills and modes of orientation, and transforming modelling not merely into preparation for action, but into a space of reconfiguration of human bodily experience.

In the bodily-existential perspective, modelling appears as a process that prepares the human being for new forms of bodily existence, ensuring a gradual transition from the terrestrial mode of existence to the cosmic one. Homo Aerospace is regarded as a human being whose bodily experience no longer coincides with the classical terrestrial norm, but is formed under conditions of technically supported and spatially altered being. In such a context, Homo Aerospace is not an abstract concept, but a bodily experienced mode of human presence within the aerospace environment.

From a historical perspective, aviation and space modelling developed as a variety of craft practice, within which technical knowledge was transmitted not only through formalised instructions, but through experience, mastery, and bodily interaction with the material. The manual creation of models of flying apparatus refers to the deep cultural strata of the human aspiration towards flight, the overcoming of terrestrial gravity, and the movement beyond the limits of the immediately given environment. Modelling should be studied as a form of cultural memory that preserves and transmits the experience of the dream of the sky and of space. In this dimension, modelling proves to be a practice through which the human being not only creates a technical object, but also enters into a long cultural tradition of mastering the sky and space.

From a philosophical-anthropological point of view, modelling is an act of cognition in which rational thought, imagination, and manual mastery are combined. In creating a model, the human being does not merely reproduce a technical object on a reduced scale, but reconstructs an entire fragment of the world, inscribing himself or herself into the history of technical development. In this process, modelling performs a communicative function: it transmits not only knowledge and skills, but also modes of thinking, professional values, and conceptions of the future. For this reason, communities of modellers may be regarded as a particular cultural environment in which an anthropotechnical tradition is formed and transmitted. From this point of view, Homo Aerospace is characterised not only by technical competence, but also by the capacity to inherit, assimilate, and transmit the cultural meanings of aerospace activity.

The transition to digital modelling in the twenty-first century does not abolish this tradition, but rather radically alters its form. Virtual environments, digital twins, and VR and AR technologies transform the carrier of kinesthetic experience, but do not eliminate it. Touching the material is replaced by interaction with digital structures, while craft mastery is replaced by the skills of navigation within virtual space. Nevertheless, even within digital environments, modelling preserves its kinesthetic dimension insofar as interaction with simulations remains connected with bodily orientation, movement, spatial coordination, and sensorimotor adaptation. The very conception of reality changes, for the technical object increasingly exists first as a simulation and only subsequently as a physical artefact. Thus, the change in the carrier of experience does not eliminate the kinesthetic dimension, but merely transfers it into another form of technical mediation.

This transformation has a distinctly cultural dimension. In Jean Baudrillard's view, contemporary culture increasingly functions in the regime of simulacra, in which the boundary between reality and its representation becomes blurred (2004). In the context of Homo Aerospace, this question acquires particular sharpness. Space is increasingly experienced primarily as a simulated space through simulators, digital missions, and virtual environments, and only afterwards as physical reality. In this sense, modelling becomes a cultural filter through which the image of space as a domain of human being is formed. It is precisely the simulational character of contemporary technical culture that constitutes one of the preconditions for the formation of Homo Aerospace, since the experience of space is increasingly acquired even prior to the direct crossing of the limits of the Earth.

The cultural-communicative perspective of modelling is also manifested in the capacity of simulations to produce new myths of the aerospace age. Science fiction, cinematography, and digital visualisations create images that influence engineering thought no less than scientific calculations. From the fantasies of Jules Verne to the cinematic simulations of space in 2001: A Space Odyssey, modelling functions as a socio-cultural matrix through which imagination is gradually transformed into a technical project. “Science fiction not only performs an entertaining function; it acts as a cultural code of aerospace engineering, fulfilling the following functions: a cultural catalyst of scientific and technological progress; a socio-cultural platform for the aerospace community; and a cultural ambassador of the aerospace sector in the socio-economic development of society” (Ushno 2025b, 77).

In this sense, cultural modelling precedes technical modelling, forming the horizons of imagination within which the very posing of aerospace tasks becomes possible.

Thus, in the cultural-communicative perspective, modelling appears as a mechanism for the transmission not only of technical knowledge and mastery, but also of cultural meanings, values, and modes of thought. Homo Aerospace is not merely an engineer or user of technical systems, but a bearer of a new cultural sensibility in which space is conceived as a real horizon of human being. It combines craft tradition with digital practices, technical rationality with myth-making, ensuring cultural continuity and expanding the horizons for interpreting Homo Aerospace.

Discussion

In contemporary philosophy of science, Ian Hacking, Nancy Cartwright, Peter Godfrey-Smith, and Mary Midgley emphasise that scientific models do not merely represent reality, but also construct, simplify, and transform it within specific epistemic and practical contexts. In the context of the present study, this position confirms the possibility of interpreting aerospace modelling not only as representation, but also as an active form of constructing technical reality.

This interpretation is also consistent with contemporary approaches in the philosophy of engineering. In the chapter “Philosophical Observations and Applications in Systems and Aerospace Engineering”, Stephen B. Johnson emphasises that philosophical and social concepts are already implicitly or explicitly used in engineering, especially in systems engineering, autonomous systems, and system health management. For the present study, this is important because it shows that aerospace modelling cannot be reduced to a technical auxiliary procedure: it participates in the organisation of goals, coordination, communication, and decision-making within complex technical systems.

The works devoted to the philosophy and practice of the design process also support this interpretation. Ryan, Blair, Townsend, and Verderaime show that physical models are tested under various conditions and may even be driven to failure. In this perspective, failure ceases to be only a technical error and acquires the status of a cognitive result, since modelling produces knowledge through correction, limitation, and the verification of possibilities.

The so-called “model philosophy” used by space engineering companies, described by Taylor, further demonstrates that the creation of aerospace systems unfolds through a sequence of models, each of which performs a specific function in the transition from the possible to the real. This confirms the thesis that modelling is not merely a stage of technical production, but a staged strategy of thinking and acting within a multi-level technical reality.

Finally, the cultural interpretation of modelling may be correlated with Jean Baudrillard’s concept of simulacra. In contemporary aerospace culture, space is often experienced first through simulations, digital environments, and virtual missions, and only later as physical reality. Therefore, modelling functions not only as an engineering tool, but also as a cultural filter through which the image of space as a horizon of human existence is formed.

Conclusions

The article has shown that philosophical interpretations of modelling make it possible to understand it not only as representation, but also as a mediated and constructive form of interaction with reality. In aerospace engineering, this means that modelling connects an idea, a technical object, bodily experience, and practical action, while the technical environment ceases to function only as an external instrument and increasingly appears as a space of technologically mediated co-being.

It has also been substantiated that aerospace modelling functions as a kinesthetically mediated mode of interaction with the technical environment. Unlike purely visual or verbal forms of technical communication, it involves bodily participation, spatial orientation, and dynamic feedback between the human being, material objects, and digital environments. In this sense, modelling enables not only technical design and verification, but also experiential entry into new conditions of existence.

The study has demonstrated that aerospace modelling constitutes a multidimensional philosophical-anthropological phenomenon revealed through three interrelated dimensions: ontological-cognitive, bodily-existential, and cultural-communicative. In the ontological-cognitive dimension, modelling appears as a form of creating possible realities; in the bodily-existential dimension, it functions as a process of pre-adaptation to aerospace environments; in the cultural-communicative dimension, it acts as a mechanism for transmitting technical mastery, cultural meanings, and images of the future.

It has been determined that aerospace modelling contributes to the formation of the bodily-technical subjectivity of *Homo Aerospace*. This subjectivity is formed through interaction with complex technical systems and is characterised by orientation towards the possible as an object of technical and existential activity. Thus, modelling becomes one of the key practices through which the human being not only designs and tests technical objects, but also transforms modes of perception, action, communication, and orientation under conditions of the technological transformation of human existence.

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АЕРОКОСМІЧНЕ МОДЕЛЮВАННЯ: КІНЕСТЕТИЧНИЙ СПОСІБ ВЗАЄМОДІЇ ЛЮДИНИ В КОНЦЕПЦІЇ HOMO AEROSPACE

Вступ. Аерокосмічне моделювання потребує філософсько-антропологічного осмислення не лише як інженерна процедура, а як особлива форма взаємодії людини з технічним середовищем у межах концепції *Homo Aerospace*. Актуальність дослідження зумовлена недостатньою розробленістю тілесно-кінетичного виміру моделювання в сучасній філософії техніки та аерокосмічної інженерії. **Мета і завдання.** Метою статті є інтерпретація аерокосмічного моделювання як кінестетично опосередкованої практики, у межах якої формується тілесно-технічна суб'єктність людини. Завдання полягають у визначенні філософсько-антропологічного змісту моделювання, розкритті його кінестетичного характеру та виокремленні основних вимірів його функціонування. **Методологія дослідження.** Методологічну основу становлять філософсько-антропологічний, онтологічний і культурно-комунікативний підходи, а також методи концептуальної інтерпретації, порівняльного аналізу та теоретичного узагальнення. **Результати.** Обґрунтовано, що аерокосмічне моделювання виконує не лише технічну й пізнавальну функції, а й постає як форма тілесно залученої взаємодії з технічною реальністю. Виокремлено три аналітичні виміри моделювання: онтологічно-когнітивний, тілесно-екзистенційний і культурно-комунікативний. **Обговорення.** Показано, що порівняно з підходами, які розглядають моделювання переважно як репрезентацію або інструмент технічного проєктування, запропонована інтерпретація акцентує його роль у формуванні тілесного досвіду, просторової орієнтації та антропологічної передадаптації до аерокосмічного середовища. **Висновки.** Аерокосмічне моделювання може бути розглянуте як кінестетично опосередкована практика взаємодії людини з технічним середовищем, що сприяє формуванню *Homo Aerospace* як типу тілесно-технічної суб'єктності.

Ключові слова: *Homo Aerospace, аерокосмічне моделювання, філософська антропологія, кінестетика, тілесність, взаємодія людини і техніки, філософія техніки, аерокосмічна інженерія.*

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