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Table of Contents

Part I:
PHILOSOPHY OF THE COSMOS

From Space to the Battlefield: Ethical and Legal Aspects of the Use of Satellite Technologies in the Russo-Ukrainian War

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The integration of satellite technologies into the Russo-Ukrainian War has redefined the strategic role of space-based assets in contemporary warfare, revealing their dual-use nature and the associated legal, ethical, and strategic challenges. This research critically examines the transformative impact

of satellite systems, highlighting their contributions to military operations, including real-time reconnaissance, secure communications, and precision navigation, while also addressing their vulnerabilities to cyberattacks and systemic risks. Through the lens of this conflict, the study explores the complex interplay between commercial and state-operated satellite networks and their implications for international security and space governance.

The analysis exposes critical deficiencies in existing legal frameworks, particularly the Outer Space Treaty of 1967, which inadequately addresses the growing militarization and commercialization of space activities. Ethical concerns are compounded by the increasing reliance on artificial intelligence and autonomous systems in satellite-linked operations, challenging traditional norms of accountability under international humanitarian law. Furthermore, the dual-use nature of satellite technologies raises urgent questions regarding the protection of civilian infrastructure and the governance of non-state actors in conflict zones.

This study advocates for a robust and comprehensive approach to space governance, integrating legal reforms, ethical safeguards, and multilateral diplomacy. It proposes actionable policy frameworks aimed at balancing technological innovation with global security imperatives, ensuring that satellite technologies support a peaceful, equitable, and sustainable future in space governance.

Keywords: satellite technology, Russo-Ukrainian War, commercial satellites, dual-use, space law, ethical gaps, militarisation, international governance, national security.

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Introduction

Satellite technology has emerged as a transformative force in modern warfare, fundamentally reshaping conflict dynamics and necessitating a critical reassessment of international security frameworks. Space-based assets – spanning communication, navigation, and intelligence systems – now play a pivotal role in military operations, statecraft, and global security. These technologies extend their influence far beyond national borders, impacting both strategic doctrines and geopolitical stability. However, the growing reliance on satellite systems highlights their dual-use vulnerabilities, as the intersection of civilian innovation and military applications challenges the ethical, legal, and policy principles that underpin the peaceful use of outer space (Soroka, 2023). While satellite militarisation provides tactical and strategic advantages, it simultaneously exacerbates systemic risks, raising profound questions about the future of space governance and the preservation of its cooperative principles.

The Russo-Ukrainian War, escalating into full-scale warfare on 24 February 2022, epitomises the transformative role of satellite technologies in contemporary military engagements. This conflict, characterised by hybrid warfare and asymmetrical tactics, has underscored the operational indispensability of space-based infrastructure. Satellite systems have proven vital for enabling real-time reconnaissance, secure communications, and precision navigation, highlighting their strategic value. However, these advancements also reveal critical vulnerabilities. For instance, Russia's cyberattack on Viasat's KA-SAT GEO satellite network exposed the fragility of satellite systems to non-kinetic threats, demonstrating the inherent risks associated with integrating space technologies into national defence strategies (ESPI, 2022). Conversely, Ukraine's utilisation of commercial satellite services, including SpaceX's Starlink, illustrates the dual-edged implications of private-sector participation. While such collaborations provide operational advantages, they also introduce risks related to dependency on non-state actors and the misalignment of commercial and national security priorities.

This conflict serves as a critical lens to examine the broader implications of integrating satellite technology into military operations. Beyond operational considerations, the conflict underscores the limitations of existing international legal frameworks – most notably, the Outer Space Treaty of 1967 – in addressing the challenges posed by the commercialisation and militarisation of space. The unprecedented reliance on commercial actors raises pressing questions about accountability, state sovereignty, and the erosion of traditional distinctions between civilian and military domains. Furthermore, the strategic importance of satellite systems highlights the evolution of space as a contested domain, where state and non-state actors compete for control over assets vital to terrestrial and orbital operations. These developments necessitate a thorough re-assessment of the regulatory and governance frameworks governing outer space.

The increasing prominence of commercial satellite technologies in the Russo-Ukrainian War, exemplified by Starlink's critical role in Ukraine's defense, signals a paradigm shift in modern warfare. Unlike the Gulf War of 1991, often referred to as the "first space war" due to its reliance on GPS, this conflict demonstrates a deeper integration of space systems into both military operations and humanitarian efforts. These technologies offer significant operational advantages, yet they also expose inherent vulnerabilities, including dependence on single commercial providers and the absence of robust regulatory oversight for non-state actors operating in conflict zones (Burbach, 2022; Höyhtyä & Uusipaavalniemi, 2023). This reliance highlights critical gaps in accountability and raises urgent questions about the governance of space activities in increasingly complex geopolitical environments.

A defining feature of the conflict is the strategic deployment of commercial satellite technology, with Starlink terminals bolstering Ukraine's communication infrastructure during the initial invasion phases. This reliance on commercial satellite services underscores the expanding role of private-sector actors in modern warfare. While such partnerships offer agility and cost-effectiveness, they also raise significant risks, including dependency on non-state entities and potential misalignment between private-sector priorities and national security imperatives (Jayanti, 2023). These concerns are magnified by the absence of comprehensive regulatory frameworks to manage the growing influence of private actors in conflict scenarios.

The democratization of space technologies, especially through the proliferation of commercial Earth Observation (EO) satellites, has further transformed conflict dynamics. These systems, which once operated exclusively within the domain of state military and intelligence agencies, now enable real-time battlefield intelligence accessible to a broader range of actors. Ukraine's effective utilization of commercial EO data to track battlefield conditions, assess infrastructure damage, and coordinate humanitarian responses exemplifies this shift (Morris, 2023; Ogden et al., 2024). However, this transparency introduces complex challenges, including the potential for misuse of satellite imagery in disinformation campaigns, surveillance overreach, and the facilitation of asymmetrical warfare. These risks emphasize the need for regulatory safeguards to prevent the exploitation of space technologies while preserving their benefits.

The integration of commercial satellite technologies has fundamentally redefined the paradigms of conflict management and strategic planning, with the Ukrainian crisis offering a pivotal case study in their operational and geopolitical significance. These technologies, encompassing secure communication, navigation, environmental monitoring, and intelligence gathering, exemplify the convergence between the private remote-sensing market and military operations (Jayanti, 2023). This intersection represents not merely an

evolution in technological application but a profound shift in the dynamics of power within modern warfare, where non-state actors now wield unprecedented influence over national security imperatives. The implications extend beyond the immediate conflict, highlighting the escalating geopolitical importance of satellite technologies while exposing the inadequacies of existing regulatory frameworks in addressing their inherently dual-use nature. Balancing the competing demands of commercial innovation and military application has thus emerged as a central challenge in contemporary space governance.

This study aims to critically analyse the role of satellite technologies in the Russo-Ukrainian War through three interconnected objectives:

1. To evaluate the strategic contributions of satellite technologies in operational contexts, particularly their role in reconnaissance, communication, and navigation during hybrid warfare.

2. To explore the ethical and legal tensions arising from the dual-use nature of satellite technologies and their military applications within existing international frameworks.

3. To propose policy recommendations that address the regulatory gaps and risks associated with the commercialisation and militarisation of space, contributing to the development of equitable governance norms.

By integrating these objectives, the paper seeks to contribute to the discourse on space governance, highlighting the strategic, legal, and ethical dimensions of satellite technologies in modern conflict. It underscores the urgency for a robust regulatory framework to balance innovation and security imperatives while preserving the principles of peaceful space use.

This paper advances the critical discourse on the integration of satellite technology into modern conflict through a concise and interdisciplinary framework. It begins by tracing the evolution of satellite systems, from their strategic Cold War origins to their contemporary dual-use applications. This historical context underscores the transformative impact of satellite technology on global security and geopolitics.

The second section, *Commercial and Public Space Capabilities* examines the operational deployment of satellite systems in the Russo-Ukrainian War. It highlights the interplay between state-operated platforms and commercial actors, with a focus on two critical dimensions*: Satellite Communications* and *Optical and SAR Imaging*. This analysis demonstrates the unprecedented strategic value of space-based technologies in modern warfare, particularly their role in reconnaissance, communication, and precision targeting.

The discussion then shifts to the legal and ethical challenges posed by satellite technologies, emphasizing the limitations of existing international frameworks. It addresses the dual-use complexities of these systems, the growing influence of non-state actors, and ambiguities in space governance. The analysis underscores the need for robust regulatory reform to enhance accountability and address the evolving dynamics of space activities.

By situating these issues within the context of the Ukrainian conflict, the paper illuminates the broader implications of satellite militarisation and commercialisation. It argues for urgent reform to preserve the principles of security, cooperation, and peaceful space use, warning that the weaponisation of satellite technologies risks undermining these foundational values. This contribution aims to inform policy and governance reforms essential for navigating the complexities of the modern space age.

Methodologically, this research employs a qualitative approach to explore the operational applications, legal ramifications, and policy implications of satellite technology in the Russo-Ukrainian War. By integrating a literature review, case study analysis, and qualitative thematic analysis, the study provides a comprehensive evaluation of the transformative impact of

satellite technologies on military operations and international security. The literature review critically assesses scholarly and governmental sources to establish a theoretical and historical foundation, identifying gaps that inform the study's focus. The case study analysis leverages primary sources such as official statements and satellite imagery to reveal the strategic significance of these technologies in the conflict. Through thematic analysis, the study identifies recurring legal, ethical, and security concerns, providing nuanced insights into the challenges of integrating satellite technologies within the constraints of existing space law frameworks.

The Evolution and Proliferation of Satellite Technology

The launch of Sputnik 1 on October 4, 1957, by the Soviet Union represented a watershed moment in modern history. This modest 22-inch aluminum sphere, weighing 183 pounds, was the first human-made object to orbit Earth. Despite its rudimentary design, Sputnik's successful orbit and transmission of simple radio signals profoundly impacted the trajectory of space exploration, exemplifying the dual-use nature of satellite technology and intertwining scientific advancement with military potential (Launius, 2007).

Emerging during the height of the Cold War, Sputnik transcended its technological significance, serving as a bold geopolitical statement. It challenged the United States' perceived superiority in technology and strategy, igniting fears that the Soviet Union could leverage satellite capabilities to enhance intercontinental ballistic missile (ICBM) technologies. These concerns underscored vulnerabilities in U.S. national security and catalysed a shift in defence priorities, emphasizing real-time surveillance capabilities and advanced reconnaissance systems to counter emerging threats (Richelson, 1990).

In response, the United States implemented a multifaceted strategy. The National Aeronautics and Space Act of 1958 established NASA, highlighting peaceful applications of space exploration while significant investments were directed toward military satellite systems. These dual-use technologies underscored the strategic integration of scientific innovation with national defense, a hallmark of the early space age (Richelson, 1990).

The Genesis of Satellite Reconnaissance

The geopolitical urgency following Sputnik's launch accelerated the development of U.S. satellite reconnaissance programs, notably CORONA and DISCOVERER. These initiatives marked a pivotal redefinition of space as a domain for intelligence and diplomacy. CORONA, operational by 1959 under President Eisenhower's direction, pioneered recoverable photographic reconnaissance, addressing the critical need for monitoring Soviet missile sites and installations (Davies & Harris, 1988; Rich, 1998).

The DISCOVERER program, publicly framed as a scientific endeavor, covertly served as a testing ground for CORONA, focusing on capsule recovery techniques. This strategic duality exemplified the Cold War-era intersection of scientific progress and military exigency. Recognizing the strategic importance of these capabilities, the National Security Council's 1958 directive emphasized the urgent operationalization of reconnaissance satellites to bolster arms control and defence (Rich, 1998).

CORONA and DISCOVERER heralded groundbreaking technological advancements, including spin-stabilized satellites, polar orbits for global coverage, and film recovery systems for high-resolution imagery. These innovations facilitated early detection of Soviet threats and informed U.S. military strategies, ensuring a critical intelligence edge. By the late 1960s, CORONA's success spurred the development of its successors, such as HEXAGON,

widely known as "Big Bird," which featured enhanced imaging and operational capabilities (Rich, 1998).

Impact on Diplomacy and Intelligence

Within two decades, satellite reconnaissance evolved from an experimental initiative to a cornerstone of U.S. national security and international diplomacy. The technological strides achieved during this period had profound global ramifications, reshaping the contours of geopolitical strategies. By 1972, intelligence derived from CORONA, GAMBIT, and HEXAGON programs played a pivotal role in diplomatic negotiations between the United States and the Soviet Union, culminating in landmark agreements such as the *Interim Agreement on Strategic Offensive Arms and the Anti-Ballistic Missile Treaty* (Richelson, 1990). These accords imposed critical limitations on nuclear arsenals, fostering a degree of stability in Cold War geopolitics.

Reconnaissance satellites underpinned these negotiations by providing incontrovertible evidence of military activities, enabling transparent verification and fostering mutual trust. This capacity to monitor missile deployments and strategic assets underscored the dual-use nature of these technologies, blending intelligence gathering with a facilitative role in arms control diplomacy. The unprecedented insights offered by orbital surveillance underscored the indispensable role of space technologies in fostering global security (Richelson, 1990).

Moreover, these programs exemplified the growing importance of orbital surveillance as an indispensable tool for geopolitical stability. Satellite systems, equipped with advanced imaging and sensory technologies, empowered states to accumulate intelligence without violating international borders. This shift heralded a new paradigm in international relations, where "eyes in the sky" facilitated both strategic defence and diplomatic negotiation.

Bridging to Modern Satellite Development

The legacy of satellite reconnaissance programs such as CORONA and HEXAGON established a foundational blueprint for the evolution of contemporary satellite technologies. These pioneering efforts not only demonstrated the immense strategic value of space-based intelligence but also fundamentally redefined the scope and trajectory of satellite development. Initially constrained to military and government use, reflecting the Cold War's geopolitical tensions, these programs underscored the transformative potential of satellites in shaping global security dynamics.

Building on the innovations of these early programs – high-resolution imaging systems, film recovery technologies, and polar orbit reconnaissance – subsequent decades witnessed significant advancements. As the Cold War receded and technology matured, satellite applications expanded far beyond their original remit. The transition from analog to digital systems, coupled with miniaturization and the rise of commercial satellite platforms, redefined the operational landscape. These developments marked the beginning of a paradigm shift from exclusive state control to a democratized space ecosystem increasingly dominated by private actors (Harrison & Strohmeyer, 2022).

The evolution of satellite technologies over the past two decades represents a significant paradigm shift from state-dominated systems to an ecosystem increasingly driven by private commercial enterprises. This transformation, while underpinned by advances in miniaturization, cost efficiency, and innovation, has not occurred in isolation. Policy interventions such as the *Land Remote Sensing Policy Act of 1992*, which provided a regulatory framework for commercial satellite operations, and initiatives like the *2010 Enhanced View contract*, which incentivized private-sector engagement through substantial government funding, catalysed this transition (Land, 1992; Harrison & Strohmeyer, 2022).

Together, such measures enabled the proliferation of commercial platforms that not only rival government capabilities but often exceed them in the speed of innovation and deployment.

The Expanding Commercial Ecosystem

The 2010s marked a turning point in the development of commercial sensing capabilities. With government initiatives like Project Maven, the United States began to rethink traditional approaches to remote sensing, leveraging privately owned satellite systems, machine-assisted data processing, and cloud-based data sharing. This reorientation reflected a recognition of the limitations of government-operated platforms in an era of rapid technological innovation (Harrison & Strohmeyer, 2022). By integrating commercial capabilities into national strategies, governments were able to achieve faster advancements while also reducing the financial and logistical burdens associated with state-run programs.

Private companies such as SpaceX, Planet Labs, and Maxar Technologies emerged as pivotal actors in this new space ecosystem. By providing high-resolution imaging, real-time data transmission, and cost-effective solutions, these companies reshaped the industry. The rise of small satellite constellations further exemplified the democratization of space technologies. Miniaturized platforms capable of delivering global coverage at reduced costs opened avenues for applications previously accessible only to nation-states. While this shift spurred innovation, it also introduced a host of challenges related to governance, security, and ethical accountability.

The transition from government exclusivity to widespread commercial availability has expanded the scope of satellite applications far beyond traditional military and intelligence uses. Commercial satellites now play a critical role in fields as diverse as disaster management, environmental monitoring, urban planning, and global communications.

In disaster management, for example, satellite communications can provide critical connectivity when terrestrial networks are damaged or overloaded, facilitating coordination and response efforts Satellite imagery allows responders to assess damage, map logistical routes, and coordinate relief efforts with greater precision. These capabilities significantly enhance the speed and effectiveness of emergency responses, as seen in recent hurricanes, wildfires, and earthquakes (The role, 2022).

The mining sector has similarly benefited from satellite-enabled advancements. High-resolution remote sensing facilitates resource identification and environmental impact assessments. This allows companies to optimize operations while adhering to regulatory standards. Furthermore, satellites enable real-time monitoring, reducing risks associated with illegal mining activities and environmental degradation (Borotkanych, 2022).

In urban planning, satellite data is revolutionizing how cities are designed and managed. By tracking urban sprawl, analyzing traffic patterns, and monitoring resource use, planners can develop more sustainable and efficient infrastructures. For example, satellite imagery is increasingly being used to address urban heat islands, reduce energy consumption, and plan green spaces that enhance livability.

Perhaps the most transformative impact of satellite technology lies in global communications. The advent of constellations like SpaceX's Starlink has bridged the digital divide by delivering high-speed internet access to underserved and remote regions. By enabling connectivity in areas where traditional infrastructure is lacking, satellites have become critical enablers of education, healthcare, and economic development. Yet, this transformation is not without its complications. The proliferation of mega-constellations has raised concerns about orbital congestion, space debris, and the long-term sustainability of space operations (Abels, 2024).

Satellites play a vital role in environmental monitoring, providing critical data on issues ranging from climate change to biodiversity loss. They enable policymakers to track deforestation, monitor ocean health, and assess greenhouse gas emissions with unparalleled accuracy. However, the very technologies that empower these capabilities also pose significant challenges. The energy-intensive manufacturing and launching of satellites contribute to carbon emissions, raising questions about the environmental trade-offs of expanded satellite use.

Ethical and Regulatory Dilemmas of Dual-Use Technologies

The dual-use nature of satellite technologies – developed for civilian applications but readily adaptable for military use – poses profound legal and ethical dilemmas in contemporary conflict. The Russo-Ukrainian War highlights this complexity. SpaceX's Starlink, while providing critical communication capabilities to Ukrainian forces, has underscored the vulnerabilities and ambiguities introduced by the involvement of private companies in military operations. This case reveals the precarious balance between commercial neutrality and implicit alignment with state objectives, raising pressing questions about accountability, sovereignty, and the role of private enterprises in national security (Fave, 2023).

Private companies, unlike states, are not directly bound by international humanitarian law, yet their technologies have become integral to military strategy. When private actors, such as SpaceX, influence operational outcomes in war zones, they effectively blur the distinction between state and non-state entities. This creates a legal vacuum, as current international frameworks lack the mechanisms to regulate the military applications of commercial infrastructure. Moreover, such involvement risks compromising state sovereignty, particularly when national security becomes contingent on external commercial systems, exposing states to undue influence or coercion (Abels, 2024).

Starlink's integration into Ukraine's defence efforts highlighted how commercial systems, initially launched with civilian aims, are now integral to warfare, complicating compliance with international norms (Fave, 2023). Such reliance on private satellite systems introduces strategic vulnerabilities. For instance, the main decisions about the provision or withdrawal of Starlink services rest solely with the private company, raising concerns about external influence over critical national security operations. Such dependencies could erode state sovereignty and expose nations to potential coercion, as private actors could prioritise commercial interests over strategic or humanitarian needs. This reliance on commercial infrastructure for military functions highlights the risks of outsourcing sovereignty to entities beyond state control.

The flexibility of satellite technologies, originally designed for civilian applications, complicates governance. Systems intended for communication can be repurposed for reconnaissance or targeting. This adaptability could undermine norms of peaceful space use and increase risks of escalation.

To address these challenges, international frameworks must evolve to regulate the militarisation of commercial space assets. Revisions to the Outer Space Treaty or complementary agreements are essential to establish accountability mechanisms for private entities. Stricter licensing regimes for dual-use technologies, combined with enhanced public-private collaboration, could mitigate misuse and reinforce adherence to international norms.

The Ukrainian conflict exemplifies how commercial and public space capabilities intersect in warfare. The following chapter will explore how these technologies, spanning communication, reconnaissance, and navigation, redefine conflict dynamics. By examining the interplay of public and private actors, it will highlight the strategic and ethical implications of satellite technologies in modern war.

Commercial and Public Space Capabilities in the Russo-Ukrainian War

Satellite services, a cornerstone of contemporary space technology, are typically classified into four key domains: (1) *Positioning, Navigation, and Timing* (PNT) services, (2) *Communications*, (3) *Remote Sensing*, and (4) *Science and Exploration.* While the latter primarily advances knowledge of outer space, the first three are instrumental in supporting life on Earth, encompassing both military and civilian applications. Military satellite services integrate PNT and satellite communications, providing critical capabilities for precision targeting, mobility, and situational awareness. These services are further enhanced by systems dedicated to (1) missile warning, (2) environmental and weather monitoring, and (3) Intelligence, Surveillance, and Reconnaissance (ISR). Military operations in space also involve the launch and maintenance of satellites and the vital task of maintaining space situational awareness – the ability to monitor and predict the movements of satellites, debris, and potential threats such as anti-satellite weapons (Höyhtyä & Uusipaavalniemi, 2023).

The Russo-Ukrainian War has underscored the transformative role of space technologies in modern warfare, highlighting their integral role in reshaping battlefield dynamics and facilitating international collaboration. Space-based services have proven indispensable in military and civilian contexts, demonstrating the democratization of space capabilities. Russia's invasion of Ukraine has extended into the space domain, disrupting international partnerships and accelerating the adoption of commercial space services. Precision weaponry such as GPS-guided HIMARS has demonstrated remarkable efficacy, while satellite monitoring has rendered the battlefield one of the most transparent in modern history. Importantly, effective exploitation of space services in warfare does not require proprietary satellite systems. As evidenced in this conflict, public and commercial satellites – many operated by allied nations or private entities – have played a pivotal role, emphasizing the growing accessibility of advanced space technologies (Höyhtyä & Uusipaavalniemi, 2023).

The Role of Commercial Entities in the Space Domain

The increasing commercial orientation of space activities has profoundly influenced their role in conflict scenarios. Today, over 90% of satellite launches involve commercial systems, underscoring the sector's dominant role in global space infrastructure (ESA's, 2022). Companies such as SpaceX, Maxar, and Planet Labs have become indispensable in both military and civilian contexts, providing high-resolution imagery, real-time communication, and essential navigation services. While this trend fosters innovation and accessibility, it also introduces vulnerabilities, particularly as private-sector decision-making increasingly intersects with national security imperatives.

Marko Höyhtyä and Sari Uusipaavalniemi identify three primary areas where commercial and public space activities have influenced the Russo-Ukrainian War: (1) Satellite Communications, (2) Optical and SAR Imaging, and (3) International Collaboration. Building on this categorization, this research narrows its focus to the first two dimensions – Satellite Communications and Optical and SAR Imaging – to provide a detailed exploration of how these technologies are reshaping the dynamics of modern conflict (Höyhtyä & Uusipaavalniemi, 2023).

The section on *Satellite Communications* examines their pivotal roles in (1) facilitating drone operations, (2) enhancing information dissemination, and (3) supporting command and control structures, while also addressing their vulnerability to (4) cyberattacks. Meanwhile, the section on *Optical and SAR Imaging* delves into the use of satellite imagery for (1) near

real-time intelligence and situational awareness, (2) the role of crowdfunded satellites and public information dissemination, and (3) the collection of evidence to support attribution and legal accountability.

By concentrating on these two dimensions, the study highlights the transformative impacts of space technologies in the Russo-Ukrainian War. It emphasizes their strategic importance while critically engaging with the associated legal and ethical challenges, particularly those posed by the dual-use nature of these technologies in contemporary warfare.

Satellite Communications

Drone Communications and Enabling Drone Strikes

Satellite links are foundational to contemporary military operations, enabling the remote control and precise coordination of unmanned aerial vehicles (UAVs). These systems provide real-time data and operational oversight, significantly enhancing the effectiveness of drone warfare by facilitating highly accurate, targeted strikes. In the Russo-Ukrainian War, first-person view (FPV) drones have emerged as a transformative innovation. Originally designed for civilian recreational activities, such as racing, these small and cost-effective drones have been repurposed into lethal weapons. Operated by ground-based pilots, FPVs are equipped with explosive payloads and directed toward their targets with remarkable precision. Their utility is particularly evident in environments where conventional airpower is limited by dense anti-aircraft defenses near the front lines (Zafra et al., 2024).

While UAVs have long been integrated into military operations, the scale, sophistication, and tactical deployment of drones in Ukraine represent a paradigm shift in modern conflict. Initially utilized sporadically, smaller drones have since become integral to Ukrainian military operations and organized into formal military structures. Presently, nearly every combat brigade includes an assault drone unit, and reconnaissance drones are ubiquitous across most operational divisions. Reflecting this strategic prioritization, the Ukrainian government has set an ambitious target to produce one million FPV drones in 2024 – a volume that exceeds the total number of artillery shells supplied by the European Union over the past year (Sadham, 2024). Furthermore, the Ministry of Defence of Ukraine has bolstered its UAV arsenal by purchasing over 8,200 DJI Mavic drones through the Lethal Defense Acquisition Agency. Valued at approximately $30 million USD, this investment underscores the critical role of drones in enhancing military efficacy (Kesteloo, 2024). This prioritization underscores the centrality of UAVs in modern warfare. Equipped with advanced cameras, these drones transmit live video feeds, enabling operators to identify and monitor enemy positions from an aerial perspective. This capability streamlines battlefield decision-making, offering commanders real-time situational awareness and improving the precision of tactical responses.

Reconnaissance drones utilized in the Russo-Ukrainian War exhibit significant variation in design and capability, reflecting both tactical adaptability and technological accessibility. Among the most widely deployed are the commercially available DJI Mavic drones, a Chinese-manufactured quadcopter originally intended for civilian use, such as aerial photography and event documentation. Priced between $1,500 and $3,000, these drones have been repurposed as indispensable tools for soldiers in trench warfare, enabling real-time battlefield surveillance (Bendett & Edmonds, 2022). Despite their consumer-grade origins, DJI Mavics provide high-resolution imaging capabilities that allow ground troops to gain critical situational awareness, often tipping the scales in high-stakes engagements.

In addition to these compact drones, specialized teams stationed farther from the front lines deploy larger, winged reconnaissance UAVs, which are equipped with advanced

imaging systems. These sophisticated platforms, often costing tens of thousands of dollars, can penetrate deeper into enemy-controlled territory, offering commanders strategic intelligence beyond the immediate combat zone. Upon identifying targets, these drones relay precise coordinates through encrypted communication channels to command units, where the data is integrated into systems like Kropyva – a Ukrainian-developed digital mapping tool aggregating geospatial data on Russian positions. This centralized platform enables commanders to evaluate the tactical landscape comprehensively and select the optimal method for neutralizing identified threats (Zafra et al., 2024).

FPV drones exhibit a remarkable ability to pursue and strike moving targets with precision that surpasses most conventional artillery. Their capacity to chase and engage mobile vehicles provides a significant tactical advantage, particularly in dynamic combat scenarios. However, their utility is tempered by their payload limitations; while drones excel in accuracy, traditional artillery shells continue to deliver a substantially greater explosive impact, underscoring the complementary roles these technologies play in modern warfare – drones for precision strikes and artillery for broader destructive power.

The utility of drones has extended far beyond the immediate battlefield. Both Ukraine and Russia have employed long-range UAVs to conduct strikes hundreds of kilometres away from the front lines, effectively broadening the scope of the conflict. The large-scale deployment of long-range attack drones emerged notably in late 2022, when Russia integrated Shahed drones, acquired from Iran, into its military strategy. These UAVs proved highly effective, not only in operational terms but also in their cost-efficiency. Shahed drones, priced significantly lower than the air defence missiles initially deployed by Ukraine to intercept them, have imposed a considerable economic strain on Ukrainian defences, exemplifying the cost-asymmetric nature of drone warfare. The Shahed drones operate on pre-programmed flight paths, often incorporating intricate twists and turns to confound and deplete Ukraine's air defense systems. This design underscores the dual purpose of the drones: inflicting damage while simultaneously draining enemy resources. The Shahed-136, the most widely utilized model, is estimated to cost less than $100,000, a factor that has enabled Russia to domestically scale its production. In response, Ukraine has adapted by deploying improvised countermeasures, including flak cannons and machine guns mounted on pickup trucks to neutralize these aerial threats. Concurrently, Ukraine has advanced the development of its own long-range drones to compensate for its limited stock of long-range missiles. Although early iterations of these drones were frequently intercepted by Russian electronic warfare (EW) systems, recent successes in targeting key facilities deep within Russian territory, including factories and oil refineries, suggest a steep learning curve and strategic evolution on Ukraine's part (Zafra et al., 2024).

The escalating use of electronic warfare systems has prompted both Ukraine and Russia to explore the integration of artificial intelligence (AI) into drone technology. AI-enabled drones possess the capability to identify and engage targets autonomously, bypassing the need for direct communication with human operators. This autonomy renders them impervious to signal jamming, a common tactic in EW operations. While the deployment of AI-driven drones remains limited, their potential to redefine the battlefield is increasingly evident. As noted by a Ukrainian drone pilot, known by his call sign Darwin, "You cannot jam such a drone because there is nothing to jam." Although current AI systems are not yet fully developed for widespread deployment, the trajectory of innovation suggests that these technologies could dominate the future of drone warfare. Industry experts anticipate that enhanced EW protections could eventually render conventional FPV drones obsolete, further

emphasizing the need for continual adaptation in both offensive and defensive strategies (Zafra et al., 2024). These advancements underscore the rapidly evolving dynamics of drone warfare, characterized by technological innovation, strategic adaptation, and operational complexity. The integration of AI into drone systems, while enhancing their effectiveness, also raises profound ethical and legal considerations. The autonomous nature of AI-guided drones challenges existing international humanitarian law, necessitating a revaluation of accountability frameworks and the rules governing their deployment in conflict zones. The Russo-Ukrainian war thus serves as a critical case study in the transformative and disruptive potential of drone technology in modern military engagements.

These developments underscore the growing complexity and sophistication of drone warfare. The rapid evolution and deployment of drone technology in the Russo-Ukrainian War highlight the crucial role that satellite communications and advanced technology play in modern warfare. This shift not only enhances operational effectiveness but also raises significant legal and ethical implications regarding the use of autonomous and semi-autonomous systems in conflict zones.

Legal and Ethical Challenges

The Russo-Ukrainian war highlights the transformative role of satellite communications and drone technologies in redefining modern conflict, while simultaneously exposing profound legal and ethical dilemmas. These technologies, although providing strategic and tactical advantages, challenge the foundational principles of international humanitarian law (IHL), particularly concerning the legality of targeted strikes and the imperative to distinguish between combatants and civilians. Under IHL, military actions must adhere to the principles of necessity and proportionality, ensuring civilian harm is minimized. However, the precision and capabilities of modern drones paradoxically complicate these assessments; their use can either mitigate or exacerbate collateral damage depending on the operational context and level of oversight (Melzer, 2009).

Legal Dilemmas: Accountability and Dual-Use Assets

The dual-use nature of drones and satellite technologies lies at the core of their legal challenges. Autonomous drones, capable of independently identifying and engaging targets, disrupt the legal frameworks predicated on human accountability. IHL emphasizes direct human oversight in decisions involving the use of lethal force. The integration of artificial intelligence (AI) into military systems challenges this premise, creating significant accountability gaps. Current legal frameworks inadequately address liability when autonomous systems cause unintended harm. This legal ambiguity risks enabling the deployment of drones in ways that contravene the principles of distinction and proportionality central to IHL (Roza, 2023).

Additionally, the reliance on commercial satellite networks for military operations amplifies the complexity of dual-use considerations. These networks, essential for communications and surveillance, become legitimate military targets under IHL when employed in conflict, potentially exposing civilian infrastructure to collateral damage. The blurred line between civilian and military applications demands urgent clarification under both space law and IHL. For instance, the liability of satellite operators – be they state or private entities – remains underdeveloped in international legal discourse, raising critical questions about their accountability for the consequences of military use (Roza, 2023).

Ethical Considerations: Autonomy and the "Distancing Effect"

The ethical implications of satellite-enabled drones in modern warfare are profound and multifaceted. Central to these concerns is the "distancing effect", a phenomenon created by the physical and psychological separation between drone operators and the battlefield.

This detachment diminishes the immediate emotional and moral weight of life-and-death decisions, lowering the threshold for engaging in acts of violence and potentially desensitizing operators to the human costs of their actions. Such a scenario risks turning lethal operations into abstract exercises, thereby eroding the accountability and gravity traditionally associated with the use of force. Addressing this challenge necessitates robust oversight mechanisms and the implementation of comprehensive training programs designed to instill ethical awareness and adherence to international humanitarian law (IHL).

The advent of autonomous drones introduces an even deeper ethical dilemma. Unlike remotely piloted systems, autonomous drones operate without direct human input, delegating critical decision-making – such as distinguishing between combatants and civilians – to algorithms. This raises serious concerns regarding the accountability for algorithmic errors. For example, should unintended civilian casualties result from an AI's flawed decision, it remains unclear whether responsibility lies with the programmer, the deploying entity, or the machine itself. This ambiguity undermines core principles of justice and fairness in warfare and highlights the urgent need for accountability frameworks specifically tailored to autonomous systems.

The reliance on AI in military decision-making also challenges fundamental ethical norms. Autonomous drones lack the capacity for moral reasoning or the ability to weigh the nuanced consequences of their actions. While proponents argue that such systems could minimize human error and reduce emotional bias, critics contend that their inability to interpret context or demonstrate compassion fundamentally disqualifies them from making decisions with profound human implications. This ethical vacuum risks creating a battlefield environment increasingly removed from the values enshrined in IHL, including humanity, proportionality, and distinction.

As Christopher Newmann (Newmann, 2012) argues, the relationship between technology and ethics is inseparable, with technologies actively shaping perceptions of reality and moral agency through a process he terms technological mediation. This concept highlights the moral responsibility embedded in the design and deployment of military technologies. In the context of drones, ethical considerations must extend beyond their operational use to their design and interface development.

For instance, user interfaces should emphasize the gravity of life-and-death decisions by integrating feedback mechanisms that visually or audibly reinforce the human consequences of actions. Such design features could help counteract the desensitization effects associated with remote operations, reintroducing a measure of emotional engagement for operators. Additionally, public deliberation processes involving multiple stakeholders – including ethicists, technologists, and international policymakers – can help guide the development of drones to align with global ethical standards.

The increasing prevalence of drone warfare has prompted what Christopher Newmann (Newmann, 2012) terms an "ethics surge", characterized by heightened scrutiny of the moral implications of remote military engagement. Despite this focus, significant gaps remain in addressing the consequences of drone usage. For example, while drones are celebrated for their precision, the operational detachment of their operators raises concerns about accountability drift, where individuals feel less responsible for the outcomes of their actions. This phenomenon is exacerbated by the anonymity and physical distance afforded by remote operations.

Furthermore, the integration of autonomous capabilities into drones amplifies these concerns. By removing human oversight from critical decision-making, such systems risk

prioritizing operational efficiency over ethical considerations. This trade-off underscores the need for comprehensive regulatory frameworks that mandate human oversight for lethal operations, even in AI-driven systems. International agreements must specify the conditions under which autonomous drones can be deployed, ensuring compliance with IHL and safeguarding against misuse.

The Role of Private Entities and Commercialization

Private companies play an increasingly critical role in enabling drone and satellite capabilities in conflict zones, but their involvement raises both strategic and ethical dilemmas. Private companies whose technologies support military efforts, blur the boundary between civilian and military applications. This dual-use nature amplifies the risk of escalation, as adversaries may perceive commercial assets as legitimate targets. Regulatory oversight is essential to ensure that private entities operate within the bounds of international law and maintain ethical standards in conflict zones. The commercialisation of warfare technology also introduces the risk of strategic dependency.

The growing involvement of private companies in providing satellite communications and drone technologies introduces additional complexities. While the private sector accelerates innovation, profit motives and a lack of stringent oversight raise ethical and legal concerns. Private actors often operate in regulatory grey areas, complicating accountability in conflict zones. The commercialization of warfare technology risks prioritizing profit over compliance with IHL, potentially eroding international norms. As Christopher Newmann (Newmann, 2012) aptly argues, technologies are not morally neutral; they shape human actions, offering both opportunities and challenges. Ensuring that private companies adhere to strict regulatory standards is essential to prevent the unchecked escalation of violence and exploitation in conflict settings.

Toward an Integrated Legal and Ethical Framework

The Russo-Ukrainian War starkly illustrates the profound legal and ethical challenges introduced by the integration of drones and satellite communications into modern warfare. These technologies, while offering unparalleled strategic and tactical advantages, disrupt fundamental principles of international humanitarian law (IHL), particularly distinction, proportionality, and accountability. The dual-use nature of drones and satellites erodes the traditional boundaries between civilian and military infrastructure, creating legal ambiguities that leave civilian assets and private operators vulnerable to targeting. Autonomous drones, driven by artificial intelligence (AI), exacerbate these challenges, as current legal frameworks fail to adequately address accountability for algorithmic errors, unintended harm, or misuse, leaving gaps that undermine the principles of justice and humanity central to IHL.

Addressing these multifaceted issues demands a reimagined legal architecture capable of regulating the complexities of modern warfare technologies. Binding international agreements must establish clear protocols for the deployment of autonomous systems, mandating transparency, traceability, and the ability to audit decision-making algorithms. The legal status of dual-use assets must be clarified to ensure that civilian systems are protected under IHL, and that any military use adheres strictly to principles of necessity and proportionality. Liability frameworks should extend to private sector entities, ensuring that companies profiting from warfare technologies are held accountable for their misuse or the harm their products cause, thereby preventing the commercialization of violence at the expense of international norms.

On the ethical front, the psychological detachment fostered by remote warfare technologies – often termed the "distancing effect" – requires a fundamental redesign of

military systems to prioritize accountability and moral engagement. Decision-feedback mechanisms embedded in interfaces could present operators with visual or auditory cues emphasizing the human consequences of their actions. For example, interfaces might display the potential civilian impact of a strike before execution, prompting operators to reconsider decisions that could disproportionately harm non-combatants. These features could serve to counteract desensitization, reinserting an essential element of moral reflection into remote operations.

Autonomous systems, while promising efficiency, must never operate without meaningful human oversight in life-and-death decisions. To achieve this, international norms could enshrine a principle of "human-in-the-loop"[1] control for all autonomous weapons systems. Furthermore, these systems should undergo rigorous pre-deployment testing to ensure compliance with IHL and ethical standards, with independent oversight bodies empowered to evaluate and certify their use.

Through coordinated global action – anchored in robust legal standards, rigorous ethical scrutiny, and transparent accountability mechanisms – it is possible to mitigate the risks posed by these systems and protect the principles of humanity, dignity, and peace in an increasingly technologized theatre of war. This reorientation not only addresses the immediate challenges of the Russo-Ukrainian War but sets a precedent for the responsible integration of advanced technologies in future conflicts.

Information Sharing and Countering Misinformation

The Russo-Ukrainian War serves as a compelling case study for the transformative role of satellite communications in modern warfare, particularly in facilitating information sharing and combating misinformation. Satellite technology has become integral to operational success, enabling real-time intelligence transmission, seamless coordination among dispersed units, and the dissemination of accurate information to counter adversarial narratives. However, the increased reliance on these technologies brings significant challenges, including governance of information flows, the mitigation of disinformation campaigns, and the ethical and legal implications of their deployment. Addressing these issues requires a nuanced approach that balances technological innovation with comprehensive regulatory oversight.

The capacity of satellite communications to synchronize military actions across dispersed units offers a decisive advantage in contemporary conflict scenarios. These systems ensure operational alignment between field personnel and strategic decision-makers, even in contested or remote environments. This synchronization preserves battlefield cohesion and amplifies the effectiveness of tactical operations. The commercialisation of space technologies further amplifies their strategic importance. For instance, the rapid deployment of Starlink terminals during the early stages of the Russian invasion of Ukraine underscores the pivotal role of private-sector innovations. Within days of a public appeal by Ukraine's Minister of Digital Transformation, Mykhailo Fedorov, SpaceX activated its Starlink services and shipped necessary hardware to Ukraine. By May 2022, over 150,000 Ukrainians were utilizing Starlink daily for critical civilian functions and military operations, including drone coordination and surveillance (Jayanti, 2023).

[1] The "Human-in-the-Loop" (HITL) paradigm integrates human judgment and oversight into the development and operation of artificial intelligence (AI) and machine learning (ML) systems. This approach ensures that human expertise guides critical decision-making processes, enhancing the system's accuracy, reliability, and ethical alignment. *Human-in-the-Loop Machine Learning: Challenges and Applications*. SpringerLink. Available at: https://link.springer.com/article/10.1007/s10462-022-10246-w

The Benefits and Risks of Commercial Integration

The Starlink deployment exemplifies the advantages of leveraging commercial technologies in conflict zones. First, the rapid deployment and activation of the network demonstrated an unprecedented level of efficiency, bypassing the bureaucratic delays that often characterize state-led initiatives. Second, the accessibility of commercially developed technologies, designed for mass-market use, allowed for seamless integration into diverse operational contexts, from hospitals and schools to frontline military units. The adaptability and practicality of these technologies underscored their utility in ensuring continuity of services during crisis scenarios.

Moreover, Starlink's low-Earth orbit (LEO) satellite architecture has proven cost-effective compared to traditional geostationary systems, benefiting from economies of scale and reduced launch costs per satellite. The resilience of the network was further demonstrated by SpaceX's ability to counter Russian cyberattacks, ensuring uninterrupted service for Ukrainian users (Jayanti, 2023).

However, this reliance on commercial entities for critical infrastructure exposes significant vulnerabilities. SpaceX's subsequent request for the U.S. Department of Defense to cover operational costs highlighted the fragility of depending on a single private entity in sustained conflict scenarios. The unpredictable nature of corporate decision-making, particularly influenced by Elon Musk's public statements, further revealed strategic risks. This dependency underscores the need for diversified partnerships and clear agreements that align corporate operations with national and international security objectives.

The ethical and legal challenges of integrating commercial satellite systems into conflict scenarios are equally significant. Dual-use technologies like Starlink blur the line between civilian and military applications, raising concerns under international humanitarian law (IHL). The potential reclassification of such systems as legitimate military targets poses risks to civilian infrastructure and the populations that rely on them. Additionally, the commercial incentives driving private-sector involvement in conflict zones can create conflicts of interest, as evidenced by the substantial valuation boost SpaceX experienced following its high-profile role in Ukraine (Jayanti, 2023).

Legal and Ethical Challenges

The dual-use nature of satellite systems presents a legal gray area under IHL. Civilian infrastructure that also serves military purposes may be considered a lawful target, endangering civilian lives and assets. This ambiguity calls for the development of robust international legal frameworks to delineate the status of such systems and establish liability mechanisms for private operators. Clear legal parameters would not only ensure accountability but also mitigate risks to civilian populations and infrastructure.

Ethical considerations also demand attention. The use of satellite technologies to counter disinformation, while critical, raises questions about privacy, the balance of power between public and private actors, and the broader implications of delegating critical infrastructure to profit-driven entities. Embedding ethical safeguards into the design and governance of these systems is essential. This includes transparency in decision-making processes, rigorous training for operators to adhere to humanitarian principles, and the development of frameworks to minimize collateral damage.

To address these challenges, a multi-faceted approach is essential. Legal reforms must clarify the dual-use status of satellite systems under IHL and establish liability frameworks that hold private operators accountable for their actions. Public-private partnerships should

be governed by transparent protocols that prioritize national security and humanitarian objectives over commercial gain.

In addition, robust cybersecurity measures are necessary to safeguard satellite systems against electronic warfare and cyber threats. Real-time anomaly detection, encryption, and segmented network architectures must be implemented to enhance system resilience. Ethical safeguards should also be integrated into the operational framework, emphasizing adherence to IHL principles, transparency, and accountability.

Command and Control: The Strategic Role of Satellite Communications

Satellite communications are a cornerstone of modern command and control (C2) systems, enabling real-time coordination, precision targeting, and adaptive decision-making in complex and dynamic military operations. In conflicts such as the Russo-Ukrainian war, these systems have proven indispensable, ensuring operational coherence across dispersed units while mitigating the vulnerabilities of traditional communication networks. By facilitating the rapid transmission of orders and intelligence, satellite-enabled C2 frameworks enhance strategic decision-making and operational effectiveness, even in the face of adversarial disruptions (Dickey & Gleason, 2023).

Satellite Communications in Modern Warfare

The Russo-Ukrainian War underscores the transformative potential of satellite communications in contemporary warfare. Ukrainian forces have leveraged satellite-enabled C2 systems to maintain cohesion and execute synchronized maneuvers amidst the destruction of terrestrial infrastructure. Unlike conventional networks, satellite systems offer resilience against both physical and cyber threats, ensuring the uninterrupted flow of critical information. This reliability has been essential in enabling decentralized decision-making, allowing tactical units to act autonomously while aligning their actions with overarching strategic goals. The flexibility provided by such systems has been instrumental in countering the rigid and hierarchical command structures of opposing forces, offering a distinct strategic advantage (Dickey & Gleason, 2023).

Decentralized Command and Control: A Strategic Evolution

Ukraine's adoption of a decentralized C2 model marks a significant shift in military strategy. By granting smaller tactical units greater autonomy, this approach fosters responsiveness and adaptability in fluid battlefield conditions. The decentralized model allows commanders to delegate decision-making authority, enabling rapid reactions to local threats while maintaining alignment with broader objectives. However, this model places considerable demands on communication and data processing architectures, which must provide real-time intelligence and maintain synchronization across distributed units. These capabilities are critical to ensuring that autonomous decisions at the tactical level remain strategically coherent.

The implications of Ukraine's decentralized strategy extend beyond the immediate conflict, offering valuable lessons for future military operations. Scalable and resilient C2 frameworks, integrated with advanced satellite networks, will become increasingly vital in supporting distributed operations. This paradigm shift necessitates continued investment in robust communication infrastructures that can withstand contested environments and sustain operational tempo.

Challenges and Dependencies in Satellite-Enabled C2 Systems.

The integration of satellite communications into C2 frameworks is inherently complex, relying on the seamless interaction of three interconnected segments:

1. Space Segment: Satellites facilitate data collection and transmission, with advancements in bandwidth and imaging resolution enhancing real-time intelligence delivery.
2. Ground Segment: Ground stations process and distribute data, requiring secure and resilient infrastructure capable of withstanding physical and cyber threats. The Ukrainian conflict has underscored the vulnerability of ground facilities, highlighting the need for redundancy and rapid recovery mechanisms.
3. Link Segment: Communication signals connect satellites to end users, representing the most vulnerable component. Effective encryption and signal protection are essential to counter electronic warfare and maintain data integrity (Jones et al., 2023).

This tripartite framework demonstrates the complexity of satellite systems and the interdependence of their components. To optimize C2 capabilities, military planners must adopt a holistic approach that considers the integration and resilience of all three segments. The development and maintenance of each component of space systems are not only technical challenges but also strategic imperatives. For instance, ensuring that ground segments can process and distribute vast amounts of data quickly is essential for maintaining the tempo of operations. Similarly, improving the link segment to enhance data security and reduce latency can be a game-changer in critical missions where real-time data transmission is crucial.

Legal and Ethical Considerations

Satellite-enabled Command and Control (C2) systems are pivotal to contemporary military operations, delivering unprecedented capabilities in real-time coordination, precision targeting, and operational adaptability. However, the deployment of these systems, particularly in high-stakes conflict zones such as the Russo-Ukrainian war, underscores the pressing need for a multidisciplinary framework that reconciles technological advancements with robust legal, ethical, and cybersecurity safeguards. The increasingly intertwined nature of civilian and military applications complicates this landscape, demanding reforms that enhance resilience while preserving the strategic utility of these systems.

A critical challenge is the ambiguity surrounding the dual-use nature of satellite systems under international humanitarian law (IHL) (Ortega, 2023). The integration of civilian infrastructure into military operations creates significant risks of misclassification, where facilities serving non-combatant purposes are deemed lawful military targets. Addressing this ambiguity necessitates the refinement of international legal frameworks to uphold the principles of distinction and proportionality central to IHL. This includes instituting clear liability mechanisms for private operators and robust protections for civilian infrastructure. Such measures not only delineate the responsibilities of state and non-state actors but also reinforce compliance with international norms, mitigating the operational and ethical dilemmas posed by dual-use technologies (Lightman et al., 2022).

The resilience of satellite-enabled C2 systems is contingent on addressing cybersecurity vulnerabilities across their interconnected components: the space, ground, and link segments. Ground segments, particularly telemetry, tracking, and command (TT&C) systems, are vulnerable to both physical and cyber threats. Proactive risk management strategies, as emphasized in NIST IR 8401, must encompass asset inventorying, threat modeling, and the adoption of robust encryption protocols. Real-time anomaly detection technologies and segmented network architectures further enhance system resilience, countering lateral threats and ensuring the confidentiality, integrity, and availability of critical communications, even in contested environments (Lightman et al., 2022). The continuity of these systems is essential

for maintaining strategic coherence, particularly in decentralized command structures where delays or disruptions can have cascading operational consequences.

The reliance on private-sector providers for satellite communications introduces an additional layer of complexity. While public-private partnerships (PPPs) have accelerated technological innovation, they also expose critical infrastructure to risks arising from supply chain vulnerabilities and corporate accountability gaps. Ensuring cybersecurity standards across all supply chain tiers is paramount to preserving system integrity. Transparent protocols must govern these collaborations, balancing national security imperatives with the operational realities of commercial stakeholders. Diversifying reliance on single providers is equally important to mitigate risks associated with monopolistic dependencies, as recent conflicts have demonstrated the fragility of overreliance on private actors.

Embedding ethical principles into the design and deployment of satellite-enabled C2 systems is essential. Comprehensive training programs for operators must emphasize adherence to humanitarian standards, ensuring that tactical decisions align with the principles of necessity and proportionality. Decision-making frameworks must prioritize transparency and integrate mechanisms to minimize collateral damage, reinforcing accountability in the use of force. Technological innovation should proactively address the ethical implications of military actions, ensuring that the human consequences of operational decisions are not overshadowed by tactical objectives.

The evolution of decentralized C2 frameworks, exemplified by the Ukrainian forces' ability to adapt and innovate under duress, highlights the need for scalable and adaptable communication architectures. These systems must seamlessly integrate with advanced satellite technologies to enable distributed decision-making while maintaining strategic alignment. Such frameworks balance flexibility with coherence, offering significant advantages in addressing the unpredictable and fluid dynamics of modern conflict.

Future development of satellite-enabled C2 systems must prioritize robust legal and ethical reforms to address the complexities of their dual-use nature and integration into modern warfare. Establishing clear liability mechanisms for private operators will enhance accountability, reduce ambiguity, and ensure adherence to the principles of distinction and proportionality central to IHL.

Sustainable public-private collaboration must be governed by transparent protocols that balance commercial interests with national security imperatives. Clear agreements are needed to define the responsibilities of private-sector providers, ensuring the accountability and resilience of critical infrastructure under protracted and unpredictable conflict scenarios. Such collaboration must also prioritize diversification to mitigate the risks associated with reliance on single providers.

Embedding ethical safeguards into the design and deployment of C2 systems is equally crucial. Comprehensive training programs, transparent decision-making frameworks, and integrated mechanisms to minimize collateral damage are necessary to align these systems with humanitarian principles. Decentralized communication models must further support scalable and resilient architectures capable of distributed operations without compromising ethical oversight or strategic coherence.

By aligning technological innovation with rigorous legal standards, ethical integrity, and cybersecurity resilience, satellite-enabled C2 systems can achieve their strategic potential while upholding the fundamental principles of justice, humanity, and accountability.

Target of Cyber Attacks

The growing reliance on satellite communications in military operations has elevated these systems as strategic targets for cyber-attacks, illustrating the vulnerabilities inherent in modern technological warfare. As critical enablers of command, control, and coordination, satellite networks serve as indispensable assets in both tactical and strategic operations. However, this reliance also exposes them to exploitation by adversaries seeking asymmetrical advantages. The deliberate targeting of satellite communications not only disrupts immediate military objectives but also amplifies vulnerabilities across interconnected civilian and economic infrastructures. Consequently, the protection of these networks has transitioned from a technical concern to a strategic imperative in modern conflict scenarios.

The Viasat Incident: A Case Study of Strategic Disruption

The cyberattack on Viasat Inc.'s KA-SAT satellite network on February 24, 2022 – the day of Russia's invasion of Ukraine – highlights the evolving sophistication of cyber threats in hybrid warfare. The deployment of "AcidRain," a wiper malware designed to remotely erase data on modems and routers, exemplifies the calculated precision of modern cyber operations. This attack rendered tens of thousands of modems inoperable, severely disrupting broadband internet access across Ukraine and Europe. Viasat confirmed the destructive nature of the malware, emphasizing that its primary purpose was service interruption rather than data exfiltration. This targeted disruption underscores the shift in cyber warfare tactics toward operational incapacitation rather than traditional espionage (Case, 2023).

The United States attributed the attack to Russian cyber operations aimed at undermining Ukrainian command and control systems. However, its spillover effects extended beyond military objectives, significantly impacting civilian and industrial infrastructures across Europe. The UK Foreign, Commonwealth & Development Office reported that the attack began approximately one hour before Russia's invasion and affected critical sectors, including wind farms and internet users in central Europe. Viasat estimated that tens of thousands of terminals were irreparably damaged, highlighting the enduring consequences of cyber disruptions in interconnected communication networks (Russia, 2022).

Strategic and Operational Implications

The Viasat incident highlights the profound and multidimensional impacts of cyberattacks on satellite communication systems, emphasizing their critical role in modern conflict. These attacks go beyond immediate battlefield consequences, creating widespread societal disruptions by targeting interconnected infrastructures essential for both military and civilian functions. This deliberate strategy underscores a calculated effort to destabilize military operations, erode economic stability, and undermine civilian morale, amplifying the strategic utility of such cyber operations.

The UK's National Cyber Security Centre (NCSC) concluded with near certainty that Russian Military Intelligence was behind the January 13 defacement of Ukrainian government websites and the deployment of the destructive malware Whispergate. Furthermore, the NCSC attributed the subsequent February 24 cyberattack on Viasat to the same actors. These findings align with the broader narrative of coordinated cyber offensives aimed at disabling critical infrastructure during pivotal moments in conflict. British Foreign Secretary Liz Truss described the Viasat attack as "clear and shocking evidence of a deliberate and malicious attack by Russia against Ukraine," emphasizing the cross-border consequences of such actions, which affected both civilian and commercial entities across Europe. Truss's statement also underscores the increasingly transnational nature of these cyber threats, as

attacks originating in one jurisdiction cascade into disruptions elsewhere, highlighting the interconnected vulnerabilities of modern communication networks (Russia, 2022).

Broader Societal Disruptions: Beyond Military Targets

The Viasat cyberattack demonstrates that the ramifications of targeting satellite communications are not confined to military objectives. Civilian infrastructure bore a significant share of the impact, with the loss of internet access disrupting both routine and critical activities. Notably, a German energy company reported the inability to monitor over 5,800 wind turbines remotely, while nearly 9,000 subscribers in France experienced prolonged outages. In addition, approximately one-third of 40,000 European broadband customers across multiple countries – including Germany, France, Hungary, and Italy – faced service disruptions (Case, 2023). These effects illustrate how the interconnectedness of satellite systems creates systemic vulnerabilities, where the compromise of a single network can have far-reaching consequences across sectors and regions.

Legal Dimensions and Frameworks

The Viasat incident highlights not only the operational and societal vulnerabilities associated with satellite communication networks but also the pressing legal challenges in addressing cyberattacks attributed to state actors. As cyberattacks increasingly blur the lines between state-led aggression and non-state activities, the importance of robust domestic, regional, and international legal frameworks becomes paramount. The Cyber Peace Institute provides an analysis of domestic, regional, and international laws that are relevant to the Viasat case. The application of these legal frameworks, especially international law, depends on who is found responsible for the breach, and if they are a state actor or working under the direction of a state. In this instance, the attack has been attributed to a nation-state actor, potentially triggering actions under international law (Case, 2023).

In the context of Ukraine, the national legal framework provides several tools to address cyber threats, emphasizing the country's commitment to safeguarding its cyberspace:

The Constitution of Ukraine (Constitution, 1996) serves as the Fundamental Law of Ukraine, reflecting the sovereign will of the people, based on the historical development of the Ukrainian state and the right to self-determination. It guarantees human rights and freedoms and ensures worthy conditions of human life.

The Criminal Code of Ukraine (Criminal, 2001) establishes the legal and organizational foundation for protecting the vital interests of individuals, society, and the state, and the national interests of Ukraine in cyberspace. It outlines the primary goals, directions, and principles of state cybersecurity policy, and defines the responsibilities and coordination mechanisms of various entities in ensuring cybersecurity.

The Law of Ukraine on Electronic Communications (Law, 2020) sets the legal and organizational framework for state policy in electronic communications and radio-frequency management. It details the rights, obligations, and responsibilities of individuals and legal entities involved in electronic communication activities or services.

Law of Ukraine on the Basic Principles of Cybersecurity (Law, 2017) defines the legal and organizational framework for safeguarding the vital interests of individuals, society, and the state in cyberspace. It specifies the main objectives, directions, and principles of state cybersecurity policy, and outlines the roles and coordination mechanisms of different entities in cybersecurity.

The procedure of the Functioning of the National Telecommunication Network (Procedure, 2020) outlines the operational mechanisms, purposes, subjects, and objects of the National Telecommunication Network. The involvement of a nation-state actor in the

Viasat attack brings several principles of international law into play. These principles are designed to maintain international order and prevent conflicts:

- principle of due diligence: states must exercise due diligence to prevent their territory or cyber infrastructure under their control from being used for cyber operations that adversely affect the rights of other states.
- principle of sovereignty: this principle applies in cyberspace, recognizing that states have sovereignty over cyber infrastructure located on their territory and related activities.
- principle of non-intervention: states are prohibited from intervening, including through cyber means, in the internal or external affairs of other states.
- prohibition of the use of force: according to the International Court of Justice, the prohibition of the use of force and the right to self-defense, as stated in Articles 2(4) and 51 of the United Nations Charter, applies to any use of force, regardless of the weapons used (Case, 2023).

In addition to the legal tools available, some other relevant agreements and obligations should be taken into consideration. These documents, such as UN agreements, cyber strategies, and multistakeholder efforts, help provide a better sense of the context in which this attack occurred. Independent evaluation of these documents concerning this case can also help to understand what tools exist and what needs to be strengthened to better protect citizens in Ukraine.

For instance, Ukraine has a National Cyber Security Strategy and an Implementation Plan for the Cyber Security Strategy, which are critical components of national policy. Furthermore, Ukraine is a signatory to and/or has ratified the Budapest Convention, a key multilateral treaty on cybercrime. Ukraine has also committed to UN Resolution 73/266 on advancing responsible state behavior in cyberspace in the context of international security and supports the Initial Set of OSCE Confidence-Building Measures to reduce the risks of conflict stemming from the use of information and communication technologies.

Additionally, Ukraine has participated in the UN Group of Governmental Experts on Developments in the Field of Information and Telecommunications in the Context of International Security Report of 2015 and the Final Substantive Report of the Open-Ended Working Group on Developments in the Field of Information and Telecommunications in the Context of International Security in 2021. Ukraine is also a member or partner in the Global Forum on Cyber Expertise (GFCE) Global Agenda for Cyber Capacity Building.

However, Ukraine is not a supporter of the Paris Call for Trust and Security in Cyberspace nor the Freedom Online Coalition's efforts on the human rights impact of cybersecurity laws, practices, and policies (Case, 2023).

Bridging the Gap Between Law and Strategy

The Viasat incident exemplifies the growing overlap between operational vulnerabilities and legal challenges in modern conflict. Ensuring accountability for cyberattacks requires not only adherence to existing frameworks but also the evolution of legal norms to address emerging threats. Strengthening international cooperation, fostering cross-sector collaboration, and enhancing legal instruments will be critical in safeguarding global communication networks against future disruptions.

By integrating domestic resilience with international norms, states can address the complexities of cyber operations that transcend borders, ensuring a balanced approach that protects military and civilian infrastructures alike. The Viasat case serves as a catalyst for reinforcing legal and strategic mechanisms, emphasizing the urgency of a unified global

response to the challenges of hybrid warfare. As satellite communications underpin both military operations and civilian infrastructure, their protection demands more than technical solutions. It requires a fundamental rethinking of cybersecurity paradigms – prioritizing resilience, adaptability, and collective action.

Optical and SAR Imaging

Near Real-Time Intelligence and Monitoring

The Russian invasion of Ukraine in February 2022 has highlighted the transformative impact of satellite imagery in modern warfare, particularly its role in real-time intelligence and operational monitoring. Advanced technologies, such as optical and synthetic aperture radar (SAR) imaging, have become indispensable for situational awareness and strategic decision-making. Once exclusive to military and intelligence agencies, satellite imagery is now a cornerstone of conflict management. The integration of deep learning has further revolutionized data processing, enabling the rapid analysis of vast datasets, which has profoundly shaped battlefield dynamics. These advancements have proven invaluable not only for military operations but also for humanitarian efforts, providing precise and actionable insights critical to both strategic and ethical considerations (Sticher et al., 2023).

Traditionally, space capabilities were the domain of a select few powerful states. In the context of the Russo-Ukrainian War, Ukraine has effectively leveraged commercial satellite services – predominantly from U.S. private companies – to overcome its lack of sovereign space assets. This strategic reliance on commercial providers has given Ukraine a competitive edge, underscoring the transformative potential of private-sector partnerships in modern conflict (Ogden et al., 2024). For states with established intelligence, surveillance, and reconnaissance (ISR) constellations, commercial Earth observation satellites provide essential redundancy and enhanced capabilities. Equipped with high-resolution electro-optical sensors, SAR imaging, and AI-driven analytics, these platforms exemplify the indispensable role of commercial space assets in enabling precision operations and dynamic decision-making (Ogden et al., 2024).

Stephen Wood, an imagery analyst at Maxar, emphasized the unprecedented scale of satellite data generated during the Ukraine conflict, observing, "The war in Ukraine has elevated satellite imagery to a level never seen before. This war is likely the most documented in history" (Torrieri, 2022). This extensive reliance on satellite imagery has not only provided critical real-time intelligence but also significantly increased public transparency, shaping global opinion and influencing policy decisions (Albon, 2022). The strategic application of commercial satellite data in military operations marks a profound shift in the use of space technologies, particularly by enhancing the capabilities of nations with limited indigenous space assets while augmenting the operational capacities of more advanced militaries.

The exceptional resolution capabilities of commercial remote sensing satellites are central to this transformation. Modern systems achieve resolutions as fine as thirty centimeters, with some platforms offering enhanced processing capabilities that reach ten centimeters. Stephen Wood highlights that such precision is indispensable for reconnaissance, surveillance, and monitoring during conflicts, providing actionable intelligence that underpins both strategic planning and immediate operational decisions (Torrieri, 2022).

The utility of high-resolution imagery extends beyond the battlefield. For instance, Sentinel-2 optical satellite data has been instrumental in damage assessments following natural disasters, enabling the detection of urban changes, including structural damage and fire-affected areas, thereby accelerating response and recovery efforts (Aimaiti et al., 2022).

This dual application underscores the pivotal role of precise imaging in environmental monitoring, humanitarian relief, and disaster management.

Synthetic Aperture Radar (SAR) data further enhances the value proposition of satellite imagery, particularly in its ability to operate under adverse weather conditions and through cloud cover. In military contexts, SAR proves vital for detecting missile movements, monitoring battlefield dynamics, and identifying GPS jamming activities, thus providing unparalleled situational awareness (Torrieri, 2022). In the civilian domain, SAR technology has applications in industries such as mining, where it is employed to monitor slope stability and detect terrain shifts to enhance operational safety (Borotkanych, 2022).

In urban conflict zones, SAR imagery has been critical for accurately assessing building damage. For example, during the Ukraine conflict, SAR data was instrumental in mapping structural damage in Kyiv, underscoring its relevance for post-conflict recovery planning (Aimaiti et al., 2022). The integration of SAR and optical data, as demonstrated by Sentinel-1 and Sentinel-2 satellites, offers a comprehensive perspective by overcoming weather-related limitations. Beyond military applications, SAR imagery has proven effective in detecting environmental impacts, such as water pollution from destroyed hydraulic structures, showcasing its versatility across multiple domains (Shevchuk et al., 2022).

Payam Banazadeh, CEO of Capella Space, underscored the indispensable role of Synthetic Aperture Radar (SAR) during adverse weather conditions in Ukraine, where optical sensors proved ineffective (Hitchens, 2022). SAR's reliability in providing real-time, all-weather data has made it a cornerstone of continuous monitoring efforts. Rafal Modrzewski, CEO of ICEYE, likened this capability to having "body cameras for our planet," emphasizing its utility in ensuring 24/7 situational awareness (Torrieri, 2022). Such comprehensive surveillance proved particularly critical during the early stages of the Russian invasion, when Maxar's satellite imagery delivered actionable intelligence on the 40-mile convoy advancing toward Kyiv, enabling strategic responses (Torrieri, 2022).

Private remote sensing services further enhance these capabilities by emphasizing automated, customer-centric processes that streamline the delivery of tailored data products. Platforms such as Spymesat.com exemplify this efficiency, ensuring military planners, humanitarian organizations, and other stakeholders can rapidly access and utilize precise satellite data for their operational needs. This approach has also been transformative in the mining sector, where automated processes facilitate swift analysis and distribution of data, enabling companies to make informed decisions effectively (Borotkanych, 2022).

The integration of automated data analysis in environmental monitoring has similarly revolutionized the ability to address urgent challenges, such as pollution events and habitat destruction resulting from the Russo-Ukrainian war (Shevchuk et al., 2022). The rapid detection and evaluation of such incidents demonstrate the critical role of advanced processing technologies in mitigating environmental and humanitarian crises. These capabilities are equally essential in military contexts, where the timely and precise dissemination of information underpins strategic decision-making and operational success.

The ongoing conflict in Ukraine underscores the critical role of private remote sensing companies in providing indispensable support to governmental agencies, with their contributions spanning both environmental and military domains.

The dual application of remote sensing technologies, addressing urgent needs in conflict zones and supporting environmental management, highlights their transformative potential in modern warfare. The increasing reliance on commercial space services underscores the expanding integration of these technologies into military operations. This trend reflects

the growing symbiosis between the commercial space sector and government contracts, a relationship that raises important considerations for future space policies and strategies.

Government contracts remain a primary focus for private remote sensing companies, driven by their scale, maturity, and the existential nature of the challenges they address. These markets are characterized by substantial budgets and the urgency created by geopolitical tensions. Payam Banazadeh, CEO of Capella Space, aptly captures this dynamic, stating, "Today we're primarily focused on government markets because they're mature, they are supply constrained, and they face problems that are often existential, which creates an urgency to move fast on products that can help solve them. They are also massive markets growing at a high rate because of geopolitical tensions" (Gangware & Swartz, 2023).

The imperative of national security and defense drives substantial investment in advanced remote sensing capabilities, as exemplified by the rapid deployment of Starlink terminals during the Russian invasion of Ukraine. This swift technological integration underscores the critical need for real-time intelligence and adaptive communication infrastructure to maintain strategic advantages (Torrieri, 2022). Such urgency accelerates government reliance on cutting-edge technologies, reflecting the increasing strategic importance of remote sensing in modern conflict (Höyhtyä & Uusipaavalniemi, 2023).

Geopolitical tensions, particularly in the context of the Russo-Ukrainian War, amplify the demand for advanced remote sensing technologies. High-resolution imagery and Synthetic Aperture Radar (SAR) capabilities provided by private companies have become indispensable for military intelligence, urban damage assessments, and humanitarian operations (Vaynman, 2021). Despite global economic challenges, government spending on remote sensing remains robust. As Payam Banazadeh of Capella Space observes, "The demand has gone up significantly across the board for our SAR capabilities, in part because of what is happening in Ukraine" (Gangware & Swartz, 2023).

The integration of high-resolution optical and SAR technologies into governmental frameworks has effectively addressed supply constraints, showcasing their ability to meet extensive operational needs. From monitoring battlefield conditions to assessing environmental changes, advanced satellite constellations and continuous surveillance have proven vital for addressing dynamic challenges. Private remote sensing providers have become integral to fulfilling these demands, highlighting their critical role in bolstering national security and responding to global crises (Gangware & Swartz, 2023).

The scalability of advanced remote sensing technologies to meet large-scale governmental needs is increasingly evident. Companies like Capella Space have expanded their satellite constellations and enhanced their imagery collection capabilities to effectively manage extensive government contracts (Gangware & Swartz, 2023). This scalability ensures operational efficiency in diverse, high-stakes scenarios, enabling swift responses to emerging global events. In recent years, private remote sensing providers have become integral to governmental and intergovernmental projects, highlighting their critical role in addressing complex challenges.

The National Reconnaissance Office (NRO) has been a key player in leveraging commercial remote sensing capabilities. In January 2022, the NRO awarded contracts to five companies – Airbus U.S., Capella Space, ICEYE U.S., PredaSAR, and Umbra – for Synthetic Aperture Radar (SAR) imagery. These contracts, initially for six months with options to extend up to 30 months, aim to validate commercial SAR capabilities and integrate them into national geospatial intelligence missions (Strout, 2022). The rapid procurement and validation of SAR data underscore the NRO's adaptability and readiness to address dynamic global challenges.

In May 2022, the NRO expanded its commercial engagement by awarding 10-year contracts to BlackSky, Maxar, and Planet, marking the largest commercial contracting effort in its history. These agreements secure a continuous supply of high-resolution satellite imagery to support intelligence and reconnaissance operations across multiple domains (Erwin, 2023). Similarly, Maxar has played a pivotal role in U.S. government initiatives, exemplified by the renewal of its Global Enhanced GEOINT Delivery (G-EGD) contract in September 2022. This renewal ensures uninterrupted access to high-resolution imagery, which has been instrumental in monitoring geopolitical developments and environmental changes, further demonstrating the strategic importance of commercial satellite providers (Erwin, 2022).

NATO's Alliance Persistent Surveillance from Space (APSS) initiative illustrates the growing integration of commercial satellite capabilities into intergovernmental operations. By leveraging high-resolution imagery and SAR data, the APSS enhances situational awareness, enabling member states to monitor global hotspots, detect emerging threats, and support humanitarian missions (Alliance, 2023).

Collaborations between commercial satellite imagery providers and governmental organizations continue to expand. For example, in December 2023, the NRO entered agreements with five commercial suppliers of electro-optical imagery – Airbus U.S., Albedo Space, Hydrosat, Muon Space, and Turion Space. These partnerships aim to diversify the range of available satellite data and assess the potential integration of emerging technologies into national operations (Erwin, 2022).

The engagement of private remote sensing providers in governmental and intergovernmental initiatives has proven transformative for situational awareness, operational readiness, and strategic planning. Ongoing collaborations with entities like the NRO and NATO highlight the indispensable role of commercial satellite technologies in addressing military and non-military challenges alike.

As geopolitical tensions and global crises persist, the reliance on commercial remote sensing is expected to grow. This shift signifies a fundamental transformation in military operations and strategic frameworks but also raises critical questions surrounding data regulation, privacy, and potential misuse. Robust space policies and governance strategies are essential to address these concerns and ensure the responsible use of satellite technologies in an increasingly interconnected global landscape (Strout, 2022).

Legal and ethical considerations

Operational security has become a critical concern in the evolving landscape of modern warfare, as demonstrated by Ukraine's reliance on commercial satellite data to counter Russian aggression. While these technologies have provided unprecedented strategic advantages for nations with limited sovereign space capabilities, they also introduce significant risks of misuse. ICEYE CEO Rafal Modrzewski emphasized the company's policy of withholding imagery of conflict zones and politically sensitive areas from media outlets to mitigate potential exploitation (ICEYE, 2022). Similarly, Ukraine's Deputy Minister of Defense, Kateryna Chernohorenko, raised concerns over Russia's ability to acquire commercial satellite imagery through third-party intermediaries, potentially weaponizing this data to facilitate targeted attacks (Wood, 2024).

A notable example of this dual-use dilemma occurred in May 2022, when Maxar received a request to capture imagery of a square in Lubny. Within days, the site was targeted by missiles, followed by additional requests for post-strike imagery (Wood, 2024). This incident underscores the ambiguities surrounding commercial satellite technologies, which

simultaneously serve civilian and military domains but often operate without clear regulatory boundaries. This lack of oversight poses critical challenges for maintaining operational security and adhering to ethical standards in the use of remote sensing technologies.

For over six decades, space remote sensing has been a cornerstone of intelligence collection and power projection, particularly for the United States. Traditional paradigms, such as government-owned satellites and siloed data processing systems, were effective during the Cold War but are increasingly inadequate in today's dynamic and technologically advanced environment (Harrison & Strohmeyer, 2022). Advances in commercial remote sensing have revolutionized this domain, introducing capabilities such as high revisit rates, advanced sensors, AI-driven data analytics, and secure cloud-based dissemination systems. These innovations eliminate traditional data silos, providing actionable intelligence at unprecedented speeds.

Despite these advancements, commercial systems cannot entirely replace government-owned and operated platforms. Certain missions require levels of security, precision, and reliability that exceed the capabilities of commercial enterprises. As Todd Harrison and Matthew Strohmeyer (Harrison & Strohmeyer, 2022) note, commercial remote sensing should complement, rather than supplant, government systems, forming a significant component of the broader ISR (Intelligence, Surveillance, and Reconnaissance) architecture for national defense and intelligence agencies.

The Broadening Scope of Space Data Applications

The term *space data* encompasses a diverse range of information collected from outer space sources, including satellite imagery, astronomical observations, space weather metrics, and navigation data. These datasets have extensive applications, spanning scientific research, environmental monitoring, agriculture, disaster response, urban planning, and military strategy (Space, 2023). However, as the utility of space data expands, so do the ethical and legal challenges associated with its collection and dissemination.

For instance, national security concerns may prompt states to demand the deletion of satellite images over sensitive installations or space assets. While these demands align with domestic security interests, they often conflict with international norms around ISR and the global imperative for enhanced space situational awareness (SSA). Comprehensive SSA is essential to prevent orbital collisions and interference, regardless of asset ownership or purpose. Balancing such demands with the need for transparency and operational efficiency remains a pressing issue.

Domestic privacy laws and access disparities further complicate the ethical landscape. Underserved stakeholders, such as Native American tribal nations or smallholder farmers, often lack the resources to fully utilize Earth Observation (EO) data, placing them at a disadvantage compared to more resourced competitors or negotiating parties (Space, 2023). The challenge lies in balancing privacy and commercial interests with the public good, ensuring equitable access to space data while safeguarding sensitive information.

A critical barrier to fully leveraging commercial remote sensing capabilities is the traditional acquisition and contracting model used by government agencies. The longstanding approach of purchasing space systems as products rather than services is misaligned with the agile, service-oriented models favored by commercial providers. Furthermore, multiyear funding cycles and rigid procurement frameworks lag behind the rapid innovation timelines of commercial space enterprises, creating inefficiencies in addressing emerging threats and opportunities (Harrison & Strohmeyer, 2022).

To address the legal and ethical challenges posed by the integration of commercial satellite technologies into global security frameworks, it is essential to establish dynamic international regulatory guidelines that define the permissible uses and dissemination of satellite imagery, particularly in conflict zones. Strengthening public-private collaboration can align the innovation cycles of commercial providers with national security interests, while modernizing acquisition models to prioritize service-oriented contracts can enhance adaptability to emerging technologies. Ethical data governance must be prioritized to ensure equitable access to Earth observation data for underserved communities without compromising privacy or security. Additionally, promoting transparent and collaborative space situational awareness (SSA) initiatives is vital to prevent orbital collisions and ensure a secure operational environment. By addressing these critical issues, stakeholders can harness the transformative benefits of satellite technologies while safeguarding ethical standards, operational security, and compliance with international law.

Crowdfunded Satellite to Support Military: **Case Study of the People's Satellite**

The emergence of crowdfunding as a vital tool in modern conflict zones has redefined resource mobilization, enabling nations like Ukraine to procure critical defense equipment through decentralized global networks. One exemplary initiative is the People's Satellite, spearheaded by the Serhiy Prytula Charity Foundation and blogger Ihor Lachenkov. This groundbreaking project provided Ukraine with access to ICEYE's SAR satellite constellation, showcasing how civilian contributions can enhance national defense in unprecedented ways (People's, 2023).

Civilian Contributions and Public-Private Partnerships.

The People's Satellite represents a transformative model of public-private partnership in wartime, illustrating the untapped potential of civilian funding for military applications. Traditionally, defense budgets and military grants have been the exclusive remit of governments. However, the ongoing conflict in Ukraine has catalyzed innovative approaches to resource mobilization, reflecting a growing trend toward engaging the public in national defense. The Serhiy Prytula Charity Foundation's acquisition of a SAR satellite from ICEYE marks a milestone in this evolution, underscoring how crowdfunding and private sector collaboration can bolster military intelligence and operational capacities (People's, 2023).

The Serhiy Prytula Charity Foundation initiated a highly successful crowdfunding campaign aimed at enhancing Ukraine's defense capabilities. Initially, the campaign sought funds for the purchase of unmanned aerial vehicles (UAVs). However, following a generous donation of Bayraktar TB2 drones by the Baykar company, the foundation redirected the funds to acquire a satellite from ICEYE, a Finnish manufacturer renowned for its advanced SAR technology (People's, 2023).

This acquisition, branded as the People's Satellite, represents a strategic enhancement in Ukraine's military intelligence infrastructure. Equipped with cutting-edge SAR technology, the satellite can capture high-resolution images regardless of weather conditions or time of day. This capability is critical for military operations, ensuring continuous and reliable intelligence that is unaffected by environmental factors or battlefield conditions. The ability to operate effectively in cloud cover and darkness underscores SAR technology's superiority over traditional optical imaging systems, which are limited by visibility constraints. SAR works by utilizing radar signals to create detailed images of the Earth's surface, making it an invaluable tool for both military reconnaissance and environmental monitoring (People's, 2023).

The operational agreement with ICEYE further amplifies the strategic impact of this initiative. In addition to transferring full operational capabilities of one SAR satellite already in orbit for Ukraine's exclusive use, ICEYE has provided access to its entire constellation of SAR satellites. This arrangement enables the Ukrainian Armed Forces to obtain radar imagery with a high revisit frequency, significantly improving their ability to monitor critical locations in near real-time. These capabilities have enhanced situational awareness, facilitated precise targeting, and supported effective operational planning by the Ministry of Defence of Ukraine.

Transformative Impact of SAR Technology.

The deployment of the People's Satellite has profoundly influenced Ukraine's military operations, demonstrating the transformative potential of Synthetic Aperture Radar (SAR) technology in modern warfare. According to the Defense Intelligence of Ukraine, the satellite was instrumental in detecting and facilitating the destruction of substantial Russian military assets. Notably, within two days of its deployment, the satellite identified and enabled the targeting of 60 Russian military vehicles, a contribution that far exceeded its cost in terms of operational and strategic gains (ICEYE, 2023). This rapid and precise intelligence underscores the satellite's extraordinary value, offering a compelling case for the integration of advanced space technologies into national defense infrastructures.

Beyond its immediate tactical advantages, the satellite's SAR capabilities have provided critical data for long-term strategic planning and environmental monitoring. Unlike traditional optical systems, SAR technology operates effectively under all weather conditions and in complete darkness, enabling uninterrupted surveillance and intelligence gathering. This capability has significantly enhanced Ukraine's situational awareness, improving decision-making processes and overall operational effectiveness. Furthermore, SAR's versatility extends to non-military applications, such as tracking environmental changes and assessing damage to critical infrastructure, further underscoring its strategic relevance.

The success of the People's Satellite initiative exemplifies the untapped potential of public engagement in national defense. The crowdfunding campaign, supported by thousands of individual donors, not only secured vital resources but also fostered a powerful sense of collective responsibility and solidarity among the Ukrainian public. This grassroots-driven approach highlights how civilian contributions can complement traditional defense funding, broadening the resource base and accelerating the deployment of innovative solutions during crises.

The pivotal role of the Serhiy Prytula Charity Foundation in orchestrating this initiative underscores the importance of effective leadership in mobilizing public support and forging partnerships with private enterprises. By aligning civilian contributions with private sector expertise, the Foundation has created a synergy that enhances Ukraine's defense capabilities. This model demonstrates the feasibility and effectiveness of public-private partnerships in addressing complex security challenges, offering valuable insights for other nations seeking to strengthen their resilience in the face of evolving threats.

In sum, the People's Satellite initiative represents a paradigm shift in how nations can leverage civilian and private sector support to address critical security needs. Its success serves as a benchmark for innovative defense strategies, emphasizing the importance of integrating advanced technologies, fostering public engagement, and building collaborative frameworks to meet the demands of contemporary conflict environments

Legal and Ethical Considerations

The legal status of Synthetic Aperture Radar (SAR) satellites, such as those operated by ICEYE, is governed by a complex framework under international space law. Unlike

maritime law, which assigns nationality based on registration, satellites derive their legal status through the responsibilities and obligations of States as outlined in key space treaties. Under Article VI of the Outer Space Treaty (OST), States are internationally responsible for all national space activities, including those carried out by private companies. In the case of ICEYE, Finland bears international responsibility for the company's activities, as the entity is headquartered in Espoo, Finland (Nasu, 2022).

Additionally, the liability for any damage caused by a satellite is attributed to the launching States under Article 1(c) of the Liability Convention. These States include those involved in launching or procuring the launch of the satellite and the State from whose territory or facility it is launched. Consequently, Finland, along with other launching States such as Russia or the United States, bears responsibility (Nasu, 2022). Furthermore, according to Article VIII of the Outer Space Treaty and Article II of the Registration Convention, the State of registry, such as Finland in this case, may exercise jurisdiction and control over the satellite (Nasu, 2022).

When SAR satellites are utilized for military purposes, they become legitimate military objectives under international humanitarian law, specifically Article 52(2) of Additional Protocol I. This designation arises because their military use contributes effectively to military action, and their destruction offers a definite military advantage. The use of ICEYE's SAR satellite by Ukraine for military operations qualifies it as a legitimate target, given its high-resolution imaging capabilities that enhance military effectiveness (Nasu, 2022). Under the agreement between ICEYE and the Serhiy Prytula Charity Foundation, Ukraine receives both the satellite and access to the constellation's database. According to Serhiy Prytula, whose foundation signed the agreement with the Finnish company ICEYE, "when the paid period of database access expires, this satellite remains fully owned by Ukraine until the end of its functionality in orbit." He further explained that the satellite could later be re-registered in the appropriate registers under Ukraine. Prytula clarified that "Ukraine is the owner of the satellite, and it is the Ukrainian side that determines what and when it captures, as well as in what format and spectrum we receive the data. Therefore, we fully own, manage, and use the images from this satellite" (Kovalevska, 2022).

However, this unique ownership arrangement introduces significant legal uncertainties. While Finland initially holds jurisdiction and control as the State of registry, Ukraine's ownership and operational control over the satellite and its data introduce complexities regarding sovereignty and the application of international space law. The agreement allows Ukraine to utilize the satellite for its military needs, asserting control over the satellite's functionalities and data outputs. Yet, questions remain about the long-term legal implications, particularly regarding the re-registration process and the full extent of Ukraine's rights and responsibilities under international law. These uncertainties highlight the evolving nature of space law and the challenges of integrating innovative public-private partnerships into existing legal frameworks.

Despite being the State of registry and responsible for space activities under Article VI of the Outer Space Treaty, Finland is not automatically implicated as a co-belligerent in the Russia-Ukraine conflict. The legal responsibilities under space law do not extend to terrestrial military use of satellite data. However, Finland retains the right to seek recourse under international law if ICEYE's satellites are attacked. Such an attack could constitute a use of force prohibited under Article 2(4) of the UN Charter. To invoke responsibility against the offending State, Finland would need to qualify as an "injured State." An "injured State" under Article 42 of the International Law Commission's Articles on State Responsibility is especially affected by the breach of an obligation owed to the international community.

If Finland's control over the satellite is compromised, it could be argued that it has been especially affected (Nasu, 2022).

Whether Finland could adopt a forcible response depends on the factual assessment of the damage. Factors such as the function of the satellite, the degree of damage, and the consequences for Finland will determine if the scale and effect meet the threshold for an armed attack, allowing for a self-defense claim. Targeting SAR satellites in military operations involves both kinetic and non-kinetic means. Regardless of the method, international humanitarian law mandates compliance with principles such as distinction, proportionality, and precaution (Nasu, 2022).

Kinetic attacks using anti-satellite (ASAT) missiles must minimize incidental civilian harm, including debris creation, and must not cause excessive harm relative to the military advantage gained. Non-kinetic methods, such as electronic warfare or directed energy weapons, may also constitute an attack if they produce violent consequences. These attacks must also adhere to the principles of distinction and proportionality. The potential civilian impact of disrupting SAR satellite operations must be considered, including interference with civilian uses such as disaster monitoring and environmental assessments, which could have significant humanitarian consequences (Nasu, 2022).

The use of crowdfunding to finance military assets, as demonstrated by the People's Satellite initiative, introduces a novel and ethically complex dimension to modern warfare. This approach engages civilians directly in funding military operations, fostering a sense of collective responsibility but also blurring the lines between civilian and military roles. The transparency and accountability of crowdfunded resources are crucial, as the potential for misuse of funds and the need for clear communication about the objectives and outcomes of such initiatives are significant ethical considerations. Furthermore, the deployment of crowdfunded military technology must comply with international humanitarian law to minimize harm to civilians, ensuring that such technology is used responsibly and ethically in conflict zones.

The legal and ethical landscape surrounding the use of crowdfunded SAR satellites in military operations necessitates a careful examination of international laws and state responsibilities. International space law, particularly the Outer Space Treaty of 1967, mandates that space must be used for peaceful purposes. While reconnaissance and intelligence gathering are generally permissible, the direct involvement of private entities in military operations raises questions about accountability and responsibility. The reliance on public funds for military assets also underscores the importance of transparency and appropriate use of resources. Ensuring that these operations adhere to principles such as distinction and proportionality is essential to minimize civilian harm and maintain ethical integrity in military engagements.

The involvement of private companies like ICEYE in military operations highlights the need for careful consideration of corporate responsibility. These companies must balance their commercial interests with the ethical implications of their technologies being used in conflict zones. The success of the People's Satellite initiative demonstrates the strategic value of integrating advanced satellite technology into military operations, prompting a re-evaluation of traditional defense funding models. This initiative underscores the increasing importance of private sector innovation in addressing security challenges and the potential for public-private collaborations to achieve strategic objectives.

Public Information in Media: Documenting War and Supporting Evidence for Accountability

Satellite imagery has become an indispensable tool for documenting and broadcasting the realities of war, profoundly shaping global public opinion, influencing policy, and fostering accountability. By offering verifiable, real-time visual evidence of conflicts, satellite technology ensures that international stakeholders are informed and able to respond effectively to humanitarian crises. This capability is particularly critical in modern conflicts, where transparency and timely information can galvanize coordinated action and accountability.

Advancements in satellite technology have significantly influenced the ongoing conflict in Ukraine, particularly in the domains of arms control, urban damage assessment, and conflict monitoring. For example, studies on Mariupol have demonstrated how satellite imagery provides detailed insights into urban destruction, environmental changes, and humanitarian needs (Huang et al., 2023). High-resolution optical and synthetic aperture radar (SAR) satellites enable precise monitoring of urban changes without the need for ground surveys, expediting response times and enhancing situational awareness. This capability not only supports immediate humanitarian and military efforts but also informs long-term strategic planning and evidence-based policymaking.

Satellite Imagery in Evidence and Attribution.

Satellite imagery plays a pivotal role in attributing responsibility for war crimes and violations of international law. It provides objective evidence that underpins accountability mechanisms, enabling the prosecution of perpetrators. For example, during the Russian invasion of Ukraine, satellite imagery provided by Maxar was instrumental in documenting the crimes in Bucha. Imagery authenticated the presence of civilian casualties during the Russian occupation, refuting claims of misinformation and validating evidence for international investigations (Torrieri, 2022).

The Impact on Global Policy and Public Opinion.

The dissemination of satellite imagery has profound implications for global policy and public awareness. By offering undeniable visual evidence of the devastation wrought by war, satellite images galvanize international responses, including humanitarian aid and diplomatic interventions. For instance, widespread condemnation of atrocities in conflict zones, spurred by satellite documentation, has often led to increased pressure on offending states through sanctions or international legal proceedings. Satellite imagery thus becomes a catalyst for justice and accountability, compelling action from institutions such as the United Nations and the International Criminal Court. Moreover, technology plays a critical role in peacekeeping and conflict resolution. Real-time satellite surveillance enables accurate monitoring of ceasefire agreements, detecting violations, and ensuring compliance with international protocols. The United Nations has increasingly relied on satellite imagery in overseeing peacekeeping operations, with successful applications in monitoring demilitarized zones and preventing escalations in conflict regions (Geospatial, 2022).

Legal and Ethical Considerations.

The advent of satellite technology and the increasing use of Earth Observation (EO) data have revolutionized our understanding of conflicts and their humanitarian impacts. However, using satellite imagery to document and broadcast the horrors of war necessitates robust legal and ethical considerations to protect privacy and uphold human rights. Space data ethics is distinct from existing data ethics frameworks that focus on business-data ethics, research ethics, AI ethics, and open-data ethics. Unlike traditional data, space data, such as satellite imagery, often involves large-scale phenomena rather than individual behaviors. However,

privacy concerns remain, such as revealing the location of uncontacted indigenous tribes or sensitive military installations (Space, 2023)

The legal landscape governing the use of satellite imagery in conflict zones includes international laws and national regulations that aim to balance transparency with security and privacy concerns. One significant issue is the potential misuse of satellite data for propaganda, which can manipulate public perception and escalate conflicts. Strengthening legal frameworks to regulate the dissemination and use of satellite imagery is imperative to prevent misinformation and ensure ethical use (Space, 2023)

Data minimization is a key principle in traditional data ethics, aimed at protecting sensitive personal information. However, in the context of space data, there might be a need to maximize data collection due to the exploratory nature of the field. Researchers may not always know what data will be valuable in the future, especially for addressing complex issues like climate change or disaster response. Furthermore, the dual-use nature of space data poses ethical challenges. While satellite data can be instrumental in humanitarian efforts, such as tracking refugee movements to coordinate aid, it can also be exploited for strategic military advantages or commercial gain, leading to ethical dilemmas about data accessibility and usage (Space, 2023).

The "Recommendation on Space Data Ethics" underscores the necessity of managing satellite imagery with care to prevent further trauma and exploitation of vulnerable populations. Misuse of satellite imagery, as evidenced in the conflicts in Bucha and Mariupol, highlights the severe psychological impact and manipulation that can result from unethical practices. Ethical guidelines must prioritize the protection of individuals' privacy and uphold human rights, especially in conflict zones (Space, 2023)

Satellite Imagery in War Crimes Investigations.

A comprehensive analysis by the Fordham International Law Journal in 2017 highlighted the transformative role of digital evidence, including satellite imagery, in war crimes prosecutions. Following the Srebrenica investigations, "satellite imagery went from an instrument of military strategists and private corporations to an important resource for war crimes investigators and prosecutors" (Freeman, 2018). This pivotal shift has seen satellite imagery used in practically every International Criminal Court (ICC) prosecution for war crimes since the Bosnian War, including cases in Sudan, Libya, Afghanistan, and Syria (Timmermans, 2022).

Returning to Ukraine, a recent BBC News report utilized satellite imagery as evidence for an attack on a children's hospital in Mariupol, clearly showing the location of a bomb crater between hospital buildings. It also presented before-and-after images of an artillery attack in a residential neighborhood. Such imagery has become crucial in conveying the realities of war to the public and serves as invaluable evidence for military strategists and war crime investigators alike. Companies like Maxar and Planet are among the key public sources of this evidence, providing detailed satellite photos of war-affected areas in Ukraine, including Russian military movements Despite their growing importance, the use of satellite images as evidence within the international criminal justice system faces challenges. These include the lack of technical proficiency among legal professionals and the unfamiliarity with legal procedures among satellite imagery experts. Addressing these gaps is essential to fully leverage satellite imagery in legal contexts (Timmermans, 2022).

Developing a Comprehensive Ethics Framework.

The unique nature of space data necessitates a robust and nuanced ethical framework that addresses the multifaceted challenges of its use. Unlike terrestrial data, space data operates at

the intersection of global accessibility, technological sophistication, and dual-use potential, raising critical issues of ownership, control, and application. The ethical implications of satellite imagery – particularly in conflict zones – extend beyond technical considerations to encompass profound questions about accountability, human rights, and global governance (Space, 2023).

A comprehensive ethics framework must integrate principles from geospatial ethics, surveillance ethics, and international law while also acknowledging the unique characteristics of space activities. Such a framework should delineate clear guidelines for data ownership, emphasizing equitable access while safeguarding against the monopolization of critical information by powerful states or private entities. Control mechanisms should address the potential misuse of satellite data for military or propagandistic purposes, ensuring that its application aligns with the principles of transparency and human dignity. The dual-use nature of space data – serving both civilian and military objectives – further complicates its governance, necessitating stringent oversight to prevent exploitation and escalation in conflict scenarios (Space, 2023).

The establishment of an effective framework demands the concerted efforts of a diverse range of stakeholders. Government agencies must take a leading role in shaping regulatory standards, while private sector entities contribute technological expertise and innovation. Civil society organizations and academic institutions provide essential checks and balances, ensuring that the framework remains inclusive, equitable, and attuned to broader societal values. Such collaborative governance is not merely desirable but imperative, given the global nature of space data and its far-reaching implications for international security and humanitarian efforts.

Satellite imagery has become an indispensable tool for documenting the horrors of war and providing incontrovertible evidence for accountability mechanisms. Its role in enhancing transparency and supporting international justice is undeniable. However, the same transparency that bolsters accountability can also infringe on privacy and human rights if mishandled. The ethical dilemmas posed by revealing sensitive information – such as the locations of vulnerable populations or critical infrastructure – highlight the need for a balanced approach. The framework must prioritize data minimization where appropriate while allowing for comprehensive collection in contexts where the benefits to public good outweigh potential risks.

The use of satellite imagery in conflict zones underscores both the promise and perils of space data. On the one hand, satellite imagery supports real-time decision-making, enhances situational awareness, and documents war crimes with a precision that traditional methods cannot achieve. On the other hand, the potential misuse of such data for disinformation or targeting non-combatants raises profound ethical concerns. Ethical guidelines must therefore ensure that data is handled responsibly, with safeguards against its use as a tool for exacerbating violence or undermining international law.

Developing a comprehensive ethics framework for space data is not only a technical challenge but also a moral imperative. The principles underpinning this framework must balance the benefits of transparency with the obligations to protect privacy, uphold human rights, and prevent misuse. As the National Space Council Users' Advisory Group (Space, 2023) emphasizes, such a framework must address the unique challenges of space data governance while fostering collaboration among key stakeholders to ensure its legitimacy and efficacy.

In conclusion, satellite imagery is a transformative tool that holds immense potential for advancing justice, transparency, and global cooperation. However, its power must be tempered with responsibility. The development of a comprehensive ethics framework, informed by interdisciplinary principles and supported by collaborative governance, is essential to ensuring that space data serves as a force for good. Only by addressing these challenges head-on can the international community harness the full potential of satellite imagery while safeguarding against its unintended consequences.

Conclusions

The Russo-Ukrainian War, with its profound integration of satellite and drone technologies, marks a transformative era in the evolution of warfare and space governance. This research underscores the dual-use nature of satellite systems as both enablers of military advantage and harbingers of ethical, legal, and strategic dilemmas. By highlighting the implications of these technologies in an active conflict, the study provides a framework for addressing the vulnerabilities and systemic risks associated with their use.

1. Satellite Technologies: The Double-Edged Nature of Modern Innovation

Satellite systems have become indispensable tools in military strategy, humanitarian operations, and state sovereignty. However, their dual-use potential underscores inherent risks:

The adoption of commercial satellite networks, such as SpaceX's Starlink, has fortified Ukraine's resilience, enabling uninterrupted communication and coordination. Yet, such reliance on private enterprises raises acute vulnerabilities, including the divergence of corporate and state priorities and the risks of strategic dependency on profit-driven entities.

The proliferation of commercial Earth Observation (EO) satellites democratizes access to high-resolution imagery, empowering both state and non-state actors. While this transparency enhances accountability and deters aggression, it also risks misuse in disinformation campaigns, breaches of privacy, and expansive surveillance operations.

The dual-use potential of these technologies demands a robust regulatory framework that addresses their operational complexities and minimizes their potential for harm.

2. Legal Ambiguities and the Need for Reform

The rapid commercialization and militarization of space technologies have outpaced the regulatory scope of existing international legal frameworks, particularly the 1967 Outer Space Treaty (OST):

The increasing reliance on private satellite operators in conflict zones has blurred traditional lines of responsibility. Current frameworks fail to adequately address the accountability of private actors whose technologies are adapted for military use.

Satellite systems serving dual civilian and military purposes become legitimate targets under International Humanitarian Law (IHL), jeopardizing civilian infrastructure and violating the principles of proportionality and necessity. This legal ambiguity challenges the protection of critical assets in times of conflict.

The strategic reliance on external, commercially operated technologies for national defense raises profound sovereignty concerns, as it places vital state functions under the influence of non-state, profit-oriented entities.

Reimagining international legal frameworks is imperative, encompassing binding provisions for private actors, liability mechanisms for dual-use technologies, and updated accountability measures to address the complexities of contemporary conflicts.

3. Ethical Challenges in Technological Mediation

The ethical dimensions of satellite technologies in warfare demand rigorous scrutiny, particularly given their role in mediating life-and-death decisions:

The integration of artificial intelligence (AI) in satellite-linked systems raises profound ethical dilemmas. Delegating critical decisions to autonomous algorithms, without human oversight, disrupts traditional accountability structures and challenges moral reasoning in warfare.

Remote operations facilitated by satellite communications risk desensitizing operators to the consequences of their decisions. This phenomenon underscores the need for systems that embed ethical awareness in their design.

The involvement of private corporations in mediating military outcomes introduces ethical inconsistencies. Commercial imperatives often conflict with humanitarian priorities, undermining international norms and principles.

To address these issues, embedding ethical safeguards, human oversight mechanisms, and transparency protocols into the design and deployment of satellite systems is essential.

4. Diplomacy and Multilateral Governance for a Multipolar Space Order

The growing number of state and non-state actors in space necessitates an adaptive and inclusive approach to governance:

Multilateral diplomacy must evolve from the bilateral agreements of the Cold War to frameworks that reflect the complexities of a multipolar world, incorporating private actors and civil society as critical stakeholders.

Space governance must prioritize collective responsibility, emphasizing shared ethical and legal norms that balance innovation with peace and sustainability.

Diplomatic initiatives should proactively establish protocols to manage disputes involving dual-use technologies, minimizing the risks of escalation and ensuring the protection of civilian interests.

The intersection of satellite technologies, commercial actors, and modern conflict, as illustrated by the Russo-Ukrainian war, reveals the transformative potential and inherent risks of the current space age. This research provides a roadmap for addressing these challenges, emphasizing the integration of adaptive legal frameworks, embedded ethical safeguards, and multilateral governance initiatives.

By fostering a collective vision of space as a shared global domain, humanity can ensure that satellite technologies serve as instruments of peace, sustainability, and innovation, rather than sources of conflict and inequity. The future of space governance depends on our ability to align technological progress with the values of justice, security, and collective responsibility.

🕮 References

Abels, J. (2024) Private infrastructure in geopolitical conflicts: the case of Starlink and the war in Ukraine. *European Journal of International Relations*, Volume 30, 842-866 Issue 4. https://doi.org/10.1177/13540661241260653

Aimaiti, Y., Sanon, C., Koch, M., Baise, L. G., & Moaveni, B. (2022) War related building damage assessment in Kyiv, Ukraine, using Sentinel-1 radar and Sentinel-2 optical images. *Remote Sensing*, 14, 6239. https://doi.org/10.3390/rs14246239

Albon, C. (2022) How commercial space systems are changing the conflict in Ukraine. *C4ISRNET*. Available online: https://www.c4isrnet.com/intel-geoint/2022/04/25/how-commercial-space-systems-are-changing-the-conflict-in-ukraine/

Alliance Persistent Surveillance from Space (APSS) (2023) *NATO*. Available online: https://www.nato.int/factsheets

Bendett, S., & Edmonds, J. (2022). *Russian military autonomy in Ukraine: Four months in*. CNA. Available online: https://www.cna.org/reports/2022/07/russian-military-autonomy-in-ukraine-four-months-in

Borotkanych, N. (2022) Use of satellite remote sensing in the mining industry. *EOS Data Analytics*. Available online: https://eos.com/blog/use-of-satellite-remote-sensing-in-the-mining-industry/

Burbach, D. T. (2022) Early lessons from the Russia-Ukraine war as a space conflict. *Atlantic Council*. Available online: https://www.atlanticcouncil.org/content-series/airpower-after-ukraine/early-lessons-from-the-russia-ukraine-war-as-a-space-conflict/

Case study: Viasat attack (2023) CyberPeace Institute. Available online: https://cyberconflicts.cyberpeaceinstitute.org/law-and-policy/cases/viasat#footnote-3.

Constitution of Ukraine (1996) Verkhovna Rada of Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/254%D0%BA/96-%D0%B2%D1%80#Text

Criminal Code of Ukraine (2001) Verkhovna Rada of Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/2341-14#Text

Davies, Merton, and William R. Harris (1988) *RAND's role in the evolution of balloon and satellite observation systems and related U.S. space technology*. RAND Corporation. Available online: https://www.rand.org/pubs/reports/R3692.html

Dickey, Robin, and Gleason, Michael P. (2023) Space and War in Ukraine: Beyond in Satellites. *Journal of Strategic Airpower & Spacepower*, 3(1), 2-24. Available online: https://www.airuniversity.af.edu/Portals/10/AEtherJournal/Journals/Volume-3_Number-1/Dickey_Gleason.pdf

Erwin, Sandra (2023) NRO signs agreements with five commercial suppliers of electro-optical imagery. *SpaceNews*. Available online: https://spacenews.com/nro-signs-agreements-with-five-commercial-suppliers-of-electro-optical-imagery/

Erwin, Sandra (2022) BlackSky, Maxar, Planet win 10-year NRO contracts for satellite imagery. *SpaceNews*. Available online: https://spacenews.com/blacksky-maxar-planet-win-10-year-nro-contracts-for-satellite-imagery/

ESA's Annual Space Environment Report (2022) ESA Space Debris Office. Available online: https://www.sdo.esoc.esa.int/ environment_report/Space_Environment_Report_latest.pdf.

ESPI Short Report 1 - The war in Ukraine from a space cybersecurity perspective (2022) European Space Policy Institute. Available online: https://www.espi.or.at/wp-content/uploads/2022/10/ESPI-Short-1-Final-Report.pdf

Fave, Danilo delle (2023). The challenges of dual-use space technologies: The non-peaceful use of satellites. Space Generation Advisory Council. https://spacegeneration.org/the-challenges-of-dual-use-space-technologies-the-non-peaceful-use-of-satellites

Freeman, Lindsay (2018) Digital Evidence and War Crimes Prosecutions: The Impact of Digital Technologies on International Criminal Investigations and Trials. *Fordham International Law Journal*, Vol. 41, No. 2. Available online: https://ssrn.com/abstract=3800418

Gangware, Will, & Dale Swartz (2023) Scaling - and funding - next-gen satellites for the coming commercial boom. *McKinsey & Company*. Available online: https://www.mckinsey.com/industries/aerospace-and-defense/our-insights/scaling-and-funding-next-gen-satellites-for-the-coming-commercial-boom

Geospatial information technology for peace (2022) United Nations Institute for Training and Research (UNITAR). Available online: https://unitar.org/about/news-stories/news/geospatial-information-technology-peace

Harrison, Todd, & Matthew Strohmeyer (2022) Commercial space remote sensing and its role in national security. *Center for Strategic and International Studies*. Available online: https://aerospace.csis.org/wp-content/uploads/2022/02/220202_Harrison_Commercial_Space-compressed.pdf

Hitchens, Theresa (2022) After Ukraine success, NRO says electro-optical imagery contracts due this summer. *Breaking Defense*. Available online: https://breakingdefense.com/2022/04/lauding-firms-ukraine-work-nro-head-says-electro-optical-imagery-contracts-coming-this-summer/

Höyhtyä, Marko, & Sari Uusipaavalniemi (2023) The space domain and the Russo-Ukrainian war: Actors, tools, and impact. *Hybrid CoE Working Paper 21*. Available online: https://www.hybridcoe.fi/publications/hybrid-coe-working-paper-21-the-space-domain-and-the-russo-ukrainian-war-actors-tools-and-impact/

Huang, Q., Jin, G., Xiong, X., Ye, H., & Xie, Y. (2023) Monitoring urban change in conflict from the perspective of optical and SAR satellites: The case of Mariupol, a city in the conflict between RUS and UKR. *Remote Sensing, 15*, 3096. https://doi.org/10.3390/rs15123096

ICEYE Satellite, Purchased with Donations from Ukrainians, Helped Identify and Destroy Thousands of russian Military Equipment (2023) Defense Intelligence of Ukraine. Available online: https://gur.gov.ua/en/content/nadanyi-hur-mo-ukrainy-kosmichnyi-aparat-iceye-dopomih-vyiavyty-ta-znyshchyty-tysiachi-odynyts-vorozhoi-tekhniky.html

ICEYE Signs Contract to Provide Government of Ukraine with Access to Its SAR Satellite Constellation (2022) ICEYE. Available online: https://www.iceye.com/press/press-releases/iceye-signs-contract-to-provide-government-of-ukraine-with-access-to-its-sar-satellite-constellation

Jayanti, A. (2023) *Starlink and the Russia-Ukraine War: A Case of Commercial Technology and Public Purpose*. Belfer Center. Available online: https://www.belfercenter.org/publication/starlink-and-russia-ukraine-war-case-commercial-technology-and-public-purpose

Jones, Grace, Janet Egan, & Eric Rosenbach (2023) *Advancing in adversity: Ukraine's battlefield technologies and lessons for the U.S.* Belfer Center for Science and International Affairs, Harvard Kennedy School. Available online: https://www.belfercenter.org/publication/advancing-adversity-ukraines-battlefield-technologies-and-lessons-us

Kesteloo, H. (2024) Ukraine's Defense Ministry buys over $27 million in DJI drones. DroneXL. Retrieved from https://dronexl.co/2024/05/29/ukraines-buys-27-million-dji-drones/

Kovalevska, Y. (2022) ICEYE satellite: What exactly Prytula bought and how it will help the Armed Forces of Ukraine. BBC News Ukraine. Available online: https://www.bbc.com/ukrainian/news-62603951

Land Remote Sensing Policy Act of 1992 (H.R. 6133) 102nd Congress (1992) U.S. Congress. Available online: https://www.congress.gov/bill/102nd-congress/house-bill/6133

Launius, R. D. (2007) A significant moment for the space age. *Space Policy*, 23(3), 148-150. Available online: https://repository.si.edu/bitstream/handle/10088/7823/Launius_a_significant_moment_for_t.pdf

Law of Ukraine on the Basic Principles of Cybersecurity (2017) Verkhovna Rada of Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/2163-19#Text

Law of Ukraine on Electronic Communications (2020) Verkhovna Rada of Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/1089-20#Text

Lightman, S., Suloway, T., & Brule, J. (2022). Satellite Ground Segment: Applying the Cybersecurity Framework to Satellite Command and Control. National Institute of Standards and Technology (NIST). https://doi.org/10.6028/NIST.IR.8401

Melzer, Nils (2008) The Principle of Distinction under International Humanitarian Law'. *Targeted Killing in International Law*. Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199533169.003.0011

Morris, C. (2023) Ukraine war: Offensive use of satellite tech a sign of how conflict is increasingly moving into space. University of Portsmouth. Available online: https://www.port.ac.uk/news-events-and-blogs/blogs/ukraine-war-offensive-use-of-satellite-tech-a-sign-of-how-conflict-is-increasingly-moving-into-space

Nasu, Hitoshi (2022) The eye in space: ICEYE's SAR satellites and the law of war. Lieber Institute West Point. Available online: https://lieber.westpoint.edu/eye-space-iceyes-sar-satellites-law-of-war/

Newmann, Christopher (2012) Moralization of technologies: Military drones – a case study. E-International Relations. https://www.e-ir.info/2012/05/02/moralization-of-technologies-military-drones-a-case-study/

Ogden, T., Knack, A., Lebret, M., Black, J., & Mavroudis, V. (2024). The role of the space domain in the Russia-Ukraine war and the impact of converging space and AI technologies. CETaS Expert Analysis. https://cetas.turing.ac.uk/publications/role-space-domain-russia-ukraine-war

Ortega, Almudena Azcárate (2023) Not a rose by any other name: Dual-use and dual-purpose space systems. Lawfare Media. Available online: https://www.lawfaremedia.org/article/not-a-rose-by-any-other-name-dual-use-and-dual-purpose-space-systems

People's Satellite (2023) Serhiy Prytula Charity Foundation. Available online: https://prytulafoundation.org/en/about/projects/archive/peoples-satellite

Procedure of the Functioning of the National Telecommunication Network (2020) Verkhovna Rada of Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/1358-2020-%D0%BF#Text

Rich, Michael D. (1998) RAND's Role in the CORONA Program: Remarks on the 35th Anniversary of the First Successful Mission. RAND Corporation. Available online: https://www.rand.org/pubs/papers/P8017.html

Richelson, Jeffrey (1990) America's secret eyes in space: The U.S. Keyhole spy satellite program. Harper & Row. Available online: https://archive.org/details/americassecretey0000rich

Roza, David (2023) Experts warn of blurring line between military, commercial satellites. *Air & Space Forces Magazine*. Available online: https://www.airandspaceforces.com/military-commercial-satellites-blurring-line/

Russia behind cyber-attack with Europe-wide impact an hour before Ukraine invasion (2022) UK Goverment, Press release. Foreign, Commonwealth & Development Office and The Rt Hon Elizabeth Truss. Published 10 May 2022. Available online: https://www.gov.uk/government/news/russia-behind-cyber-attack-with-europe-wide-impact-an-hour-before-ukraine-invasion

Sadham, V. (2024) Drone war escalates: Ukraine plans to produce 1 million drones per year. The News Mill. Available online: https://thenewsmill.com/2024/02/drone-war-escalates-ukraine-plans-to-produce-1-million-drones-per-year/

Shevchuk, S. A., Vyshnevskyi, V. I., & Bilous, O. P. (2022) The use of remote sensing data for investigation of environmental consequences of Russia-Ukraine war. *Journal of Landscape Ecology, 15*(3), 35-53. https://doi.org/10.2478/jlecol-2022-0017

Soroka, Larysa (2023) Collective Security Crisis: Challenges to Space Law and Space Security. *Advanced Space Law*, Volume 12, 76-81. https://doi.org/10.29202/asl/12/10

Space data ethics: The next frontier in responsible leadership (2023) National Space Council Users' Advisory Group, Climate and Societal Benefits Subcommittee. Available online: https://www.nasa.gov/wp-content/uploads/2024/02/white-paper-space-data-ethics-2023-12-01-final-002.pdf?emrc=65d8fcfdca26f

Sticher, V., Wegner, J. D., & Pfeifle, B. (2023) Toward the remote monitoring of armed conflicts. *PNAS Nexus, 2*(6), 181. https://doi.org/10.1093/pnasnexus/pgad181

Strout, N. (2022) National Reconnaissance Office awards five contracts for commercial satellite radar capabilities. *C4ISRNET*. Available online: https://www.c4isrnet.com/intel-geoint/2022/01/20/national-reconnaissance-office-awards-five-contracts-for-commercial-satellite-radar-capabilities/

The role of satellite communications in disaster management (2022) Access Partnership. Fair Tech Institute. Available online: https://accesspartnership.com/wp-content/uploads/2022/03/The-Role-of-Satellite-Communications-in-Disaster-Management.pdf

Timmermans, R. (2022) Using satellite data in court, not as evident as it seems. *Groundstation. Space*. Available online: https://www.groundstation.space/business/using-satellite-data-in-court-not-as-evident-as-it-seems/

Torrieri, M. (2022) How satellite imagery magnified Ukraine to the world. *Earth Observation*. Available online: https://interactive.satellitetoday.com/via/november-2022/how-satellite-imagery-magnified-ukraine-to-the-world/

Vaynman, J. (2021) Better monitoring and better spying: The implications of emerging technology for arms control. *Texas National Security Review, 4*(4), Fall 2021. Available online: https://repositories.lib.utexas.edu/server/api/core/bitstreams/c1dff0fb-deda-4306-9552-55cdda14fb19/content

Wood, G. (2024) A suspicious pattern alarming the Ukrainian military. *The Atlantic*. Available online: https://www.theatlantic.com/international/archive/2024/03/american-satellites-russia-ukraine-war/677775/

Zafra, M., Hunder, M., Rao, A., & Kiyada, S. (2024) How drone combat in Ukraine is changing warfare. *Reuters*. Available online: https://www.reuters.com/graphics/UKRAINE-CRISIS/DRONES/dwpkeyjwkpm/

The Nuclear-Seed Theory of the Origin and Formation of the Universe

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In this paper, a general nuclear-seed theory of the origin and creation of the universe is suggested for arbitrary dimensional spaces, which is one of the main problems of the natural sciences. This newly proposed theory is that the universe and its early evaluation could be created from the nuclear seed as a continuous process, and this theory is supported with proofs. The aim of this study is also to provide a brief overview of the exciting progress realized during the past hundred years regarding the formation theory and modeling of the universe, highlighting some key breakthroughs and present challenges. The nuclear seed model is very successful in explaining the observed phenomenology of the universe based on the formalism of living and nonliving systems. From this point of view, nuclear seed theory has become the fundamental theory for the progress of all modern natural sciences for the study of the formation of the universe.

Keywords: Big Bang theory; Standard model; Nuclear-seed theory; Universe

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I. Introduction

Despite the current developments in the natural sciences, the question of the creation of the universe remains an important problem in this field. The concept of the universe has developed significantly throughout human history, with various models proposed to explain its nature and structure (Hoyle et al., 2000; Padmanabhan, 1993; Kofman et al., 1990; Bolejko, 2010). In this period, several notable models were proposed, such as the Geocentric Model, Heliocentric Model, Kepler's Laws of Planetary Motion, Newton's Law of Universal Gravitation, Einstein's Theory of General Relativity, and the Big Bang Theory, for universe modeling (Hoyle et al., 2000; Padmanabhan, 1993; Kofman et al., 1990; Bolejko, 2010; García–Bellido,1999; Coleman & Pietronero, 1992; Dekel & Ostriker, 1999; Bahcall et al., 1997; Rubakov & Gorbunov, 2018; Schroeder, 2011). In the Geocentric Model, ancient civilizations, including the Greeks and Egyptians, believed in a geocentric universe, where

Earth was at the center, and celestial bodies orbited around it. Ptolemy's model, refined over centuries, depicted this system with epicycles to explain retrograde motion. The Heliocentric Model, proposed by Nicolaus Copernicus in the 16th century, placed the Sun at the center of the solar system with Earth and other planets revolving around it. This model laid the foundation for a modern understanding of solar systems. Kepler's laws of planetary motion were formulated based on observations made by Tycho Brahe, who described planetary orbits as elliptical rather than circular and established mathematical principles governing planetary motion. Newton's law of universal gravitation explains how gravitational forces act between objects by providing a framework for understanding not only planetary motion but also the motion of celestial bodies in general. Einstein's theory of general relativity fundamentally altered our understanding of gravity by describing it as the space-time curvature caused by mass and energy (Born, 1962; Vishwakarma, 2016; Hess, 2020; Infeld, 1957; Choquet-Bruhat, 2008; Mehra, 2012; Dirac, 1996). It provided a new perspective on the universe's structure and dynamics, particularly on large scales. The Big Bang Theory suggests that the universe originated from an extremely hot and dense state approximately 13.8 billion years ago and explains the expansion of the universe, the cosmic microwave background radiation, and the formation of galaxies (Fox, 2002; Uzan, 2021; Zobel, 2015; Traunmüller, 2023; Ellis, 1984; Clegg, 2009). The Inflationary Theory, which is proposed to explain certain aspects of the Big Bang theory, suggests a rapid exponential expansion of the universe in the first moments after its birth, addressing issues such as the horizon problem and the uniformity of the universe. In multiverse hypotheses, various models speculate that our universe is one of many existing within a broader multiverse. Additionally, these models propose different mechanisms for the existence of multiple universes, such as bubble universes or parallel dimensions. It should be noted that a new spin-top theory for the formation of the universe was developed in this study (Veziroglu, 2020).

These models represent our evolving interpretation of the universe, with each contributing to our current cosmological framework. Researchers continue to refine and develop new models to explain observed phenomena and reconcile inconsistencies between various theories for a more comprehensive understanding of the cosmos.

It is well known that the prevailing theory explaining the formation of the universe is the Big Bang theory. According to this theory, we can briefly summarize the formation of the universe in the following stages. Singularity: The Big Bang Theory suggests that the universe began as an extremely hot and dense point, often referred to as a singularity. At this moment, all matter, energy, space, and time were compressed into an infinitely small point. Expansion: Approximately 13.8 billion years ago, this singularity underwent an unimaginably rapid expansion known as cosmic inflation. The universe expanded and cooled, allowing matter and energy to form. Formation of Fundamental Particles: As the universe cooled further, fundamental particles such as quarks and electrons began to form. In the first few minutes after the Big Bang, these particles combined to form hydrogen, helium, and trace amounts of lithium. Formation of Atoms: After approximately 380,000 years, the universe cooled enough for electrons to combine with nuclei to form atoms. This allowed photons to travel freely, creating what is known as cosmic microwave background radiation, which we can currently detect. Formation of Stars and Galaxies: Over millions and billions of years, regions of slightly greater density in the early universe attracted more matter through gravity. These regions collapsed and formed the first stars and galaxies. Cosmic Evolution: The universe continued to evolve, forming clusters of galaxies, stars, and planetary systems. Gravity has played a crucial role in the formation of structures, such as galaxies and galaxy

clusters, for billions of years. Ongoing Expansion: Observations indicate that the universe is still expanding. Galaxies are moving away from each other, suggesting that space itself is expanding. This expansion is one of the fundamental aspects of the Big Bang theory (Trouille et al., 2013; Weitekamp, 2017; Bertschinger, 1998).

It is important to note that while the Big Bang Theory is the leading explanation for the universe's origin and early evolution, there are ongoing studies and investigations into the finer details, such as the nature of cosmic inflation, the early moments of the universe, and the behavior of dark matter and dark energy, which collectively constitute a large portion of the universe but remain largely mysterious. At the heart of the theory is the idea that the universe started from an incredibly hot, dense state and has since been expanding and cooling. This expansion led to the formation of galaxies, stars, planets, and everything we know today. The evidence supporting the Big Bang theory comes from various scientific observations, such as cosmic microwave background radiation and the redshift of galaxies (Mamas, 2010; Aquirre, 2000; Wang, 2013; Ashmore, 2016; Gray & Dunning-Davies, 2008; Srianamd et al., 2000; Rowland, 2020; Peebles et al., 2019).

However, there are still aspects of the Big Bang theory that remain unexplained or are under investigation. Questions about what happened before the Big Bang, the nature of dark matter and dark energy, and the conditions in the earliest moments of the universe continue to challenge scientists and inspire ongoing research and theories in cosmology. One of the essential concepts in this theory is the assumption of homogeneity and isotropy on large scales. This aspect of homogeneity implies that, on a large scale, the universe looks roughly the same in all directions. This means that if you look at the universe on a grand scale, you would find a similar distribution of matter and energy regardless of the direction you were observing from. This concept is known as the cosmological principle. Isotropy complements homogeneity and refers to the idea that the universe looks the same from any vantage point. Essentially, this means that there are no preferred directions in the cosmos (Vilenchik & Vilenchik, 2019; Bojowald, 2007; Bojowald, 2008; Enqvist & Sloth, 2002; Gasperini, 2008; Cherepashchuk, 2013; Schucking, 1992).

These assumptions are supported by observational evidence such as the uniformity of cosmic microwave background radiation (CMB), which is a remnant of the early universe. The CMB is incredibly uniform, exhibiting very small temperature differences across the sky, supporting the idea that the universe, on the largest observable scales, appears remarkably consistent in all directions. The homogeneity and isotropy of the universe on large scales are key components of the Big Bang theory and provide the foundation for our understanding of its evolution and structure. However, on smaller scales and within galaxies and galactic clusters, variations and structures do exist due to gravitational interactions and other forces acting on matter.

As we can see from recent important studies, some fundamental inconsistencies in the Big Bang theory have been revealed. Although the Big Bang theory is the leading cosmological model to explain the origin and evolution of the universe, it has certain explanatory limitations and areas where it faces challenges (Rafique, 2018; Lerner, 2010; Barbosa, 2022; Grinin, 2019; Thopson et al., 2003; Bagdonas & Kojevnikov, 2021; Smith, 1991; Smith, 1994; Dasagiri, 2018).

According to the homogeneity and isotropy of the universe, which are key constituents of the Big Bang theory, there would be no large-scale galaxy clusters or large voids in space. However, recent comprehensive studies have revealed large galaxy superclusters and vast voids in space, meaning that we live in a "clumpy" universe. In one study (Tully, 1986), R.

Brent Tully showed that there are galaxies with enormous lengths and large layers of size. This means that at the speeds at which galaxies are assumed to be moving, it would take 80 billion years for such large systems to form, whereas for Big Bang theory, the age of the universe is estimated to be between 10 and 20 billion years. While Brent Tully's work focused on the properties and distances of galaxies, contributing to our understanding of the structure of the universe, his research was not directly centered on formulating or advancing the theoretical frameworks of the Big Bang cosmologies. His expertise lies more in observational astronomy, specifically in understanding the dynamics and distribution of galaxies within the universe. While Saunders's work (Saunders et al., 1991) is related to studying the universe's structure and evolution through observational methods, his contributions are more in the realm of observational astronomy and the analysis of galaxy surveys. He has contributed valuable insights into understanding the distribution and properties of galaxies, which indirectly supports our understanding of the Big Bang model by providing observational data about the structure of the universe. However, he is not among the scientists credited with formulating or advancing the theoretical framework of the Big Bang theory itself. The U.S.-European Roentgen Satellite (ROSAT) has made significant contributions to X-ray astronomy by providing a comprehensive catalog of X-ray sources across the sky. Its data greatly expanded our understanding of various celestial objects that emit X-rays, shedding light on their properties, interactions, and distributions. The mission operated until 1999, when ROSAT re-entered Earth's atmosphere in a controlled manner, ending its operational life. The legacy of the ROSAT continues through the valuable data it provides, aiding ongoing research in X-ray astronomy (Parker, 1993; Schur, 2007; Cowen, 1991). In one study (Cowen, 1991), the US-European X-ray Satellite (ROSAT), which detected X-ray emissions, discovered verification superclusters of quasars at the edge of the universe, eight to 12 billion light-years from Earth.

In the book (Rafique, 2018), the author shows the misleading and unscientific nature of the Big Bang theory and offers important alternative suggestions for the solution of the problem and explanations of observed phenomena. Hubble's discovery of the cosmological redshift and his formulation of Hubble's law provided strong evidence for the expanding universe. This led to the development of the Big Bang theory, suggesting that the universe is not static but rather is continuously expanding, with galaxies moving away from each other as space itself expands. The cosmological redshift observed in distant galaxies remains a crucial piece of evidence supporting the Big Bang theory and our understanding of the large-scale structure and expansion of the universe. Hubbell's notes on Cosmological Redshifts in his latest works are summarized in the book as follows: "Exact this thing was noted by Edwin Hubble and finally scientists realized that what redshifts they had been observing since the second decade of twentieth century were not Doppler's Shifts but were Cosmological Redshifts. At this point, the Wikipedia article on Edwin Hubble states that "yet the reason for the redshift remained unclear."

Eric J. Lerner, the author of the book (Lerner, 2010) "The Big Bang Never Happened," published in 1991, presents a contrarian view challenging the prevailing Big Bang theory. Lerner, who is not a cosmologist but rather a plasma physicist, proposed an alternative cosmological model that opposes the standard model of the Big Bang. The key arguments presented in the book are as follows: Steady State Universe: Lerner challenges the Big Bang theory's central concept of an initial singularity followed by rapid expansion. Instead, he leans toward a steady-state universe, where the universe is eternal and has no specific beginning or end. This model suggests that the universe does not expand but maintains a consistent state over time. Plasma Cosmology: Lerner advocates for a plasma-based cosmology,

emphasizing the role of plasma—a state of matter consisting of charged particles—in the formation and evolution of the universe. He argued that electromagnetic forces play a more significant role than gravity in shaping the cosmos. Challenges to Big Bang Evidence: Lerner questions the interpretations of cosmic background radiation and redshift data that are often used as evidence supporting Big Bang theory. He proposes alternative explanations for these observations within the framework of plasma cosmology. It is important to note that Lerner's views and alternative cosmological models are not widely accepted within the scientific community. The overwhelming majority of cosmologists and astrophysicists support the Big Bang theory due to extensive observational evidence, such as cosmic microwave background radiation, the redshift of galaxies, and the observed expansion of the universe.

Exploring what might have existed before the Big Bang is challenging because our current understanding of physics breaks down at the singularity—the extremely hot and dense state that initiated the expansion of the universe. This singularity marks the starting point of the Big Bang, as we comprehend it within the framework of our current theories. Several hypotheses and speculative ideas have been proposed regarding what might have existed or what might have triggered the Big Bang. Multiverse Theories: Some theories propose that our universe is just one of many within a larger multiverse. These multiverse models suggest that other universes might exist alongside ours, each with its physical laws and properties. Quantum Fluctuations: Certain hypotheses in quantum physics suggest that the Big Bang might have resulted from quantum fluctuations in a preexisting state. These fluctuations could have triggered the rapid expansion that led to our observable universe. Eternal Inflation: According to this concept, the universe might have undergone cycles of expansion and contraction before our observable Big Bang, possibly through an eternal process. String Theory and Brane Cosmology: String theory and related ideas propose extra dimensions beyond our familiar three-dimensional space and one-dimensional time. Some theories within this framework suggest that collisions between higher-dimensional objects (branes) might have led to the Big Bang (Schucking, 1992; Rafique, 2018; Lerner, 2016).

However, it is crucial to emphasize that these ideas remain largely speculative and are currently difficult to test empirically. The singularity at the beginning of the universe poses a challenge to our current understanding of physics because extreme conditions make our known physical laws inadequate for describing what might have occurred in that initial state. Until we have a more comprehensive theory that unifies quantum mechanics and general relativity (the two pillars of modern physics) to describe the physics of extreme conditions at the birth of the universe, the question of what existed "before" the Big Bang remains an area of active theoretical exploration and speculation (Bojowald, 2007; Bojowald, 2008; Enqvist & Sloth, 2002; Gasperini, 2008; Cherepashchuk, 2013; Schucking, 1992).

Despite these inconsistencies, the Big Bang theory is supported by substantial observational evidence, including the cosmic microwave background radiation, the redshift of galaxies, and the abundance of light elements, among others. Scientists continue to explore these limitations, aiming to refine and extend our understanding of the universe's origins through ongoing research, observations, and advancements in theoretical physics.

All the above historical developments in the natural sciences show that the Big Bang theory's approach to the universe's formation is inadequate for explaining many aspects of experimental and theoretical processes. Considering the creation of all systems in the universe and subsequent developments over time, a new theory of the formation of the universe is proposed in this study and may be considered an alternative theory from a radical perspective. Here, for the first time, a new unified nuclear seed model has been developed

that enables a successful explanation and implementation of the origin and creation of the universe.

2. The nuclear-seed theory of the formation of the universe

A strong scientific theory should be based on careful examination of facts, representative samples, and simple and interconnected samples that can be predicted and explained. We believe that the new nuclear seed model will be the most powerful among the available theories of the creation of the universe because its conceptual comprehensiveness allows us to overcome many difficulties and the complete representation of its structures and manifestations. It is well known that all the systems constituting the universe are generally divided into two groups: living and nonliving. Furthermore, it is well known that all living and nonliving systems consist of only two types of fundamental particles, nuclei and electrons (National Research Council, 1998; Wells, 2020; Spencer, 2020; Montevil et al., 2021; Norton, 2021).

Living organisms are created through various methods, and they originate from a small source, typically a single cell or a group of cells (Bogdanov, 1999; Popkin, 2016; Newman, 2010). The diversity of life on Earth arises from different processes of reproduction and development. There are several common methods through which living organisms are created. Many single-celled organisms, as well as multicellular organisms, reproduce through cell division. This process includes mitosis in eukaryotic cells, where a single cell divides into two identical daughter cells. In sexual reproduction, two parent organisms contribute genetic material to produce offspring. This genetic material often comes from specialized cells (gametes) produced by each parent through processes such as meiosis. This method involves the generation of offspring without the involvement of gametes or the combination of genetic material from two parents. Asexual reproduction can occur through various means, including binary fission, budding, fragmentation, and spore formation. Some plants, fungi, and certain bacteria reproduce by producing spores. Spores are typically small, single cells capable of growing into a new organism under suitable conditions. Certain plants can create new individuals from vegetative parts such as stems, roots, or leaves. This process includes methods involving runners, rhizomes, tubers, and bulbs. In some animals, particularly invertebrates and certain reptiles, females can produce offspring without fertilization by a male. This process is known as parthenogenesis. The diversity of life is a result of the combination of these various reproductive methods, each adapted to the specific needs and environments of different organisms. In summary, while reproduction sources are a common and important means of reproduction for live organisms, they are a universal feature of all living things in nature, and different organisms have evolved various strategies for reproduction based on their specific characteristics and environmental conditions (Roza, 2006: Bogdanov, 1999; Popkin, 2016; Newman, 2010; Sung, 2018; Schrödinger, 1992; Latash, 2019; Bayn, 2023). Since all the various reproduction sources consist of nuclei and electrons, which are fundamental particles, we can generally combine them under the name "nuclear seed", which represents the universal source of all living systems in nature. These characteristics of the source of formation of living and non-living systems are interrelated and interdependent, so it is reasonable to combine them under the name of "nuclear seed".

According to the nuclear seed model, if energy is transferred to a system, all living systems can be found at various levels of natural science (physical, biological, and chemical) organization, from nuclear seeds to simple cells and multicellular organisms and entire ecosystems (Schrödinger, 1992; Latash, 2019; Bayn, 2023). These characteristics include

organization, energy processing, growth, adaptation, response to stimuli, reproduction, and evolution. Living systems require energy to carry out various life processes. They obtain energy through processes such as photosynthesis (in plants and some bacteria) or by consuming other organisms (in animals and many microorganisms). Living organisms grow by increasing in size and, in the case of multicellular organisms, by increasing the number of cells. Growth often involves cell division and the synthesis of new cellular components. Living organisms can respond to external stimuli from their environment. This responsiveness is often demonstrated through behaviors, movements, or biochemical reactions. Living systems have mechanisms for producing nuclear seeds, ensuring the continuity of their species. Reproduction can occur through various methods, depending on the organism.

The transition from living systems to nonliving structures involves a shift from complex, organized structures capable of growth, metabolism, and reproduction to simpler, inanimate arrangements. This transition is associated with the concept of entropy, which describes the tendency of systems to move toward greater disorder and randomness. Living systems, such as organisms, exhibit high levels of organization, maintain internal structures and are capable of carrying out complex processes to sustain life. These processes include metabolism (chemical reactions that provide energy and build or break down molecules), homeostasis (maintenance of a stable internal environment), and reproduction (generation of new, similar organisms). On the other hand, nonliving structures lack the characteristics of living systems. They may include simple molecules, minerals, and various inanimate objects. The transition from living to nonliving involves the breakdown of complex biological structures into simpler components through processes such as decay and decomposition. Several factors contribute to the transition from living to nonliving structures. When energy transfer stops, the cell ceases to function and undergoes a process called autolysis, where enzymes within the cell start breaking down cellular components. During the decomposition process, nutrients and organic molecules are released into the surrounding environment. After an organism becomes nonliving, the processes of decomposition involve the breakdown of organic matter into simpler molecules by various microorganisms, enzymes, and environmental factors. As decomposition progresses, chemical processes such as oxidation, hydrolysis, and microbial metabolism continue to break down organic molecules into smaller, inorganic compounds such as carbon dioxide, water, ammonia, and minerals. The chemical components of living organisms, such as proteins, lipids, and carbohydrates, may undergo chemical reactions and transformations, leading to the formation of simpler, nonliving compounds. Exposure to environmental conditions, such as temperature, humidity, and radiation, can contribute to the breakdown of organic structures and the dispersal of their components (Van Kampen et al., 1982; Vidales & Brier, 2021; Cottam et al., 2018; Popkin, 2016; Fabrizio, 2016; Waigh, 2014; Castillo & Vera-Cruz, 2011). The second law of thermodynamics states that entropy, or disorder, tends to increase in isolated systems. Living systems actively maintain low entropy internally, but upon death or cessation of life processes, entropy increases, leading to a transition toward simpler, nonliving states. In the context of the universe, entropy is sometimes used to describe the tendency of the cosmos to move toward a state of greater disorder or randomness. According to entropy theory, in the absence of external energy input to an isolated system, order tends to transition into disorder, and disorder tends to evolve into chaos. This is related to discussions about the arrow of time and the increasing entropy in the universe over time. It is important to note that the boundary between living and nonliving is not always sharply defined, and there are complex processes and debates surrounding the origins of life and the definition of life itself. The transition from living to nonliving

structures is a natural part of the life cycle and the cycling of matter in ecosystems. Overall, the transformation of living systems into nonliving systems involves a series of physical, chemical, and biological processes that ultimately return organic matter and nutrients to the environment, completing the cycle of life and contributing to the biogeochemical cycles of the universe (Valageas & Silk, 1999; Rowland, 2020; Frautschi, 1982; Ribeiro et al., 2021; Avchenko & Chudnenko, 2021).

On the basis of the above developments, which have thus far been substantiated by the basic sciences, we can now conceptually elucidate the processes involved in the formation of the universe. According to the new hypothesis, the universe is thought to have started from a nuclear seed in an infinitesimally small state. When the energy was transferred to the nuclear seed, parts of the universe were created and emerged as the first living system, and over time, the living system completed its development and turned into a nonliving system. In this model, however, the origin of the initial energy and the formation of the nuclear seed remain unclear. At this point, over billions of years in a singularity, the universe was formed from the matter, energy, and space we observe today. Nuclear seed theory provides a more comprehensive and accurate description of gravity behavior, especially in the presence of massive objects such as stars and planets. Einstein's theories laid the foundation for our modern understanding of the cosmos, influencing fields such as astrophysics and cosmology. His equations are used to describe the large-scale structure and dynamics of the universe. Additionally, the theory of relativity has implications for understanding the nature of time, space, and the relationship between matter and energy. Since nuclear seed theory is based on the facts of the universe, Einstein's studies, especially his theories of relativity, also contributed to a new understanding of the universe and its fundamental properties and continued to shape modern physics and cosmology.

3. Conclusion

Although nuclear seed theory provides a comprehensive framework for understanding the origin and early evolution of the universe, we believe it will provide valuable insight into ongoing research on aspects such as dark matter, dark energy, and conditions in the first moments of the universe.

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🕮 References

Aguirre A. N. (2000) The cosmic background radiation in a cold big bang. *Astrophys. J.*, *533*(1), 1-18.

Ashmore L. (2016) An explanation of redshift in a static universe. *Unified Field Mechanics: Natural Science Beyond the Veil of Spacetime - Proceedings of the IX Symposium Honoring Noted French Mathematical Physicist Jean-Pierre Vigier*, 456-463.

Avchenko O. V., and Chudnenko, K. V. (2020) Entropy and the evolution of the Universe. *Complex Syst.*, 4, 31-37.

Bahcall, J., Fisher, K., Miralda-Escude, J., Strauss, M., and Weinberg, D. (1997) *Formation of Structure in the Universe* (No. NAS 1.26: 204541).

Bolejko, K. (2010) *Structures in the Universe by exact methods: formation, evolution, interactions*. Cambridge University Press, Cambridge.

Born, M. (1962) *Einstein's theory of relativity*. Courier Corporation.

Bojowald, M. (2007) What happened before the Big Bang? *Nature Phys.*, *3*(8), 523-525.
Bojowald, M. (2008) Harmonic cosmology: how much can we know about a universe before the big bang? *Proc.Royal Soc. A: Math., Phys. Engin. Sci.*, *464*(2096), 2135-2150.
Bertschinger, E. (1998) Simulations of structure formation in the universe *Annual Rev. Astron. Astrophys.*, *36*(1), 599-654.
Barbosa, J. (2022) A thematic approach to selection effects and biases in cosmology: Fred Hoyle and the rejection of the Big Bang idea, despite the experimental observations. *Belgrade Philos. Annual*, (35), 7-15.
Bagdonas, A., and Kojevnikov, A. (2021) Funny origins of the Big Bang theory. *Historical Stud. Natural Sci.*, *51*(1), 87-137.
Bogdanov, K. Y. (1999) *Biology in physics: is life matter?* (Vol. 2). Elsevier Publisher.
Bayın, S. Ş. (2023) *The Pursuit of Reality: Narrative History of the Quantum and the Great Minds That Made it.* Springer Nature.
Cottam, R., and Ranson, W. (2018) *Bridging the Gap between Life and Physics*. Springer Nature.
Coleman, P. H., and Pietronero, L. (1992) The fractal structure of the universe. *Phys. Reports*, *213*(6), 311-389.
Choquet-Bruhat, Y. (2008) *General relativity and the Einstein equations*. OUP Oxford.
Clegg, B. (2009) *Before the Big Bang: the prehistory of our universe*. St. Martin's Press.
Cherepashchuk, A. M. (2013) History of the Universe History. *Physics-Uspekhi*, *56*(5), 509.
Cowen, R. (1991) Quasar Clumps Dim Cosmological Theory. *Sci. News*, *139*(4), 52-52.
Dekel, A., and Ostriker, J. P. (1999) *Formation of Structure in the Universe*. Cambridge University Press.
Dirac, P. A. M. (1996) *General theory of relativity* (Vol. 50). Princeton University Press.
Dastagiri, M. B. (2018) The Origin of the Universe: Big Bang to God Theory. *Europ. Sci. J.*, *14*(33), 143-155.
del Castillo, L. F., Vera-Cruz, P. (2011) Thermodynamic formulation of living systems and their evolution. *J. Mod. Phys.*, *2*(05), 379
Ellis, G. F. (1984) Alternatives to the Big Bang. *Annual Rev. Astro. Astrophys.*, *22*(1), 157-184.
Enqvist, K., and Sloth, M. S. (2002) Adiabatic CMB perturbations in pre-Big-Bang string cosmology. *Nuc. Phys. B*, *626*(1-2), 395-409.
Fox, K. C. (2002). *The Big Bang Theory: What it is, where it came from, and why it works*. John Wiley & Sons.
Frautschi, S. (1982) Entropy in an expanding universe. *Science*, *217*(4560), 593-599.
Fabrizio, C., (2016) *The Physics of Living Systems*, Springer, New York.
García–Bellido, J. (1999) The origin of matter and structure in the universe. *Philos. Trans. Royal Soc. London. Ser. A: Math., Phys, Engin. Sci.*, *357*(1763), 3237-3257.
Gasperini, M. (2008) *The universe before the big bang: cosmology and string theory*. Springer, Berlin.
Gray, R., & Dunning-Davies, J. (2008) A review of redshift and its interpretation in cosmology and astrophysics. *arXiv preprint arXiv:0806.4085*.
Grinin, L. E. (2019) *Was There a Big Bang? History & Mathematics*. Uchitel Publishing House.
Hoyle, F., Burbidge, G., Narlikar, J. V. (2000) *A different approach to cosmology: from* a *static universe through the big bang toward reality*. Cambridge University Press.

Hess, P. O. (2020) Alternatives to Einstein's General Relativity Theory. *Prog. Part. Nuc. Phys., 114*, 103809.

Infeld, L. (1957) Equations of motion in general relativity theory and the action principle. *Rev. Mod. Phys.*, *29*(3), 398.

Kofman, L., Pogosian, D., Shandarin, S. (1990) Structure of the universe in the two-dimensional model of adhesion. *MNRAS*, *242*(2), 200-208.

Latash, M. L. (2019) *Physics of biological action and perception*. Academic Press.

Lerner, E. (2010) *The Big Bang never happened: a startling refutation of the dominant theory of the origin of the universe*. Simon & Schuster Publisher.

Montévil, M., Mossio, M., Pocheville, A., & Longo, G. (2016) Theoretical principles for biology: Variation. *Prog. Biophys. Molec. Biol.*, *122*(1), 36-50.

Mamas, D. L. (2010) An explanation for the cosmological redshift. *Phys. Essays*, *23*(2), 326-329.

Mehra, J. (2012). *Einstein, Hilbert, and the theory of gravitation: Historical origins of general relativity theory*. Springer Science & Business Media.

Newman, J. (2010) *Physics of the life sciences*. Springer Science & Business Media.

National Research Council. (1998) *Elementary-particle physics: revealing the secrets of energy and matter*. National Academies Press.

National Research Council. (2006) *Revealing the Hidden Nature of Space and Time: Charting the Course for Elementary Particle Physics* (Vol. 1). National Academies Press.

Norton, A. (2021) *Understanding the Universe: The Physics of the Cosmos from Quasars to Quarks*. CRC Press.

Popkin, G. (2016) The physics of life. *Nature*, *529*(7584), 16-18.

Padmanabhan, T. (1993) *Structure formation in the universe*. Cambridge University Press.

Peebles, P. J. E., Page, L. A., Partridge, R. B. (2009) *Finding the big bang*. Cambridge University Press.

Parker, B. (1993) COBE: The Cosmic Background Satellite. In *The Vindication of the Big Bang: Breakthroughs and Barriers*. Boston, MA: Springer US.

Rubakov, V. A., Gorbunov, D. S. (2018). *Introduction to the Theory of the Early Universe: Hot big bang theory*. World Scientific Publishing Company. New York.

Rowland, D. (2020) The big bang never happened: a conclusive argument. *J. Phys. Astr.*, *8*(2), 1-13.

Rafique, K. (2018). A Philosophical Rejection of The Big Bang Theory. Create Space Independent Publishing Platform.

Roza, G. (2006) *Looking at Differences Between Living and Nonliving Things with Graphic Organizers*. The Rosen Publishing Group, Inc.

Ribeiro, M., Henriques, T., Castro, L., Souto, A., Antunes, L., Costa-Santos, C., Teixeira, A. (2021) The entropy universe. *Entropy*, *23*(2), e23020222.

Smith, Q. (1991) Atheism, theism and big bang cosmology. *Austral. J. Philo.*, *69*(1), 48-66.

Smith, Q. (1994) Did the big bang have a cause?. *British J. Philos. Sci.*, *45*(2), 649-668.

Schroeder, G. (2011) *Genesis and the Big Bang Theory: The discovery of harmony between modern science and the Bible*. Bantam Publisher, New York.

Schucking, E. L. (1992) The Time before the Big Bang. *Annals New York Acad. Sci.*, *655*(1), 340-348.

Srianand, R., Petitjean, P., & Ledoux, C. (2000) The cosmic microwave background radiation temperature at a redshift of 2.34. *Nature*, *408*(6815), 931-935.

Saunders, W., Frenk, C., Rowan-Robinson, M., Efstathiou, G., Lawrence, A., Kaiser, N., Parry, I. (1991) The density field of the local Universe. *Nature*, *349*(6304), 32-38.

Spencer, H. (2020) *The Principles of Biology: Volume 1*. Outlook Verlag.

Sung, W. (2018) *Statistical Physics for Biological Matter*. Springer.

Schrödinger, E. (1992) *What is life?: With mind and matter and autobiographical sketches*. Cambridge University Press.

Schur, C. (2007). Cosmic Code Breakers. *Sky & Telescope*, 32-37.

Traunmüller, H. (2023) The big bang theory: two fatal flaws. *Qeios,* 1-19.

Trouille, L. E., Coble, K., Cochran, G. L., Bailey, J. M., Camarillo, C. T., Nickerson, M. D., Cominsky, L. R. (2013) Investigating student ideas about cosmology III: Big bang theory, expansion, age, and history of the universe. *Astron. Educ. Rev.*, *12*(1), 010110.

Thompson, B., Harrub, B., and May, B. (2003) The Big Bang Theory—A Scientific Critique (Part 1). *Reason & Revelation*, *23*(5), 32-34.

Tully, R. B. (1986) Alignment of clusters and galaxies on scales up to 0.1 c. *Astrophys. J., Part 1, 303, 25- 38*.

Uzan, J. P. (2016) The big-bang theory: construction, evolution and status. arXiv:1606.06112v1.

Vishwakarma, R. G. (2016) Einstein and beyond: a critical perspective on general relativity *Universe*, *2*(2), 11.

Vilenchik, L. Z., and Vilenchik, M. (2019) The Emergence and Evolution of the Universe. *J. High Ener. Phys., Gravit. Cosmol.*, *5*(3), 884- 898.

Veziroğlu, T. N. (2020) Hydrogen & hydrogen energy creating the universe: Spin-Top Theory. *International Journal of Hydrogen Energy*, *45*(11), 6863-6873.

Van Kampen, N. G., Lamprecht, I., and Zotin, A. I. (1982) Thermodynamics and kinetics of biological processes, Walter de Gruyter, New York.

Vidales, C., and Brier, S. (2021) *Introduction to cybersemiotics: a transdisciplinary perspective*. Cham: Springer.

Valageas, P., and Silk, J. (1999) The entropy history of the universe. *arXiv preprint astro-ph/9907068*.

Zobel, D. (2015) *The Science of TV's The Big Bang Theory: Explanations Even Penny Would Understand*. ECW Press.

Weitekamp, M. A. (2017) The image of scientists in The Big Bang Theory. *Physics Today*, 70, 40-48.

Wang, L. J. (2013) An Alternative Cosmology to the Big Bang-Dispersive Extinction Theory of Red Shift. *Appl. Phys. Resear.*, *5*(2), 47-61.

Wells, J. D. (2020) *Discovery Beyond the standard model of elementary particle physics*. Springer: Springer.

Waigh, T. A. (2014) *The physics of living processes: a mesoscopic approach*. John Wiley & Sons.

From Whitehead's conception of Mass and Spacetime towards the Universe as a Giant Carnot Engine

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Whitehead's conception of space and time discloses a substantivalistic 4D-spacetime of observable events. His mass concept makes room for Verlinde's approach of gravity as elastic response of mass created out of the de Sitter Space. By combining Whitehead's concept of observability with Hawking's "Top Down" approach we formulate the Big Bang singularity as creating information out of disappearing Black Holes. We conclude that a Big Bounce-like model is more converging to Whitehead's concept of Nature, and that the creation and destruction of information qubits resemble a "Giant Carnot Engine", a metaphor for the eternal cycle of the Universe.

Keywords: Whitehead, substantivism, spacetime, gravitation, hysteresis and Big Bounce

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1. Whitehead's Nature of Observable Events

Whitehead's motto about the discovery of Nature is summarized by the one-liner, "What is Nature disclosing to the Mind?" (Whitehead, 1920/2007). Observation of events is the cornerstone of any natural science. The Universe is perceived by discerned or discernible factors of natural events with quantifiable properties. Thought projects this countable

representation of natural events on a 4D Minkowski space, in which the events are mapped on continuous space and time coordinates as physical entities. Since Galilei's observation of Jupiter's satellites, the human senses in any experimental setup are substituted by technical devices constructed for detecting boundary conditions to corroborate theories of physical entities representing natural events. It is clear that what nature discloses to the mind and what the mind is disclosing of Nature is deeply entangled in any scientific experiment, provided the respective theoretical and technical feedback are both supported by a widespread scientific community. This suggests some (very weak) form of social constructivism (Kukla, 2000).

Whitehead (2007) argues that extension (space) and duration (time) are both a priori conditions for observability. Events imply extension and distinguishability of a characteristic of a place through a period of time-related to a complex of events. Time is the passage of events. Only extrinsic characteristics are measurable and place-like. As duration is an a priori condition for measurability, duration is connected to the extrinsic characteristic of place. Besides place-like extrinsic characteristics, events are also endowed by non-measurable intrinsic characteristics.

Event-particles are events limited to the ultimate duration and in the 4D Minkowski space projected on instants of time. The latter are abstraction of events-particles or events going to a limited point of duration. Whitehead defined the denotation of an instant of time as "the ideal real of all nature" without any temporal extension or the "non-measurable ideal of the non-entity." Instantaneousness is a concept of all nature at an instant conceived and deprived of all temporal extension (Whitehead, 2007). Temporal and spatial instants as the "ideal real of the non-event" are not real, and consequently, the absolute instants of time "zero" and dimensionless particle-events of spatial "here" are not real either. The ensemble of discernible event-particles is endowed with a Hausdorff topology as a result of separated observations. There is, however, a limit of ultimate expansion called the Planck length.

The concepts of space and time are tightly connected to Whitehead's peculiar conception of mass. A widely accepted connotation of mass considers matter as an a priori substrate of energy and linear momentum in the 4D Minkowski space. Whitehead, however, defined mass as a factor of events implying duration and extension. Extension (space) is the ensemble of bits of factor mass, duration (time) is the ensemble of bits of mass with itself (Whitehead, 2007). According to Whitehead, mass emerges as a factor of an event whose interior character appears as gravitation and whose exterior character appears as movement characterized by energy and momentum (Whitehead, 2007). Therefore, mass as a quantifiable characteristic of events is not observable since it is an intrinsic characteristic. By contrast, luminosity as it appears in the Tully Fisher (1977) relation is an observable extrinsic characteristic, just as Cosmic microwave background radiation (CMBR) (Whitehead, 2007).

Though the space of discernible bits is discontinuous, it can be extended to a continuous space, provided the terms with respect to the bandwidth limit of the Shannon sample theory are accepted (Shannon & Weaver, 1963). Moreover, accepting the UV-cutoff, Kempf (2010) claims an extension of a discontinuous space to a continuous Riemann manifold and even to the Lorentz manifold. In addition, external symmetries are not broken by discretization since theories of discontinuous spaces are equivalent to theories of continuum. The latter claim is of great importance if Whitehead's conception of mass, space and time intervenes with the Quantum Field Theory in order to disclose the essence of gravity.

According to Noether's first theorem (1918/1971), the homogeneity of space and time implies the conservation of linear momentum and energy, respectively, while the isotropy of space involves the conservation of angular momentum. The symmetry properties are put

a priori on the Minkowski container, and the three physical parameters (linear and angular momentum, and energy) are part of the dynamical field. In addition, as per the equivalence of the continuous 4D Minkowski space of entities and the discontinuous spacetime of discernible events, the a priori symmetries are valid in both the former and the latter spacetime.

It is really amazing how a rather philosophical approach to the essence of Nature reveals what was happening at the origin of the Universe by analysing the origin of quantum gravitation in the scope of Whitehead's conception of observability, mass, space and time (Whitehead, 2007). Obviously, the hidden characteristic of mass as factor within the spacetime of events has to be reconciled with mass as a substratum of a dynamical state in the spacetime of entities. To shed light on this conceptual paradox, we examine Verlinde's conception of mass as a hidden variable in its connection to gravitation (2017) in the scope of Whitehead's concepts of Nature. Moreover, we establish the ontological status of the spacetime of events as well as the ontology of the spacetime of entities. The most fascinating challenge, however, is the analysis of Hawking's Top-Down approach to the origin of the Universe in Whitehead's concepts of Nature. Hawking abandoned the Newtonian spacetime and embraced the Leibnizian spacetime, although he never mentioned Newton's German contemporary (Hawking & Hertog, 2006). The Top-Down approach starts from inside the position of the Observer, because it is impossible to inspect the Universe from the outside. Instead of starting from the principle of what the Mind is teaching us, even Hawking started from what Nature is disclosing to the Mind just as Whitehead did. It is this analysis that will result in the rejection of the Big Bang and an alternative approach for a Big Bounce, called the Giant Carnot Cycle Approach. First, we examine Whitehead's critical remarks concerning Einstein's General Relativity, published in the same decade as Whitehead his "Concepts of Nature".

2. Einstein's General Relativity in the Scope of Whitehead's Conception of Mass

Contrary to Whitehead's device, Einstein starts from what the Mind is discovering of Nature. Einstein started from the Newtonian conception of space and time as an a priori continuous 4D Minkowski manifold, in which mass emerges as the substratum of action T_{ij} (Energy Tensor with i,j = 1, …, 4) while reaction is mirrored by the curvature R_{ij} (Curvature Tensor with i,j = 1,…,4) of spacetime. Formally, the dynamic Friedmann-Einstein equation is:

$$R_{ij} + \frac{1}{2} R g_{ij} = \frac{8\pi G}{c^4} T_{ij} \qquad \text{(Eq. 1)}$$

With *G* and c respectively the Cavendish's universal gravitation constant and the maximum speed of electromagnetic radiation in vacuum.

This equation is a corollary derived from the d'Alembert variation principle of minimum action so that any dynamic event is reduced to a static fact (Misner et al., 1973). In the scope of relativity, patterns governed by dynamical gravitation laws are formally equivalent within any inertial reference system linked by a Lorentz transformation, the so-called equivalence principle (Udwadia & Kalaba, 2002). Matter is considered as a substratum of a dynamic state, while the extensive factor of any substratum is reflected in the curvature of its occupied spacetime. Within General Relativity, only geometric curvature deviations of the 4D Minkowski spacetime provide experimental support for the action of gravitation. Obviously, Whitehead's a priori space-like and time-like terms of observability become the final

experimental support for general relativity. Whitehead, however, rejected the geometrical consequences of Einstein' conception of gravitation because spacetime emerged through factor mass is just the a priori condition of observability of the event whose dynamic state is represented by tensor T (Whitehead, 2007). Besides, "impetus" is expressing the character of the gravitational field of activity settling down energy and momentum in the web of space- and time-like events. Observability of the extrinsic dynamical factor of any event provides evidence for its intrinsic gravitation and mass factor. There are two experiments that give evidence for Einstein's claims, namely the Pound-Rebka and Redshift experiments, however, both are recently discussed with critical comments (Verstraeten & Verstraeten, 2022, 2024).

3. Linking Whitehead's Terms of Observability with Verlinde's Conception of Gravitation

According to Verlinde (2017), mass is a hidden variable that changes the entanglement of quantum information considered as the cause of emergence of spacetime and gravity. He makes room for the central role of the Bekenstein-Hawking Entropy (Eq. 2) and the Hawking Temperature (Eq. 3), both corollaries of the thermodynamics of black holes.

$$S_{BH} = \frac{A}{4}\,\mathrm{G}.\frac{h}{2\pi} \qquad \text{(Eq. 2)}$$

Here, *A* is the cosmological horizon, *G* is the gravitation constant, and *h* is the Planck constant., The Hawking Temperature is given by:

$$kT_H = h.g.2\pi.c \qquad \text{(Eq. 3)}$$

Here, *k* is Boltzmann's constant, *h* is Planck's constant, and *g* is the surface gravity at the horizon.

Verlinde, however, extends the former claims to the de Sitter spacetime characterized by a positive cosmological constant and by no boundary at spatial infinity. He restricts the entanglement of dynamic information qubits on one site of the horizon with internal entanglements as well. Adopting the Ryi-Takanayagi formulation (Vidal, 2007), we refer to the well-known area law for entanglement entropy of Casini and Huerta (2009).

The entanglement entropy, however, is the entropy of the non-observable (Casini & Huerta, 2009). Consequently, this entropy is out of the range of Whitehead's spacetime of observable events. Within the de Sitter space, however, some degrees of freedom are thermalized. A nonlocally stored thermodynamic entropy $S_t(V)$ emerges and competes with the entanglement entropy. The result is the emergence of baryons and the creation of mass M. The entropy of the de Sitter space (S_M) declines with an amount (Verlinde, 2017):

$$S_M = 2\pi.\frac{M}{h}.a_0 \qquad \text{(Eq. 4)}$$

With a_0 the Hubble acceleration.

This means that the so-called Coulomb branch mass branches-off from Higg's branch as a stress-strain response of the pre-baryonic Universe (Verlinde, 2017). In Whitehead's conception of observability, the creation of the Coulomb branch out of Higg's branch is

presented as an instant of time. However, since the latter is the ideal real of all nature without any temporal extension, the branch-off is unobservable (Whitehead, 2007).

Moreover, de Sitter space contains exactly the limits of storage capacity by its cosmological horizon. In consequence, thermal volume entropy turns the spacetime into a reactive elastic medium and gravitation. It is fed by the created positive dark energy which emerges from the elastic reaction of the de Sitter space within the cosmological horizon, while the horizon stabilises (Verlinde, 2017). Gravitation is a spacetime reaction to this competition after the production of mass-carrying baryons. Furthered, entropy of the de Sitter space S_M is decreasing and the reason is that thermal entropy contributes to the de Sitter entanglement entropy. Formally:

$$S_M < A(r) + \frac{A(r)}{4}.\frac{h}{2\pi} \qquad \text{(Eq. 5)}$$

The right-hand side is the entropy of a black hole inside the region bounded by surface *A* (Verlinde, 2017, 5). The reactive action of gravitation to the baryon mass escape, minimizes the memory effects on external perturbations in condensed matter. Verlinde identifies the latter as the emergence of apparent positive dark energy. The pressure-less fluid disclosures the emergent nature of gravitation as the intrinsic elastic response of spacetime.

From the first law of horizon thermodynamics, where the Hamiltonian is expressed in terms of the stress tensor and in the regime of Newtonian potential, we express mass in function of the stress tensor (Verlinde, 2017). Finally, it results in the classic Lame equality:

$$\mu \geq 0, \lambda + 2.\mu \geq 0 \qquad \text{(Eq. 6.1)}$$

Where

$$\sigma_{ij} = \lambda.\varepsilon_{kk}.\delta_{ij} + 2.\mu.\varepsilon_{ij} \qquad \text{(Eq. 6.2)}$$

Here σ is the stress and ε is the strain, δ is the Kronecker delta, the indices i and j vary between 1 and 4, corresponding to the time and space coordinates, and *k* indicates the diagonal terms of the matrix. μ and λ are the Lamé parameters.

Since Verlinde does not put a substratum status on mass, and since he does not equate curvature of space with gravitation action, he reformulates gravitation rather as Whitehead's concept of nature. Particularly, the cornerstone role of factor mass for observability of events gives support to the emergence of space and time after the escape of baryonic mass and the reactive force of gravitation, followed by the settling down of energy and momentum in a web of space- and time-like events. Moreover, Verlinde's experimental support for his conception of gravitation sounds analogous to Whitehead's claims about what Nature is disclosing to the Mind. Indeed, Verlinde links his results about visible baryonic matter density to the missing dark matter by means of the Tully-Fisher scaling relation that explains the border flattering of galaxies (Verlinde, 2017). In Verlinde's conception, the baryonic Tully-Fisher scaling relation connects visible baryonic matter Σ_b density to positive apparent matter Σ_D:

$$\sum_D r = \frac{a_0}{8\pi G}.\frac{\sum_b(r)}{(d-1)}\frac{\sum_b(r)}{(d-1)} \qquad \text{(Eq. 7)}$$

Gravitation and Mass correspond to the expanding or shrinking spacetime but not the motion of the hypothetical substratum mass is measured, but the spacetime variation by varying luminosity.

Summarising Verlinde's conception of mass and gravity in Whitehead's claims, observability and experimental databases start when space and time are created by the mass escape due to competition of entanglement of degrees of freedom of stress tensors and thermalization of some bits. The corresponding extensive thermal entropy $S_t(V)$ of the latter, implies extension and duration, and consequently, $S_t(V)$ implies observability of the involved events. The measurement of this event implies that the observable creation of baryonic mass forms part of a set of event particles. The observed events are mapped on the 4D Minkowski space of entities of physics.

4. Does Whitehead's Mass Factor Create its Own A Priori Conditions of Space and Time?

Another challenge to Whitehead's claims about the observability of Nature are Kauffman's claims about the creation of space and time by mass in the environment of galaxies (Kauffman, 2022, 2023). The aim of Kauffman's claims, however, is to discover how the mind can disclose the essence of gravity, mass and spacetime instead of Whitehead's attempt to discover what nature is revealing to the mind. Nevertheless, what Nature discloses to the mind about mass of galaxies does not corresponds to that what the mind is disclosing from nature. Indeed, the galactic rotation curves of lensed galaxies contain a gap between the expected Radial Velocity-Distance curve and the observed curve. The halo of Dark Matter surrounding the galaxies compensates the apparent discordance between observation and the results from fundamental dynamical equations. Dark Matter is not observable and in Whitehead's concepts of Nature this means that there is neither duration nor extension of the mentioned dark matter, or, in other words, there is no space nor time. It is not surprising that there are many theoretical proposals to overrule this discordance. One of the most recent proposals is the claims of Yahalom (2021, 2023), who explains the discordance by a retardation theory for galaxies. For large distances from the centre of the galaxy, attractive or repulsive retardation forces produced by density variation of mass accreted from the intergalactic medium are so substantial that they cannot be neglected. However, Yahalom adopts the classical substratum status of mass.

On the contrary, Kauffman proposes the creation of space and time by mass starting from a SU(3)+SU(2)+SU(1) symmetric Quantum Gravitation Field. SU(n) with n, 1,2,3 are Special Unitary groups of the Standard Model of Particle Physics describing electromagnetic, weak and strong interaction respectively. Kauffmann adopts the substratum status of mass. Contrary to previous proposals, he starts from non-locality because General Relativity and Quantum Gravitation are not yet reconciled due to their Locality (Kauffmann, 2022). Non-locality consists of N entangled coherent particles in the Hilbert Space. The triangle inequality of the von Neumann Entropy of a pair of entangled particles is a real number distance between 0 and ln(N), with N the number of entangled particles. Thus, this is a Metric in Hilbert Space and sequential actualization converts the potentia in Hilbert space to spacetime. That process is governed by creating space and time by mass. This actualization emerges as observable parameters. Consequently, Local Theories such as String Theory and Holographic approaches are not fundamental because of the locality of Space and Time. Kauffmann posits an alternative dynamical equation for the Friedman-Einstein equation. The latter is completed with a scalar mass term multiplying the dynamical tensor T_ij in order to create a spacetime-creating field Kauffman 2023). Eq. 1 transforms into

$$R_{ij} + K_{ex} M \frac{1}{4} T_{ij} = k T_{ij} \qquad \text{(Eq. 8)}$$

With k is a scalar, $K_{ex}M$ represents a mass creating operator.

Besides, the Friedman-Einstein equation as well as Kauffman's modification, describe the dynamical state within the space and time of Whitehead's entities. Kauffman supports his claims by the baryonic Tully-Fisher relation that the maximal rotation velocity of a galaxy, V, scales as V^4 proportional to Baryonic Matter. Hence there is no doubt that this relation is a relation between factors of events from the point of view of Whitehead.

Obviously, Kauffman makes room for Whitehead's spacetime of observable events since the experimental gauge of his claims is supported by the experimental baryon-like Tully-Fisher relation connecting luminosity to mass density in galaxies. However, a fundamental paradox arises: how can the Non-Local Quantum Gravity entanglement of masses within the Hilbert spacetime of entities be reconciled with Whitehead's spacetime of events characterised by the factor mass wherein mass refers to something else? Furthermore, Kauffman's claims of spacetime production by matter is in contradiction to Verlinde's conception of gravity as a memory effect of spacetime to baryonic production. Indeed, how can gravity as the memory effect of spacetime already have arisen when spacetime is the product of the mass factor hiding the essence of gravity since the memory precedes its own cause? Moreover, as Verlinde defines baryon creation as a result of the transition from the Higg's branch to the Coulomb branch, it is out of the question that the pre-baryonic ensemble of elementary particles is endowed with an actual SU(1) symmetry, unless the pre-baryonic ground state of the de Sitter space just contains massless energy bits of weak and strong core interactions. Provided that the symmetry properties are connoted as excitation propensities with very low probability, massless energy bits produce baryonic masses as well as space and time. Obviously, by actualizing the creation of baryons, the potential SU(1) symmetry propensity increases dramatically, and the propensity to create space and time is accompanied by the propensity to create baryonic masses of the Coulomb branch. Furthermore, Whitehead's intrinsic unobservable factor 'gravity' considered as memory effect appears by luminosity while mass intervenes as an intrinsic unobservable factor. But Kauffman's dynamical ensemble of pre-baryonic information units stays unobservable, and similarly, the baryon branching off as instant derived from Eq. 8 within the formal spacetime of entities, is a typical example of Whitehead's ideal/real of the non-event.

What about a negative K_{ex} term in Eq. 8? Does it mean that spacetime annihilation to massless information bits is also possible? In that case, spacetime contraction alternates with spacetime expansion. In terms of Verlinde, this situation corresponds to a Lamé-elastic response of spacetime with strain exceeding stress, while gravity disappears and the extensive thermodynamic entropy decreases. For now, let us leave aside further speculations and turn back to the ontological status of spacetime of entities in its relation to the spacetime of events.

5. The Ontological Status of Spacetime of Events and Spacetime of Entities

Within Whitehead's spacetime of entities the Friedmann-Einstein dynamic equation (Eq. 1) and Kauffman's alternative claims (see Eq. 8) adequately describe the external world. The realistic point of view is straightforward because natural facts are discovered and not constructed. Though Verlinde's holographic approach of the de Sitter space adopts two mathematical artifacts by analytically extending the anti de Sitter space and putting the compatibility of his claims with string approaches, nevertheless Verlinde makes room for a realistic point of view by connecting his theoretical claims to the baryonic Tully-Fisher

relation. And so does Kauffman. Moreover, the ontological status of the spacetime of entities is endowed with an a-priori symmetry while mass as a substratum of dynamic fields is not directly related to spacetime's existence. Consequently, matter has its own ontological status. In fact, the above-mentioned approaches of spacetime of entities are 4D containers of different units of mass. Recently Luty proposed the dualistic claim of spacetime realism (Luty, 2023). But what about the Whitehead's spacetime of events to which all mentioned authors are referring for experimental support for their claims?

According to Whitehead's conceptions, this spacetime of events is considered as substantivalism, provided gravity is a field hidden by a factor mass that is the constructed Coulomb branch in sequence of the simultaneous construction of space and time by the Higg's branch. Whitehead's spacetime is a thing besides other things and it exists as an event because nothing exists in Nature besides events. So, we claim the term super-substantivalism. Therefore, we must cancel dualistic realism of the spacetime of entities and leave alone the substratum status of mass. But what remains of spacetime realism?

Concerning Kauffman's formal Eq. 8, from the epistemological point of view there still exists an experimental method to support the predictions, namely the baryonic Tully-Fisher equation. Semantically, however, mass is no longer a substratum but transforms to a formal operator creating space and time. Metaphysically, the existence of space and time is indisputable but it is no longer the 4D container filled with matter, instead created space and time is the super-substantivalistic ensemble of events. Moreover, space and time do not coincide with the field of real numbers. Events are fractioned in extension and duration, and consequently the spacetime of events is ordered along four ordered rings of rational numbers.

What about realism of the spacetime of entities beyond the domain of observable events? Does the creation of space and time also exist beyond the borders of the past and future light cone? The actual "now" and "here" observe only events within the past light cone and it can only influence events within the future light cone. Insofar as events within the light cone are influenced by phenomena from without, realism extends the horizon of events. The cosmological horizon of de Sitter space is the absolute metaphysical border of spacetime of entities. Spacetime of events, however, is a thing limited by the a priori terms of observability of extrinsic characteristics of events. Metaphysical claims beyond this "thing" are pure speculation and deny the epistemological terms of realism. Furthermore, the super-substantivalism approach of Whitehead's concepts of Nature puts even more restrictions on possible speculations and ontological claims. Indeed, as extension and duration appear after baryonic creation and the gravity-memory reaction of space and time, claims about what precedes and what is happening after space and time destruction are out of the question. Before and afterwards, there is no 'thing' and in consequence metaphysically there exists nothing in the scope of Whitehead's super-substantivalism.

6. Hawking's Holographic Top Down Approach in the Scope of Whitehead's Terms of Observability of Events

Though the rationale of technical laboratory settings is in accordance with some physical theory, the realistic point of view about the spacetime of entities guarantees the adequacy of the experimental results as the actualization of facts corresponding to the respective events. However, Whitehead's substantivalism of spacetime of events and his conception of mass imply particular speculations about the origin and corruption of the Universe. Thus the absolute Big Bang of the Universe as an original pointless instant of time is an acceptable conception in the spacetime of entities – provided realism is accepted -- in the spacetime of

events. The Big Bang, however, reduces to the ideal/real of the non-event. Indeed, without space and time, there can be no observable events, furthermore according to Kauffman no baryons, no creation of space and time and, furthermore, no gravity, according to Verlinde. Nevertheless, Whitehead's spacetime of events can be integrated within the holographic top-down conception of the Universe by Hawking (2016) as a representation of the de Sitter space.

Within Whitehead's spacetime of entities, Hawking adopted the holographic conception of the Universe to reconcile Quantum Gravitation and General Gravity. His final ambition is shedding light on origin, evolution and observation of the Universe. Though the expanding de Sitter space is not bordered by a horizon, he defines a 3D hologram containing a finite amount of information bits, the so called qubits, stored in micro squares with the Planck Length as rib. The holographic surface is endowed with a Quantum Field Theory without Gravitation. By entanglement of bits, the spacetime is an actualization of the entanglement. However, the entangled information is spread out over more than one actualization, according to the respective wave function. Projecting the hologram on a two-dimensional surface, the amount of matter declines from the external circular border to the centre of the circular projection. Time and space are completely and mutually entangled in the deep origin of the Universe when the finite bits cease to be entangled. Consequently, duration and extension flow into each other and observation on the 3D hologram of extension of entanglement results in traveling back to the origin of the Universe.

Back to Whitehead's conception of observation, duration and extension right now. Although spacetime of events is a 4D thing as the result of qubits entanglement, the first question arises which actual representation of the respective information wave function corresponds to the actual 4D spacetime of our observations of events? Secondly, as emerging duration and extension are essential a priori conditions of observable factor mass, what happens in case of the complete merging of space and time? Regarding the first question, however, we adopt Boltzmann's claims about the Stosszahlansatz from the statistical Boltzmann formulation of thermodynamic entropy: the actually observed spacetime actualization of events is the most probable for now. What about the second question? Following Whitehead's terms of observability of events by the factor mass we conclude that this actualization of qubit entanglement is not observable. As extension and duration are substantial conditions of observability of the factor mass, observation starts and ends with the appearance of extrinsic characteristics referring to the gravity hidden by the factor mass. Nevertheless, Whitehead's rejections concerning observability of the pre-baryonic Universe cannot claim any proposition about the ultimate event called the "Big Bang". At first glance, the absolute origin of the Universe cannot be confirmed or denied. Primordially we make room for a logical counter-argument. Indeed, Popper already claimed the nonexistence of a central source causing the singularity of the outgoing and contacting waves (Popper, 1956a; b; 1957). According to Popper's claims, even the singularity of the Big Bang evolving from a central source, sounds rather odd.

More analyses of the creation of space and time is required to shed light on the so-called absolute origin as well as the absolute corruption of our Universe. Therefore, we examine the role of internal black energy – also called black holes – in connection with the entanglement of qubits on the external hologram. Particularly, within Whitehead's concepts we examine the role of Hawking Radiation (Hawking, 1974) in the framework of Verlinde's creation of baryons out of excitation of the de Sitter ground state and Kauffman's creation of space and time by mass.

The information stored in a black hole is finite and lost by radiation energy. The latter is thermalized. Verlinde did not mention the origin of the thermalized excitation of the entanglement of qubits, but it cannot be ruled out that this concerns the Hawking radiation. Furthermore, elementary massless particles, besides matter, are created and, following Kauffman, the latter is the source of the creation of space and time. Mass depletion of a black hole exceeds the critical temperature of a black hole, and the black hole disappears. Moreover, even the qubits of the hologram are finite, so that after depletion entanglement becomes very unlikely. As a consequence, baryon production decreases, and so does space and time production. Furthermore, the elastic memory reaction of spacetime of gravitation hidden by the factor mass collapses. Indeed, referring to the Lame formula, the Strain μ component exceeds the Stress component λ, and the hysteresis curve of the elastic medium breaks down. Even the energy of the black holes depletes, and the production of space and time shrinks.

At the origin of the Universe space and time interweave, or in terms of Whitehead's spacetime of events duration and extension flow together. In the scope of his concepts of space and time, all information of an extensive characteristic is enclosed in a moment or duration of minimum extension, representing all nature at an event-particle or instant. Any physical body is a mere aggregate of event-particles, illustrated by a certain quality of position. A body which does not lie completely on a moment will be called vagrant. A vagrant route, called a station, is intersected by a moment in just one event-particle. Two stations belonging to the same duration cannot intersect unless space and time interweave when baryon production ceases by depletion of qubits (Whitehead 2007, chapter 5). Though unlikely, according to Popper, the whole Universe collapses towards a situation that is pretty similar to the Origin of the Universe and its corresponding Big Bang. The latter event is confirmed by the discovery of the CMB by Penzias and Wilson (1965). The information, however, cannot disappear or be destroyed either. In consequence, Whitehead's contracted substantivalistic ensemble of events can be realistically represented by a hologram containing all past information to start a new cycle of qubit entanglement and a new inflating Universe. This scenario looks rather more to a Big Bounce Universe than Lemaitre's Big Bang (Lemaitre, 1931) and corresponds more to Penrose's claims (Penrose, 2010). The cyclic expansion and contraction of the Universe is governed by the transformation of a hologram of free qubits into entanglement and thermalization, eventually to a new hologram of free qubits. Instead of Big Bounce, we rather prefer to label the cycling Origin and Corruption of the Universe as the Giant Carnot Cycle because the source of information becomes sink and sink becomes the new source of information.

7. Conclusions

(i) Whitehead's conception of mass as factor of events breaks with the widely accepted concept of the substratum, but makes room for recent cosmological propositions claiming the alternative conception of mass as hidden factor of dynamical Fields. According to Whitehead, mass emerges as the characteristic of an event whose exterior side appears as gravitation and its interior side as movement characterized by energy and momentum (Whitehead, 2007, 20-23). His conception of space and time of events is a substantivalistic thing. Space and time of entities, however, are endowed with realism.

(ii) Whitehead's refutation of the pure geometrical interpretation of General Relativity and particularly the central role of gravity as symmetry breaking of the Euclidean manifold,

supports Verlinde's alternative conception of Gravity. He puts forward the idea which he called `impetus`, expressing the characteristic of the gravitational field of activity.

(iii) Kauffman's claims concerning mass as drive of space and time creation, complete Verlinde's baryon creation by thermalized excitations of entanglement of qubits and determine the frontier of observability of events according to Whitehead's standards.

(iv) Against the background of Verlinde's and Kaufmann's claims about gravity and space and time production, Whitehead's concepts of mass, space and time transforms Hawking's top-down approach of Origin, Evolution and Observation, from a Big Bang to a Big Bounce Universe or metaphorically to a Giant Carnot Cycle.

🕮 References

Casini, Horatio and Huerta, Marin (2009) Entanglement Entropy in free Quantum Field Theory. *J. Phys.* A4 2504007, https://doi.org/10.1088/1751-8113/42/50/504007.

Hawking, Stephen W (1974) Black hole explosions. *Nature*, 248, (5443); 30-31.

Hawking, Stephen W., Hertog, Thomas (2006) Populating the Landscape. A Top-Down Approach. *Physical review* D 73: 123527.

Hawking, Stephen W. (2016) *The Origin of the Universe.* Proceedings of the Plenary Session 25-29 November 2016, reds. W. Arbers, J. von Braun, M. Sanchez Sorondo. City of Vatican, 2020. Acta 24.

Kauffman, Stuart A. (2022) Quantum Gravity If Non-Locality is Fundamental. *Entropy*, 24(4), 554.

Kauffman, Stuart A. (2023) *Notes on Quantum Gravity, Dark Matter and Dark Energy*. In The Third *Minkowski Conference on the Foundations of Spacetime Physics*. September 11-14 2023, Albena.

Kempf, Achim (2010) Spacetime could be simultaneously continuous and discrete, in the same way that information can be. *New Journal of Physics* 12, 115001.

Kukla, André (2000) *Social constructivism and the philosophy of science*, Routledge, London and New York.

Lemaitre, Georges (1931) The Beginning of the World from the Point of View of Quantum Theory. *Nature*, 127 (3210), 706, https://doi.org/10.1038/127706b0.

Luty, Damian (2023) *Spacetime realism against supersubstantivalism*. In Third Hermann Minkowski Meeting on the Foundations of Spacetime Physics 10.09.2023 – 14.09.2023 Albena, Bulgaria.

Misner, Charles W, Thorne, Kip S, and Wheeler, John A. (1973) *Gravitation*. San Francisco: Freemand and Company.

Noether, Emmy (1971) Invariant variation problems. *Transport Theory and Statistical Physics*, 1(3), 186-207.(M. A. Tavel's English translation of "Invariante Variationsprobleme," Nachr. d. Köonig. Gesellsch. d. Wiss. zu Göttingen, Math-phys.1918 Klasse, 235-257. https://doi.org/10.1080/00411457108231446

Penrose, Roger (2010) *Cycles of Time: An Extraordinary New View of the Universe*. London: Bodley Head.

Penzias, Arno A., Wilson, Robert W. (1965) A Measurement of Excess Antenna Temperature At 4080 Mc/s*. *Astrophysical Journal Letters*. 142, 419-421.

Popper, Karl R. (1956a) The arrow of time. *Nature*, 177, 538.

Popper, Karl R. (1956b) Irreversibility and Mechanics. *Nature*, 178, 382.

Popper, Karl R. (1957) Irreversible Processes in Physical Theory. *Nature* 2, 179, 1297.

Shannon, Claude E. and Weaver Warren (1963) *The Mathematical Theory of Communication*. Champaign, IL: University of Illinois Press.

Tully, R. Brent and Fisher, J.Richard (1977) A New Method of Determining Distances to Galaxies. *Astronomy and Astrophysics*, 54, 661-673.

Udwadia, Firdaus E., and Kalaba, Robert E. (2002) On the Foundations of Analytical Dynamics. *Int. Journal Nonlinear Mechanics*, 37(6), 1079- 090.

Verlinde, Erik P. (2017) Emergent Gravity and the dark Universe. *SciPost Phys*. 2, 016, http://arxiv.org/abs/1611.02269v2.

Verstraeten, Guido J.M. and Verstraeten, Willem W. (2022) Accessing a Big Bounce Universe with Concealed Mass and Gravitation. *Philosophy and Cosmology*, 28, 2022, 32-40.

Verstraeten, Guido J.M. and Verstraeten, Willem W. (2024) *Concealed Mass and Gravitation within Whitehead's conception of observability in space and time suggest a Big Bounce Universe*, In Eric Ling and Annachiara Piubello (Eds), Spacetime 1908-2023. Selected peer-reviewed papers presented at the Third Hermann *Minkowski Meeting on the Foundations of Spacetime Physics*, pp. 63-72, 11-14 September 2023, Albena, Bulgaria (Minkowski Institute Press, Montreal 2024).

Vidal, Guifré (2007) Entanglement renormalization*. Phys. Rev. Lett.*, 99, 220405.

Whitehead, Alfred, N. (2007) *The Concept of Nature*. New York: Cosimo Classics.

Yahalom, Asher (2021) Tully–Fisher relations and retardation theory for galaxies. *International Journal of Modern Physics D* Vol. 30, No. 14, 2142008-1-8.

Yahalom, Asher (2023) *Hermann Minkowski's Spacetime and the "Dark Matter Problem¨*. In Eric Ling and Annachiara Piubello (Eds), Spacetime 1908-2023. Selected peer-reviewed papers presented at the *Third Hermann Minkowski Meeting on the Foundations of Spacetime Physics*, pp. 63-72, 11-14 September 2023, Albena, Bulgaria (Minkowski Institute Press, Montreal 2024).

Section Two
NATURE AND CIVILIZATION

Cosmos-Containing Mental Disorders: Phenomenological Advancing for Psychopathology and Philosophy of Psychiatry

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Rudenko, Sergii, Mykhailo Tasenko and Yevheniia Levcheniuk (2025) Cosmos-Containing Mental Disorders: Phenomenological Advancing for Psychopathology and Philosophy of Psychiatry. *Philosophy and Cosmology*, Volume 34, 67-84. https://doi.org/10.29202/phil-cosm/34/4

The study explores the potential of phenomenological psychopathology to describe the experience of individuals with cosmos-containing mental disorders. These disorders are examined through the frameworks of psychiatric classifications such as the ICD-10 and DSM-5 while integrating insights from phenomenology, psychiatry, philosophy, and cultural psychiatry. The investigation employs interdisciplinary, comparative, phenomenological, and descriptive methodologies. These approaches integrate perspectives from phenomenological psychopathology, philosophy of psychiatry, and cultural psychiatry, using the frameworks of ICD-10 and DSM-5. The phenomenological method provides a nuanced description of the altered life dimensions of affected individuals, while the interdisciplinary approach synthesises insights from multiple disciplines to contextualise cosmos-containing mental disorders.

Through the analysis of clinical cases, the authors demonstrate the distinct manifestations of cosmological content in mental disorders. A notable challenge identified is patients' frequent dissimulation of symptoms, which complicates the diagnostic process and subsequently affects the efficacy of psychopharmacological and psychotherapeutic interventions. The findings underscore the value of incorporating phenomenological psychopathology into traditional diagnostic practices, enabling a more comprehensive understanding of these unique symptoms.

The findings highlight the necessity of incorporating phenomenological psychopathology into psychiatric practice to improve diagnostic accuracy and treatment outcomes for cosmos-containing mental disorders. Ethical concerns, including stigma, discrimination, and social exclusion, are underscored, emphasising the importance of raising awareness among non-mental health professionals. Enhanced understanding of the unique experiences of these individuals is crucial for early diagnosis and reducing societal stigma.

Keywords: cosmos-containing mental disorders, phenomenology, phenomenological psychopathology, philosophy of psychiatry, hallucinations, delusions, oneiroid syndrome, cultural psychiatry, cosmology

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Introduction

Cosmos-containing mental disorders are a unique phenomenon in psychiatry and psychopathology. These disorders often involve symptoms such as hallucinations and delusions related to concepts of the creation, development and structure of the universe. While this aspect of the disorders is not new, insight is being gained through phenomenological psychopathology, which allows researchers to gain a deeper understanding of the subjective experiences of individuals suffering from mental disorders.

The cosmological content of these mental disorders reflects a deep inner connection between a person's mental state and his or her perception of the macrocosm. Patients with these disorders may see themselves as part of a larger cosmic order or believe they have a special role in cosmic events. For example, some may believe they are a prophet or messenger from another world with special knowledge or abilities. These beliefs may manifest as complex hallucinations in which patients see or hear deities or other supernatural beings.

Delusions may include the belief that cosmic forces influence them or that their actions can affect the course of cosmic history.

Phenomenological psychopathology allows researchers to focus on the experience of mental disorders and their interpretation by patients with cosmos-containing mental disorders. This approach attaches importance not only to the external manifestations of symptoms but also to the inner world of patients and their subjective perception of reality. Phenomenological psychopathology examines how patients perceive and interpret their experiences, what cultural and personal factors influence their beliefs, and how these beliefs are reflected in their behaviour. This leads to a deeper understanding of mental disorders and allows for a more sensitive approach to diagnosis and treatment tailored to the individual needs of the patient.

A phenomenological approach also allows researchers and clinicians to better understand how patients integrate their cosmological beliefs into their daily lives. This may include examining how patients use these beliefs to explain or respond to their experiences. For example, patients may use cosmological beliefs to give meaning to their symptoms or to create a sense of control over their lives. This is particularly important when patients feel anxious or fearful about their symptoms and are looking for ways to cope.

In addition, a phenomenological approach can help to develop more effective therapeutic interventions for patients with cosmos-containing mental disorders. Therapists can use phenomenological methods to help patients understand and interpret their cosmological experiences and find ways to integrate these experiences into their lives. This may include methods such as narrative therapy or cognitive behavioural therapy to help patients understand their experiences and develop healthier ways of responding to them.

Disorders of the psyche and behaviour with cosmological content are a complex and multifaceted phenomenon that requires a careful and delicate approach by researchers and clinicians. Their in-depth study requires a combination of methods from phenomenological psychopathology, cultural psychiatry and philosophy of psychiatry, and an explanation of their origin through the dominant model in modern psychiatric practice.

A further problematic issue is the ethical challenges that may arise from stigmatisation, over-prescribing of medications and lack of public trust in people with mental disorders.

The Phenomenological Approach in Psychopathology and Psychiatric Practice: a Research Background

Phenomenology is a philosophical tradition initiated in the first half of the twentieth century by Edmund Husserl and further developed and improved by Martin Heidegger, Maurice Merleau-Ponty, Jean-Paul Sartre, and others. In the twentieth century, phenomenology became a central philosophical movement and field of research.

The methods and characteristics of phenomenology as a philosophical discipline were widely discussed by Husserl and his colleagues, and they are still a field for current and future research.

Phenomenology involves a careful, unbiased description of conscious, subjective experience, without imposing an external explanatory framework, whether from the natural or social sciences or ordinary language.

In modern philosophy of mind, psychiatric and psychological research, the use of the term "phenomenology" is limited to the description of sensations that occur in sensory analysers such as sight, hearing, smell, taste and touch. However, our experience usually has a much richer content than just sensations. On this basis, the phenomenological tradition provides a

much wider range of meanings that are reflected in our experience, in particular, the meaning of objects in the world around us, past, present, and future events, the flow of time, perception, thinking, memory, imagination, emotions, desires and will, bodily awareness, awareness of the self, its structure and stability, embodied action and social activity, including language activity.

The structure of these forms of experience, according to Husserl, includes "intentionality". That is the orientation of experience towards things in the world, the property of consciousness to be conscious of or about something. According to Husserl's classical phenomenology, our experience is directed to things and represents or "intends" them, only through certain concepts, thoughts, ideas, and images (Woodruff, 2018). They are the content of this experience and differ from the things they represent or signify.

The basic intentional structure of consciousness, which we find in reflection or analysis, includes further forms of experience. Thus, phenomenology develops a comprehensive description of temporal awareness, spatial awareness, attention, awareness of one's own experience, self-awareness, self in different roles, embodied action, purpose or intention of action, awareness of other people, language activity, social interaction of everyday activity in the world of life (Woodruff, 2018).

The continued attraction of the phenomenological approach to research in the social, behavioural, and medical sciences lies in the persistent advocacy of the importance and anti-reductionism of subjectivity and the detailed analysis of the structures of the lived world.

Contemporary phenomenology is not only characterised by research in its subject field. Today, it is a set of interdisciplinary projects. Phenomenology actively interacts with cognitive sciences, psychiatry, literary studies, gender studies, and theology. This openness to new interactions, the creation of new approaches, and convergence is the most significant and characteristic trend in contemporary phenomenology. These studies lead to the improvement and expansion of the boundaries of the phenomenological method in other fields of scientific research and the development and filling of phenomenology in general with new theoretical and practical perspectives.

Below are some examples of such interaction.

The cognitive sciences integrate the phenomenological methods and conceptual apparatus of phenomenology into their empirical research. One such project has become neurophenomenology or frontal phenomenology. They are designed to investigate and demonstrate the correlation of first-person data with third-person data obtained through neuroimaging. Another example is the objectification of first-person phenomenological description through mathematisation.

In general clinical medicine and bioethics, phenomenology is becoming a platform for integrating discourses about the body and bodily processes into clinical practice. Here, the phenomenological method is used to describe a patient's subjective experience of somatic disease and the changes in the physicality that it causes. This experience is expressed in interrelated dimensions, such as material, affective, functional and social. That is why the language and methods of the medical sciences cannot comprehensively capture the entire experience of disorders. The involvement of phenomenology can provide such an opportunity (Adamiak & Pokropski, 2018: 12).

Before we begin to review the use of phenomenology in psychopathology, a brief definition is necessary.

Psychopathology is a branch of general psychiatry and clinical psychology. It is a branch of scientific and clinical research that focuses on the observation, description and evaluation

of abnormal cognition, inappropriate behaviour and experiences that accompany mental and behavioural disorders and contrast sharply with generally accepted social norms. Based on the subject of its study, psychopathology is divided into general and special.

General psychopathology studies the main symptoms and syndromes common to many mental diseases, patterns of manifestation and development of mental pathology, general issues of aetiology and pathogenesis, and the nature of psychopathological processes, their causes, principles of classification, methods of research, and treatment.

In turn, specialised psychopathology studies changes in human mental activity in specific mental disorders (e.g. schizophrenia, generalised anxiety disorder), their aetiology, pathogenesis, clinical manifestations, developmental patterns, treatment and rehabilitation.

The main method of diagnosis within the framework of general psychopathology in psychiatric practice is a clinical (psychiatric) interview. During the interview, the psychiatrist, in a certain sequence, examines various areas of mental activity for the presence of pathologically altered processes. For example, they examine attention, memory, emotions, cognitive skills, imagination, and orientation in oneself and the surrounding area.

Karl Jaspers' seminal work *General Psychopathology* was the first to outline the connection between phenomenology and psychopathology. He argued that, unlike general psychopathology, which focuses only on the objective side of the information that a psychiatrist receives from a patient or their relatives, phenomenological psychopathology would provide clinicians with the tools to "intuitively imagine" a patient's experience of mental disorders (Dey et al., 2020: 915).

Phenomenological psychopathology is an interdisciplinary project that aims to assess and describe the abnormal subjective experiences of a mental disorders patient through changes in their basic existential structures, such as selfhood, spatiality, embodiment, temporality, affectivity, understanding, and intersubjectivity (Messas et al., 2018, p. 1).

Phenomenological psychopathology attempts to describe the diversity of empirical variations and differences and to set aside socio-political and scientific views of what is considered a mental and behavioural disorder. It attempts to find, identify and demonstrate what is 'human' about the irrational phenomena of mental disorders. If we take the position that the most important task of psychiatry is to understand mental suffering, then its project should be to articulate each person's life world and identify the conditions for the possibility of pathological phenomena in human existence. This can shed light on the structure, meaning, and significance of the phenomenon under study. Phenomenological psychopathology can help us rethink the meaning of psychopathological conditions.

Psychiatric and psychopathological research has had a close and fruitful relationship with philosophical phenomenology. Leading philosophers such as Husserl, Stein, Heidegger, Gadamer, Sartre, Merleau-Ponty, Ricoeur, and Levinas, and psychiatrists and psychologists such as Jaspers, Binswanger, Boss, Fanon, Laing, Minkowski, Strauss, Krachmer, Tellenbach, Blankenburg, Kimura, and Basaglia, have conducted research in phenomenological psychopathology.

The result of fundamental research in recent years in phenomenological psychopathology is *The Oxford Handbook of Phenomenological Psychopathology* by G. Stanghellini, M. Broome, A. Fernandez, P. Fusar-Poli, A. Raballo, and R. Rosfort. The manual consists of six sections that comprehensively cover the history of development, specificity of the phenomenological method in psychopathology, the main conceptual categories, the application of phenomenological psychopathology in direct clinical practice (for example, in describing the lived experience of schizophrenic spectrum disorders, verbal and auditory

hallucinations, and delusions) and describes the current state and prospects of research on phenomenological psychopathology in the fields of neurology, psychotherapy, general and special ethics, political and social regulation of mental health issues (2019: 34).

In the article *New Perspectives in Phenomenological Psychopathology: Its Use in Psychiatric Treatment*, G. Messas, M. Tamelini, M. Mancini and G. Stanghellini demonstrate how modern models based on the principles of phenomenological psychopathology can be used in direct clinical practice, using the example of the dialectical-proportional approach and the personality-oriented dialectical approach in the implementation of therapeutic measures.

The study *Phenomenology as a Resource for Translational Research in Mental Health: methodological trends, challenges and new directions* by R. Ritunnano, D. Papola, M.R. Broome, and B. Nelson emphasises the importance of understanding the experience of mental disorders using the methods of phenomenological psychopathology, pointing to the need for their integration into direct clinical practice, which will increase the emphasis on the subjective structure of the patient's experience when planning psychological and psychotherapeutic interventions.

H. R. Neto and A. Tomé's phenomenological analysis of post-traumatic stress disorder (PTSD) using phenomenological interviewing in the article *Phenomenological description of PTSD through a case* demonstrated the need for an interdisciplinary approach to the process of initial diagnosis and further classification of symptoms that correspond to the diagnosis of PTSD. Since existing diagnostic systems, such as the International Statistical Classification of Diseases and Related Health Problems-10 (ICD-10) and the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-5), do not take into consideration the specifics of a person's experience of mental disorders, this can lead to an inappropriate diagnosis.

In the article *The Phenomenological Model of Depression: From Methodological Challenges to Clinical Advances*, O.O. Frohn and K.M. Martiny proposed a phenomenological model of depressive disorder based on a semi-structured phenomenological interview. The authors emphasize the possibility of improving the provision of psychotherapeutic care for depression, including art therapy and complementing existing diagnostic scales and clinical guidelines.

In Ukrainian psychotherapeutic practice, the use of phenomenological psychopathology is represented in the practical application of existential-analytical psychotherapy in the Second Inpatient Department of the Lviv Regional Psychoneurological Dispensary (Zabor & Filts, 2018: 29).

The history of the interaction between philosophy and psychiatry begins in the late nineteenth century. This interaction can be divided into four stages: the initial stage (S. Freud, E. Bleuler), the syncretic stage (phenomenological psychiatry: K. Jaspers, E. Minkowski, E. Strauss, V. Emil von Gebsattel, L. Binswanger, and existential analysis: M. Heidegger, M. Boss), the practical or anti-psychiatry stage (R. Laing, D. Cooper, T. Saas) and the stage associated with the formation of an interdisciplinary project in the late twentieth century, which is positioned by its representatives as a philosophy of psychiatry (Dariienko, 2022: 60).

The first stage of this interaction was characterized by humanization in psychiatry. The development of phenomenology at that time meant the necessity of research in psychiatric practice that appealed to the experience of mental disorders. The second stage (syncretic) was characterized by the development of the phenomenological approach in psychiatry and the creation of new categories and concepts in the study of mental disorders. The phenomenological method was constituted as one of the main methods for describing the

experience of mental and behavioural disorders and abnormal experiences. The stage of anti-psychiatry was characterized by several objections and criticisms of the postulates of classical psychiatry. These included the questioning of the reliability of psychiatric diagnosis, the grounds for its determination, the analysis of the potential effectiveness and harm to the individual's life world associated with the use of psychopharmacology, the inability of biological psychiatry to explain the origin and development of mental disorders only in terms of, for example, molecular theory, and ethical and legal issues affecting patient autonomy and the restriction of their civil liberties. The last stage, the philosophy of psychiatry stage, is characterised by the study of psychiatry as a science, using the tools of the philosophy of science more broadly, involving the study of concepts used in the study of mental disorders, including the experience of mental disorders, its phenomenological analysis, normative issues that arise from the understanding of this experience and the study of the links between psychopathology and the philosophy of consciousness (Adamiak & Pokropski, 2018, p. 11; Dariienko, 2022: 61-62).

One of the main texts in the field of philosophy of psychiatry is *The Oxford Handbook of Philosophy and Psychiatry* by K. W. M. Fulford, M. Davies, R. Gipps, G. Graham, J. Sadler and G. Stanghellini. The handbook brings together a representative cross-section of the new field of research between philosophy and psychiatry. The authors note that the material presented is of immediate practical relevance and reflects several innovations that reflect the lively dynamic between theory and practice that is such a characteristic feature of the philosophy of psychiatry. The materials presented in the handbook are based on direct clinical cases, and the structure is built around the stages of the clinical encounter between patient and clinician to better reflect the problematic issues of diagnosis, classification, and treatment of mental disorders (Fulford et al., 2013: 6).

The next important work in recent years in the philosophy of psychiatry is *Philosophy of Psychiatry*, edited by Sam Wilkinson. According to the author, this is a textbook for undergraduate and graduate students studying philosophy and seeking to deepen their knowledge of the philosophy of psychiatry. An important note from the author indicates the growing demand for the study of the philosophy of psychiatry as a philosophical discipline in universities in the training of certified specialists in philosophy. Wilkinson examines in detail the definition of "mental disorders," the concept of "diagnosis," and the analysis of the criteria for its assessment, the role of cultural and religious background in the diagnosis of mental and behavioral disorders. The philosophical conceptualisation of schizophrenic spectrum disorders, depressive disorders, delusions and addictions is also provided.

The growing interest in the philosophy of psychiatry and its formation as an independent philosophical discipline is evidenced by the book *Continental Philosophy of Psychiatry* and the creation of scientific communities and associations around it, for example, The Association for the Advancement of Philosophy and Psychiatry, The International Network for Philosophy and Psychiatry, which organise joint research, conferences and educational programmes. It also launched scientific journals aimed at highlighting topical issues of philosophical understanding of psychopathology and building strong interdisciplinary links between philosophy and medicine, such as the journal *Philosophy, Psychiatry, & Psychology*, which has been covering various philosophical aspects of psychopathology and psychiatric methodology since 1993. Research on the philosophy of psychiatry is regularly published in interdisciplinary journals such as *The Journal of Medicine and Philosophy*, *Philosophy, Ethics, and Humanities in Medicine*, *Medicine, Health Care and Philosophy*, and *Phenomenology and the Cognitive Sciences*. Philosophical research in the field of mental

health also appears in psychiatric journals such as *General Psychiatry* and *World Psychiatry*. A separate achievement for the development of the philosophy of psychiatry was the creation of specialised courses and educational programmes. For example, the University of Warwick was the first to open a department of philosophy and mental health. The Royal College of Psychiatrists in the UK has included a philosophy course in its mental health training programme.

Some of the most recent research in the field of philosophy of psychiatry is devoted to the issue of patient autonomy, ethical challenges faced by psychiatrists in their practice, and discrimination against and/or stigmatisation of patients with mental disorders (e.g. epistemic and hermeneutical injustice, an overview of which is presented below).

The Biopsychosocial Model of Cosmos-Containing Mental Disorders

In 1977, the American psychiatrist and pathologist George Engel in his article *The need for a new medical model: A challenge for biomedicine* proposed a new model for understanding the causes of somatic and mental diseases called the biopsychosocial model. His research was based on cases of depression, ulcerative colitis and psychogenic pain. The study of these pathological conditions was a challenge for the biomedicine of the time and the dominant biomedical model of understanding the causes of somatic and mental diseases because they favoured somatic manifestations of diseases as more "real", more "reliable", and therefore the only thing worthy of a clinician's attention. What could not be verified or explained in terms of cellular and molecular processes was either ignored or devalued. In such a conceptual and methodological context, medicine neglected the subjective dimension of the human experience of disorders as a source of meaningful research and understanding (Borrell-Carrió et al., 2004).

The biopsychosocial model is both an updated philosophical approach to understanding healthcare service delivery and a practical guideline for healthcare practitioners. It aims to change the paradigm of research in medical practice from exclusively analytical, reductionist and specialised to more contextual and interdisciplinary.

Philosophically, it is a way of understanding how the causes of the development and progression of somatic and mental disorders and their experience are influenced by different levels of organisation of internal and external factors, from the molecular level of an individual to the level of social interaction between such individuals.

On the level of practice, it is a way of understanding how the subjective experience of a person suffering from a particular somatic or mental disorder can make a significant contribution to the accuracy and comprehensiveness of diagnostic processes, the results of selected pharmacological, psychotherapeutic and other types of therapeutic interventions, the expected outcome of treatment, and humane, ethical treatment during and after treatment and rehabilitation.

The direct application of the biopsychosocial model in clinical practice is called biopsychosocial-oriented clinical practice.

In psychiatric practice, the biomedical model describes mental disorders as defects or abnormalities in brain structures, dysregulation of neurotransmitters, or genetically determined defects. However, the common theory of chemical imbalance could not provide a diagnostic test that included an assessment of neurotransmitter levels that could be used in direct clinical practice. Neither of the primary nosological systems for classifying mental disorders, the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) or

the International Statistical Classification of Diseases and Related Health Problems (ICD), included biological tests for detecting, diagnosing or classifying mental disorders. No valid and reliable biological tests for the diagnosis of any psychiatric disorders exist yet.

The reductionist approach of the biomedical model, which conceptualised all behavioural manifestations as disorders of physico-chemical processes, was not sufficient to explain all aspects of mental disorders and ignored the individuality and uniqueness of the patient's experiences and feelings. The basic principles of the new biopsychosocial model include a combination of biological, psychological and social dimensions of human life. It postulates that a person suffers from a disease as a whole and not just as a specific disorder of the adequate physiological activity of isolated, separate organs. The doctor should use a holistic and integrated approach to the study and treatment of the disease and consider his relationship with the patient to be socially equal (Tripathi et al., 2019: 583).

In the aetiology of the onset and progression of mental and behavioural disorders in psychiatry, the biopsychosocial approach is implemented through the following components:

a) Biological: genetic predisposition to the development of diseases and pathological conditions, sex, gender, age, presence of concomitant diseases, state of the immune system, anatomical features of the brain structure, possible negative effects of medications, level of activity of neurochemical reactions.
b) Psychological: emotions, behaviour, state of development of coping strategies, temperament, character, beliefs, social interaction skills, self-esteem.
c) Social: socio-economic status, cultural characteristics, occupation, education, communication with colleagues, family background, level of social support from others.

Psychiatry, as a branch of medical knowledge, has certain features in everyday practice that are distinct from other medical disciplines due to the complexity and polymorphism of the expression of mental disorders and their close relationship with psychosocial factors, the lack of obvious pathognomonic elements and the stigma of mental disorders. For these reasons, the biopsychosocial model has been used to diagnose, classify and explain the causality of mental disorders (Papadimitriou, 2017: 210).

The biopsychosocial model stimulated the development of interdisciplinary research in the field of psychiatry. This allowed us to expand the subject field of study of mental disorders characterised by the presence of psychopathological symptoms of cosmological content using the methods and conceptual tools of philosophy of psychiatry, cultural psychiatry, phenomenological psychopathology, cultural studies and religious studies.

In formulating the biopsychosocial model, Engel recognised culture as an important factor in understanding disorders. He noted that the boundaries between health and disorders are far from being as clear as we have come to believe, as they are diffused through the lens of cultural, social and psychological assumptions. Engel defined culture as a set of institutional conditions, formal and informal practices, explicit and implicit rules, and ways of making meaning and representing experience in ways that will influence others. However, in practice, culture has been relegated to a social factor, which largely underestimates the fundamental role of culture in the experience and manifestation of mental and behavioural disorders, including those with cosmological implications (Babalola et al., 2017: 294).

The Cultural Psychiatry of Cosmos-Containing Mental Disorders

The objective of psychiatry is to solve clinical problems that arise between the patient and the doctor with the knowledge acquired within the discipline, using it to provide qualified medical care. In most cases, this task is not problematic, as the doctor and patient share a common cultural and linguistic background, and communication on relevant topics is relatively easy and accessible between them. For example, they have a common understanding of social reality, what mental disorders and mood disorders are, what a psychiatrist should ask during a psychiatric interview, and how to talk about and explain problematic, unexplained phenomena that a person faces in the process of experiencing a mental disorder.

The objective of cultural psychiatry is quite similar but at the same time different due to inconsistencies in the ontology and epistemology of psychiatric disorders in speakers of different cultures, and differences in speech acts, which can complicate communication between doctor and patient during the diagnostic and treatment processes.

Cultural psychiatry focuses on the development and improvement of data on how culture and language affect all aspects of a person's mental state. This includes, for example, the causes of disturbances, the characteristic manifestations of these disturbances, their interpretation by the patient and their relatives, and the behavioural consequences in the patient's personal and social world. All these factors form symbols, meanings and values. The basic principle of cultural psychiatry is a correspondence between, on the one hand, the meaningful elements of the mental state as they are represented cognitively in the patient, and on the other hand, the meaningful elements that shape the patient's social relationships, circumstances, situation, life problems, and the actual signs and symptoms of mental and behavioural disorders. The patient's social background, ethnicity, religious affiliation and level of religious involvement, view of self, and social situation are considered to understand how the mental state is constructed. What does it mean in the patient's world of thought and life space? How does it affect and fit into the patient's social world? What in this world needs to be addressed in treatment to improve the patient's social functioning? (Fabrega Jr, 2007: 547)

The relationship between religion and mental health depends on previous upbringing, education, gender, religious denomination, and other factors. The most accurate measure of religiosity is geography. For example, while religious identification is declining in Western Europe and North America, it is increasing in other regions. Until the early nineteenth century, the diagnosis and treatment of mental disorders were largely the domain of religious communities. A significant change occurred when Charcot and Freud linked religion to hysteria and neurosis. This created a gap between religion and psychiatry that has only begun to change in the last few decades.

One of the signs of change was that in 1994, the DSM-IV introduced a code called "religious or spiritual problems" to help professionals better understand their patients' beliefs and rituals. In the current version of the DSM-V, using this code is recommended when the focus of clinical attention is a problem of a religious or spiritual nature. Examples of this include experiences of anxiety related to conversion to a new faith and doubts about the individual's current spiritual values, which are not necessarily associated with a stable, organised religious institution. Moreover, manifestations of certain religious practices can serve as leading symptoms of mental disorders. For example, certain forms of hallucinations, including the creation of the universe, the cosmos, its origin and development, but at the same time being within the normative framework of a particular religious affiliation, are

considered socially and medically acceptable. This can directly affect the interpretation of psychiatric symptoms in the diagnostic process.

Religiosity and religious beliefs play a role in the diagnosis and treatment of mental and behavioural disorders, but to what extent remains a matter for further research. Information about affiliation with a particular religious denomination can provide clinicians with initial parameters for providing primary psychiatric care. In turn, spirituality is more subjective and has no clear indications of what a patient believes in or how they feel about mental health and treatment. Although these are separate areas of belief, they often go hand in hand when understanding the need for mental health care.

When planning diagnostic and treatment interventions for people with symptoms of mental and behavioural disorders, doctors should address the following questions: Should a potential patient's religiosity be considered a symptom of a mental disorder if the patient did not show interest and involvement in religious practices before the onset of the disease? Can religion negatively affect a person's mental health, or is it an auxiliary mechanism in the preparation and implementation of treatment and diagnostic measures? What list of specialists, other than mental health professionals, can identify signs of hyperreligiosity and its direct impact on all aspects of a patient's life? If the content of a culture is determined by the people who are part of it, then if a certain religious movement or spiritual beliefs no longer correspond to that culture, is this a manifestation of a mental disorder?

Reflecting on this list of problematic issues, cultural psychiatry becomes a unique example of a medical, philosophical, religious and cultural focus on psychiatric disorders. Cultural psychiatry does not only analyse specific, relevant aspects of the influence of religious beliefs, faiths, spirituality and other cultural practices to address clinical challenges from a modern perspective. After all, the multifaceted factors inherent in psychiatric phenomena, such as stigmatisation of people with mental disorders, equating symptoms of mental disorders with mystical practices, and determining the rank of psychiatric symptoms in comparison with somatic diseases, are historically conditioned. For example, the significance and role of altered mental states in ancient medical traditions (Ayurveda, traditional Chinese medicine, Central Asian medicine, Mediterranean medicine) contrast with the ideas and scientific paradigm of modern psychiatry. However, they should be seen as a necessary component of what psychiatric conditions mean in a comparative perspective. This comparison makes available for analysis the concepts of defining a person's identity, the conformity of his or her actions to a social situation based on dominant, stable models of cultural systems, and cosmological ideas that are passed down from generation to generation (Lim, 2006: 84).

Religious cosmology is a vivid example of the combination of religious beliefs of an individual who may potentially suffer from mental and behavioural disorders with cosmological ideas about the origin, evolution and further development of the universe and the cosmos. The experience of mental disorders in this case will reflect the following ideas: the myth of the creation of the world, beliefs about the further evolution of the world, its current form and nature, and the possible fate or purpose of the universe. The characteristic features of these experiences may vary and be supplemented according to different traditions in each particular religion or religious mythology. For example, religious mythologies may include descriptions of the act or process of creation by a creator God or a pantheon of deities, explanations of the transformation of chaos into order, or claims that human existence is a never-ending cycle of transformation. People with symptoms of mental disorders can testify and convince others that they hear the voice of God, talk directly to Him, and receive beliefs about the order of the universe in these conversations. Psychotic experiences of a

spiritual and religious nature with cosmos-containing narratives also include the themes of being persecuted by evil spirits from distant planets, control over the person's actions and thoughts by representatives of alien religions or cultures, and the person acquiring the status of a "prophet". Reflecting on such experiences of psychotic symptoms, a person tends to perceive them more plausibly and convincingly (Sweet & Paul, 2022:142).

Recently, a combination of religious and cultural practices with cosmos-containing narratives has occurred in popular culture. For example, among the most frequent theories are secret experiments of governments on artefacts of alien origin and their possible use to control human behaviour or theories suggesting that the origin of humanity is the result of alien genetic engineering, for example, that representatives of the Sumerian culture were a race of aliens. Another topic under discussion is the "reptilian conspiracy", according to which all processes on Earth are controlled by shape-shifting reptilian aliens; researchers do not exclude that this theory originates from earlier pseudo-historical legends that became known during the study of the culture of Indigenous tribes in Africa (Fountoulakis, 2022: 552).

These new explications of cosmological and religious-cosmological content can expand, supplement and qualitatively change the narrative of psychotic experience, which in turn requires improving the methods of its identification, description and conceptualisation.

The Phenomenological Psychopathology of Cosmos-Containing Mental Disorders

The description of the experience of changes in basic existential structures in modern phenomenological psychopathology involves a phenomenological interview, which is conducted using a semi-structured psychometric questionnaire. Examples of such interview instruments include the Examination of Anomalous Self-Experience (EASE), the Examination of Anomalous World Experience (EAWE), and the Examination of Anomalous Fantasy and Imagination (EAFI).

The EAFI is one of the most recently created semi-structured phenomenological interviews, developed in 2018 by A. Rasmussen, H. Stephensen, and J. Parnas. The EAFI is an instrument for semi-structured phenomenological research into the psychopathology of imagination and provides a conceptual and descriptive framework for the study of such experiences by describing them through 16 main items: 1) spatiotemporal constancy, 2) autonomy, 3) localisation and sense of experiential distance, 4) intense affects, 5) imagination as multimodal perceptualisation, 6) anomalous vivid imaginative experience, unspecified, 7) violent, macabre, or bizarre content, 8) ruminations-obsessions, 9) disturbance of control, 10) loss of ipseity, 11) image interference, 12) image pressure, 13) existential reorientation in fantasy, 14) preoccupation with fantasy life, 15) disturbances of irreality, 16) lack of insight. The researchers suggest that the imagination abnormalities studied by the EAFI reflect changes in the structure of consciousness and belong to the fundamental, generative layer of psychopathology, which should improve the differential diagnosis of mental and behavioural disorders (Rasmussen et al., 2018: 1).

The Ukrainian psychodiagnostic tradition has implemented the reception and adaptation of the EAFI. The potential of using the EAFI semi-structured phenomenological interview in the study of the heterogeneous nature of schizophrenic spectrum disorders (SSDs) is emphasised. No epistemological and heuristic basis exists for modelling imagination disorders in SSDs. In modern systems of classification of mental and behavioural disorders, the dimension of imagination is also ignored, which is an obstacle to further research and personalised psychotherapy (Pushko, 2023: 183).

To describe cosmos-containing mental disorders using a semi-structured phenomenological interview, we will provide examples of case reports for the nosological units of mental and behavioural disorders that are most characterised by manifestations of abnormal fantasy and imagination: paranoid schizophrenia (F20.0), delusional disorder (F22.0) and oneiroid syndrome. The codes are presented following ICD-10.

Paranoid schizophrenia is the most commonly diagnosed form of schizophrenic spectrum disorder. Its characteristic symptomatic features are auditory and visual hallucinations and delusions of persecution (Harrison et al., 2017: 256). The expression of cosmos-containing psychotic symptoms within paranoid schizophrenia has the following clinical picture: a middle-aged patient who graduated from high school and the law faculty of the university. In childhood, she was fond of astronomy and led a school club for its in-depth study. From time to time, she visited the planetarium. During one of her visits, she thought someone was following her. When she returned home after the show, she could not sleep at night because of the constant fear and anxiety that she was being watched from a neighbouring universe. The anxiety intensified in the morning because a part of the cosmos came down to her apartment to transform one of the planets into several smaller ones. For three days, the patient did not leave the apartment and watched the process unfold before her eyes. Later, she wanted to tell her family about this incredible astronomical miracle, but she was being watched from above, and an alien voice told her that it should remain a secret. After that, she became silent, as the forces from above took away her voice so that she would not talk about them while they were on Earth.

Analysing the patient's evidence from the perspective of the EAFI, activity in the following areas can be recorded: spatiotemporal constancy describes a stable quasi-spatial structure of the image as an object that persists in time. Hallucinatory images are experienced with a fixed arrangement and ratio of elements and are accompanied by a sense of depth. The duration of the experience of hallucinatory contemplation is described. Autonomy occurs when hallucinatory images acquire their own course, sequence or development, regardless of the subject's will. A feeling of passive perception of such images is described, including localisation and a sense of experiential distance, where psychotic images and experiences are described as having mutual spatial relations and being in motion with each other. Intense affects: anxiety, anxiety, and fear during the experience of abnormal imagination are strong. Concerning disturbance of control, the case describes the inability to distract attention or otherwise stop unwanted imaginary or intrusive experiences by willpower. The person experiences a violation of their ability to exercise control over their object of attention.

Also, persons with paranoid schizophrenia describe delusional experiences as consisting of "souls", "gods" and "rays" that span the cosmos, connect them to God, and often monitor or control their thoughts and actions (Sass & Pienkos, 2013: 646).

The next mental disorder that can manifest itself with cosmological narratives is delusional disorder. This pathology of the psyche and behaviour is characterised by the development of a single delusion or a set of interrelated delusions, which are usually persistent and sometimes lifelong; their content is highly variable. The presence of hallucinations does not support this diagnosis (Boland & Verduin, 2022: 1055-1059). For example, a patient went to church every Sunday, but for the last four months he has not been attending because he has had "enlightenment". Waking up in the moonlight, he saw that the constellation of the Big Dipper was moving and changing its configuration. The moon moved closer to the bright stars and placed itself in the centre, with a figure that looked like a hand pointing to the right. Turning his head in the direction of the hand, he saw a shooting star. The man interpreted this as a sign

from God that he should spread the word of God and that this would help save all sinners. He was firmly convinced of this and told everyone he met what his mission was in this world. He would become anxious and then angry if people around him did not share his views.

Examining this case through the diagnostic prism of EAFI, we can emphasise the presence of the changes in spatiotemporal constancy, autonomy, intense affects, and disturbance of control already described in the previous case. The following parameters are new to the description here: Ruminations-obsessions are manifested in the disturbing persistence of repetition of certain obsessive content of the mind. These repetitions are usually religious, as noted in the case study. Existential reorientation in fantasy means that the experience of an abnormal experience of imagination and fantasy causes a fundamental change in the metaphysical worldview and redefinition and restructuring of the hierarchy of human values and interests. In our case, this change was the acquisition of the qualities of a "prophet", and a preoccupation with fantasy life, where the patient spent an excessive amount of time and energy analysing, processing, and comprehending fantasy experiences. We consider this parameter to be relevant to this case, since in an attempt to convey to others his or her purpose in the world, the patient reactualises and rethinks his or her situation, spending a certain amount of time on this. Lack of insight means the patient does not consider his or her abnormal imaginary experience absurd or inappropriate and does not critically define the content of his or her experience as indicative of mental disorders.

Oneiroid syndrome is a rare form of confusion that is poorly described in the psychiatric literature and is not represented as a separate nosological unit in the ICD-10 and DSM-5 classification systems. The symptom complex of the oneiroid syndrome is represented by the kaleidoscopic nature of psychopathological experiences, in which reality, illusions and hallucinations merge into one. They are filled with modified fragments of what has already been seen, heard, experienced, and read, which are intricately intertwined with distorted perceived details of the environment. The scenes and dreams that emerge are distinguished by their scene-like nature, similar to dreams. The patient is their protagonist, actively participating in delusional events, for example, getting into a spaceship and landing on Mars, meeting and talking to the inhabitants of the planet (Chamelee et al., 2019: 3938). Clinically, the oneiroid syndrome manifested itself as follows: The man lay with his eyes open for several hours, did not respond to the treatment, periodically made floating movements and was completely immersed in his own world. The patient noted that during this time he managed to travel into space, visit several planets, become friends with aliens and save the Earth from collision with Venus and Mars. His inner gaze saw the formation of stars from gas and dust clouds in the Milky Way, and he felt shock waves caused by collisions of different galaxies. At the beginning of his delusional experiences, he felt anxious, but then he felt happy to have become a direct participant in such incredibly exciting adventures.

The development and reduction of the oneiroid syndrome can occur quickly, so a phenomenological interview should be conducted directly during the development of psychotic symptoms if the patient's condition allows it. After active psychopathological symptoms, the data obtained may not be representative of a particular individual case since oneiroid syndrome ends with partial amnesia of delusional events.

The above example captures the following EAFI parameters: spatiotemporal constancy, autonomy, localisation and sense of experiential distance, intense affects, and disturbance of control. Their characteristic features have been discussed above. However, in contrast to a protracted, chronic delusional process, in a phenomenological study of oneiroid syndrome, the parameters responsible for profound changes in worldview, values, and interests do

not change. The relationship between the person's inner self and the outside world is not disturbed, and a minimal critical assessment of abnormal experiences is not lost.

To summarise, cosmos-containing mental disorders are characterised by three phenomenological dimensions (Pushko, 2023: 193):

a) perceptualisation of images: the experience of psychotic symptoms acquires certain quasi-perceptual qualities, such as spatiality and spatiotemporal constancy, and becomes a researchable experience;
b) autonomy of images with a quasi-spontaneous flow and a sense of empirical distance between the conscious image and the sense of will;
c) blurring of unreality: usually, the functioning of the imagination is accompanied by the character of unreality. Individuals suffering from schizophrenia spectrum disorders and other psychotic disorders perceive delusional images without a clear separation from the real world.

Ethical Challenges

The above cases of using the semi-structured phenomenological interview EAFI in the process of diagnosing cosmos-containing mental disorders indicate the limited use of phenomenological tools to describe the subjective characteristics of the experience of mental disorders. Such limitations are associated with the situational use of phenomenological psychopathology in the process of diagnosing mental disorders due to the need for additional training of specialists, additional material resources, increased time for diagnostic procedures, and the use of methods only within the framework of scientific research or educational process.

For people who need qualified psychiatric care, this may mean a lack of concentration or complete neglect by clinicians of the subjective features of mental disorders. This, in turn, can lead to insufficient diagnosis and inaccurate diagnosis, polypharmacy, and stigmatisation of a person suffering from a mental and behavioural disorder.

These ethical challenges are discussed below.

Disregard for the testimonies of patients with mental disorders about their experiences of mental disorders is most often associated with epistemic and hermeneutical injustices. Epistemic injustice is a form of discrimination related to the ability to produce knowledge and provide testimony about one's condition. It is manifested in the exclusion of epistemic agents belonging to marginalised groups from the process of creating and disseminating knowledge and testimonies. The role of interpreters of the experience of excluded epistemic agents is assumed by agents who do not share their social position, which in turn distorts and devalues the knowledge gained. Hermeneutical injustice is associated with the lack of tools for the social interpretation of experience in society.

Thus, in the system of mental health care, the evidence of epistemic agents with mental and behavioural disorders is rejected in favour of clinical, academic, and professional knowledge. This is due to the peculiarities of training future mental health professionals. During the educational process, emphasis is placed on the positivist-oriented notion of the "gold standard" of research based on randomised trials, meta-analyses and systematic reviews, i.e. on the generalised scientific and academic achievements of medical science. In turn, empirical patient data may be of less diagnostic value to clinicians (Okoroji et al., 2023, p. 2).

The consequence is a growing lack of trust between people with mental and behavioural disorders and healthcare professionals and between clinicians and these people. The mere

possibility or indirect evidence of a mental disorder can provoke a lack of trust. In some situations, certain religious practices with a different cosmology from the dominant religious one in a particular social landscape are considered to be a manifestation of mental disorders, which can lead to false hospitalisation and prescription of psychiatric drugs. Alternatively, a person with a confirmed diagnosis of a mental disorder may deliberately dissimulate and conceal cosmos-containing psychotic symptoms because they fear forced hospitalisation in a psychiatric hospital and the prescription of an excessive amount of psychopharmacological drugs (polypharmacy).

People with mental disorders are often stigmatised. In everyday language, they are often described as "crazy", "not from this planet", "strange", or "defective". Stigmatisation generates social rejection of people with mental disorders. It extends to all areas of human functioning: work, housing, financial security, and relationships with others. As a result, they are constantly trying to adjust their social identity. This increases their cognitive and social burden, which can lead to a worsening of the disease. People suffering from mental disorders describe stigma as a much worse and more destructive phenomenon for the individual than the symptoms of mental disorders they experience (Crichton et al., 2017: 67).

Conclusions

The article discusses the phenomenological approach to the psychopathology of cosmos-containing mental disorders, which allows for a deeper understanding of the subjective experience of persons suffering from mental disorders. Cosmological ideas related to hallucinations and delusions about the universe, creation and divine forces are important aspects in the diagnosis and treatment of such disorders.

Cosmos-containing mental disorders should not be considered only from the point of view of the biological model in psychiatry. The biopsychosocial model, proposed by George Engel, allows us to consider biological, psychological and social aspects that influence the development and course of these disorders. This approach contributes to more accurate diagnosis, adequate treatment and more ethical and humane treatment of patients.

Phenomenological psychopathology emphasises the importance of patients' subjective experience, their inner feelings and personal interpretations of the symptoms of mental disorders. The use of semi-structured interviews, such as the EAFI, allows for a detailed examination of changes in imagination, fantasies, and perception of reality as a result of experiencing psychotic symptoms. This allows a better understanding of the specifics of mental disorders such as paranoid schizophrenia, delusional disorders, and oneiroid syndrome.

Cultural psychiatry also plays a major role in the research of cosmos-containing mental disorders. Patients' religious and cultural beliefs can have a profound impact on their mental state and interpretation of symptoms of mental disorders. This emphasises the need to consider the cultural context in the process of diagnosis and treatment.

The ethical challenges associated with stigmatisation and discrimination against people with mental disorders are serious problems. Stigma can lead to social isolation, negatively affect self-esteem and worsen the course of disorders. Healthcare professionals and members of the public must avoid prejudice and treat people with mental disorders with due respect.

The authors emphasise the need to disseminate knowledge about cosmos-containing mental disorders among mental health professionals and medical professionals of other specialities, social workers, and psychologists, since premorbid changes in personality, against

the background of expressing cosmological ideas did not correspond to the characteristic features of the person concerned before, may indicate the initial stage of a mental disorder.

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🕮 References

Adamiak, M., and Pokropski, M. (2018) The landscape of contemporary phenomenology. *AVANT. The Journal of the Philosophical-Interdisciplinary Vanguard*, *9*(2), 9-15. https://doi.org/10.26913/avant.2018.02.01

Babalola, E., Noel, P., and White, R. (2017) The biopsychosocial approach and global mental health: Synergies and opportunities. *Indian Journal of Social Psychiatry*, *33*(4), 291-296. https://doi.org/10.4103/ijsp.ijsp_13_17

Boland, R., and Verduin, M. L. (2022) *Kaplan & Sadock's Concise Textbook of Clinical Psychiatry* (5th ed.). Wolters Kluwer.

Borrell-Carrió, F., Suchman, A. L., and Epstein, R. M. (2004) *The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry*. PubMed Central (PMC). https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1466742/

Chamelee, A., Selvamani, I., and Nambi, S. (2019) Oneiroid syndrome: A rare form of psychosis. *International Journal of Research in Medical Sciences*, *7*(10), 3938-3940. https://doi.org/10.18203/2320-6012.ijrms20194336

Crichton, P., Carel, H., and Kidd, I. J. (2017) Epistemic injustice in psychiatry. *BJPsych Bulletin*, *41*(2), 65–70. https://doi.org/10.1192/pb.bp.115.050682

Dariienko, D. (2022) Phenomenological method and philosophy of psychiatry: History and prospects of interaction. *Scientific Notes of NaUKMA. Philosophy and Religious Studies*, *9-10*, 60–67.

Dey, D., Singh, A., and Khess, C. (2020) Phenomenology and psychopathology. *The International Journal of Indian Psychology*, *8*(4), 914–920.

Fabrega Jr, H. (2007) Scope of cultural psychiatry. In *Textbook of Cultural Psychiatry* (pp. 537–550). Cambridge University Press.

Fountoulakis, K.N. (2022) *Psychiatry: From its historical and philosophical roots to the modern face*. Springer International Publishing AG.

Fulford, K. W. M., Davies, M., Graham, G., Sadler, J., and Gipps, R. (2013) *Oxford handbook of philosophy and psychiatry*. Oxford University Press.

Harrison, P., Cowen, P., Burns, T., and Fazel, M. (2017) *Shorter Oxford Textbook of Psychiatry*. Oxford University Press.

Lim, R. F. (2006) *Clinical manual of cultural psychiatry*. American Psychiatric Publishing.

Malivskiy, A., and Kolesnikova, T. (2022) Descartes on Open Knowledge and Human Perfection Project. *Anthropological Measurements of Philosophical Research* 22, 14-25. https://doi.org/10.15802/ampr.v0i22.271318

Messas, G., Tamelini, M., Mancini, M., and Stanghellini, G. (2018) New perspectives in phenomenological psychopathology: Its use in psychiatric treatment. *Frontiers in Psychiatry*, *9*, 1–5. https://doi.org/10.3389/fpsyt.2018.00466

Okoroji, C., Mackay, T., Robotham, D., Beckford, D., and Pinfold, V. (2023) Epistemic injustice and mental health research: A pragmatic approach to working with lived

experience expertise. *Frontiers in Psychiatry*, *14*, 1-5. https://doi.org/10.3389/fpsyt.2023.1114725

Papadimitriou, G. N. (2017) The "biopsychosocial model": 40 years of application in psychiatry. *Psychiatriki*, *28*(2), 109-110.

Pushko, Y. (2023) Phenomenological research of imagination in schizophrenia spectrum disorders as a conceptual framework for understanding psychotherapeutic processes and recovery strategies. *Psychology and Personality*, *1*(23), 178-197.

Rasmussen, A. R., Stephensen, H., and Parnas, J. (2018) EAFI: Examination of anomalous fantasy and imagination. *Psychopathology*, *51*, 1-11.

Sass, L.A., and Pienkos, E. (2013) Delusion: The phenomenological approach. In *The Oxford Handbook of Philosophy and Psychiatry,* 632-658. University Press.

Stanghellini, G., Broome, M., Fernandez, A. V., Rosfort, R., and Fusar-Poli, P. (2019) *Oxford handbook of phenomenological psychopathology*. Oxford University Press.

Stezhko, Z. and Khmil, T. (2023). Artificial Intelligence as a Socio-Cultural Phenomenon: the Educational. *Anthropological Measurements of Philosophical Research*, 24. https://doi.org/10.15802/ampr.v0i24.295317

Sweet, H. C., and Paul, R. A. (2022) Religion, spirituality, and mental health. In *Diversity in action,* 139-154. Springer.

Tripathi, A., Das, A., and Kar, S. K. (2019) Biopsychosocial model in contemporary psychiatry: Current validity and future prospects. *Indian Journal of Psychological Medicine*, *41*(6), 582-585. https://doi.org/10.4103/ijpsym.ijpsym_314_19

Woodruff, D. (2018) *Phenomenology*. The Stanford Encyclopedia of Philosophy (Summer 2018 Edition). https://plato.stanford.edu/archives/sum2018/entries/phenomenology/

Zabor, V., and Filts, O. (2018) Phenomenology as a method of psychopathology and psychotherapy. *Medical Psychology and Psychotherapy*, *24*(1), 26-31.

Noohumanistic Worldview as a New Worldview Matrix within Educational Paradigm

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Addressed is the genesis of Noohumanism as a new worldview matrix of the present. The study was carried over the ideas underlying Noohumanism and traced back to the early elaborations of Teilhard Chardin, Volodymyr Vernadsky, etc. We have investigated backgrounds for the semantics of "the Noohumanistic Worldview" as associated with its noospheric, humanistic, environmental, philosophical components and with the state-of-the-art studies in the philosophy of education. The author considers an Equilibrium (Balance) as the universal principle of the Cosmos in terms of an analogy therewith, i.e. the ideas of the socio-natural homeostasis within the "human-society-nature" system, which lays the foundation of the currently trending Noohumanistic Worldview. The objective hereof is the author's elaboration of the worldview-wise (ideational) potential of Noohumanism as an evolving and call-of-the-time worldview matrix that is based upon the socio-natural homeostasis. As a result of the research, we have elaborated the scientific-theoretical grounds of the noohumanistic worldview concept, with its principal methodological regulator – the idea of the socio-natural homeostasis (analogous concepts: "socio-natural accordance", "metaprinciple of harmony"). This concept opens new perspectives in the philosophy of education. In other research studies, we have developed the pedagogical system of forming the noohumanistic worldview in students and set out relevant pedagogical conditions and teaching methods.

Keywords: noohumanism, principle of socio-natural homeostasis, noohumanistic values.

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Introduction

Present day situation is unstable and full of threats and various cataclysms. These either are the terrorist threats or environmental calamities fatal for humanity, or the sustained geopolitical and economical clashes among leading countries, as well as the bursts of hybrid and local warfare on the global arena. The behind causes are of immense complexity. They

are associated with the destructive processes occurring within the different dimensions of society. One of the factors affecting the state and evolution of certain social trends is undoubtedly connected to the worldview component. Apparently, the worldview paradigms and value-based orientations of Homo sapiens do structurize its behavior models and further vector of attitude towards the world.

According to the Encyclopedia of Psychology and Religion, *worldview* is "the outlook one has about life. It is a paradigm by which the individual or the group interprets reality and acts upon life. It is how we normally view and conceptualize the world" (Abi-Hashemv, 2017). One may define the following traditional types of worldview: scientific, mythological, religious, mundane (conventional), philosophic, historic, etc.

There are specific types of worldviews targeting the formation of value-based orientations across different areas of human activity, which can conveniently be systematized as the "human-society-nature."

Types of worldviews pertaining to humans, their existence within society, and their relation to nature comprise a wide range from humanistic, universal in its significance, historical, and the like, to environmentally-oriented, noospheric, etc.

At that dissipation, we are concerned with such a worldview, which could synthesize the scale of values encompassing the "human-society-nature" system, and reflect each of the listed aspects, while also being organically integrative in its totality.

In this regard, in our understanding, it is the Noohumanistic Worldview that better meets the said conditions, having as its global idea the socio-natural homeostasis. We shall note that the Noohumanistic Worldview consists of two components: the noospheric and the humanistic, which is a raising trend in modern education.

Noohumanistic Worldview as the implementation of the idea of socio-natural homeostasis within the system of "human-society-nature."

Let us investigate the main characteristics of the Noohumanistic Worldview and trace its origins to the noospheric education, which is based on the doctrine of noosphere.

The term "Noohumanism" is first distinctly encountered in the research study by G. Sikorskaya and is interpreted as "the noospheric humanism (noohumanism) characterized by the human commitment to co-evolution with the biosphere". The given definition outlines the environmental aspect that emphasizes the necessity of cooperative evolution of biological species and humanity.

However, it seems that modern people shall need not only the environmental orientation points, but also those references that could direct to the harmonization of relationships at all three levels of the "human-society-nature" triad. Indeed, the modern palette of the worldview reference points more often reflects only certain separate aspects of the said system.

As far as the social aspect (the "human-society" element in the aforementioned triad) is considered, the individual has to challenge and decide based on the specific worldview positions regarding the issues of his or her social existence. Those might be the issues associated with either the civil security, social welfare or with the economic, political and other phenomena. Lack of internal moral foundations, sound judgment or life experience towards a given issue may cause anxiety, stresses and trigger the psychoemotional disintegrity in a person, deterioration of the life quality. In this respect, one might choose between the multiplicities of worldview orientations. A person might appreciate the humanistic worldview

or be solely interested in the moral aspect, at that addressing the formation of spiritual and moral worldview creeds. In either case, the choice vector for a certain type of worldview is determined by the human's intuitive or deliberate search of balance between its inner "Ego" and outer social environment.

Should the noohumanistic worldview potential be considered from the human's perspective within the said "human-society-nature" triad, then the formation of the resistance against any negative applications to date shall become ever demanding for the rising noohumanistic worldview. Since it is quite obvious that the destructive social and information-driven backgrounds around modern people, lack of spiritual constants result in their psychic destabilization, depressive-aggressive mood and suicidal tendencies (especially among youth). That provokes the social strain and destabilizes the society in general. In this regard, an individual shall find and rely upon such moral bonds, which would contribute to a relative equilibrium with him or herself, society and nature.

The foregoing highlights the axiological attributes of the evolving of the noohumanistic worldview by projecting the ideas of socio-natural homeostasis through the "human-society-nature" threefold synthesis, and vitalizes the following value-based properties: at the society level – the needful are the tolerance, the humanity, empathy, etc.; at the "nature" level – the responsibility and the environmental friendliness, the environmental culture; at the "human" level – the critical are the spirituality, the stress resistance and the congruence, and in the broader scale – the moral and psychic health of a person.

Thus, at the current development phase of society, the most required is a worldview with such a value scale that would reflect the socio-natural homeostasis both within the mentioned triad and across the interaction level of subsystems. Fair enough, why has the idea of socio-natural homeostasis (or its counterpart – "the socio-natural harmony") become a rallying point in structuring the noohumanistic worldview?

The issue is that the socio-natural homeostasis is one of the evolutionary development mechanisms, for any open system cannot exist without a dynamic balance of centrifugal and centripetal forces. Homeostasis stands for autoregulation, the ability of an open system to maintain steady conditions through coordinated reactions while maintaining its dynamic state of equilibrium. The tendency of a system to reproduce itself, restore the lost balance and overcome resistance of the ambient environment. The concept of the steady internal environment was formulated back in 1878 by French scientist Claude Bernard, and the term "homeostasis" was coined by the U.S. physiologist Walter Cannon in 1932 in his book "The Wisdom of the Body." "The present volume carries the same general line of study a step further, treating, as it does, of the relation of the autonomic system to the balance (or, as he terms it, homeostasis) of physiological processes" (Cannon, 1934).

At the same time, the socio-natural homeostasis per se is a manifestation of the universal principle of harmony that reflects the dynamic equilibrium of the open systems, of which the coordinated multidirectional forces enables assimilating the listed meanings (i.e. "the socio-natural homeostasis", "the harmony principle") with the meaning of "the socio-natural accordance" and put them in the single semantic array.

The philosophic reference literature defines harmony as the "reconciliation of opposites, a fitting together of disparate elements, whether in music, universe, the body politic, or the body of man" (Ilievski, 1993: 19). The harmony is defined by such properties as measure, proportionality, equilibrium, clarity, etc. It must be stressed that the meaning of "accordance" enters into the list of etymological characteristics of the meaning of "harmony", since it is the

idea of the socio-natural harmony or the socio-natural accordance that lies on the ground of the now evolving of the noohumanistic worldview.

Outstanding modern scholar Oleg Bazaluk in his "Discursive Thinking Through of Education," highlights that the harmony or the "(accordance)" between ethos and nomos is called the *Laws of Ethics.* "...Laws of ethics ensure accordance (harmony) between the internal policy manifested as the 'internal law' and the 'right view' of fair and happy life advanced by the policy and education technologies" (Bazaluk, 2023: 215, 216).

Volodymyr Vernadsky, while studying the scientific worldview, wrote the following: "Everybody knows the expressions such as: the Universe, Cosmos and the World Harmony. Presently, to those notions, we attach the idea of the regularity of the processes subject to research. Previously, those have been understood differently. When observing the correct – prime numerical – relations between the harmonic tones of music and the producer exponents thereof (derivators), it was believed that their interdependency is constantly preserved, it was thought that any phenomenon expressed as the prime numerical ratio to other phenomena, … has its own correspondent tone unhearable by our material ear, but permeable for our inner contemplation. Earlier then, it was considered that one could hear the harmony of the celestial bodies, the celestial spheres, or of anything ambient through self-absortion, immersing into the sanctuary of one's heart" (Vernadsky, 1987: 45).

The meaning "harmony", "which came from the oldest art – the music, … the impact … of the musical *harmony* we can witness yet in some hymns of the Rigveda, in which the numeric relations of the world order possess a certain analogy with music" (Vernadsky, 1987: 44). The harmony became a principle, then a metaprinciple at times of antiquity, before it had streamed into the conceptual and education field of Europeans. As far back as the earliest Pythagorean cosmologic concepts, the philosophic principle of the harmony has marked the primary in terms of the foundational core of the Universe, as per which the human is a part of the Cosmos, being in dynamic equilibrium therewith. The antique philosophy, being of a cosmocentric nature, postulated the inextricable connection between human and the Cosmos, which manifested the ordered structure of the creation (Vlastos, 2005).

However, why does the evolving of the noohumanistic worldview, resting on the basic yet substantially identical concepts, such as: " homeostasis", the philosophic principle of harmonization ("the harmony"), "the accordance", have the "socio-natural accordance" as its closest counterpart value within the framework of socio-natural systems? It stands to reason that the latter is one of the aspects of the "socio-natural harmony". Still, the critical point here is an intention by a future carrier of the investigated worldview to harmonize the interaction of subject-object relations across the "human-society-nature" system. In other words, it is important that an individual would have an aspiration to reach a consensus, the good will to collectively and positively build up and maintain the principle of harmonization within a socio-natural system, since the self-intention of the individual, his or her personal attitude and eagerness to establish the dialogue will promote constructive and mutually beneficial cooperation.

We read the noohumanism as a progressing worldview branch within the social philosophy and the philosophy of contemporary education, which integrates implications of various philosophic, natural-scientific, and socio-political concepts. It encompasses the ideas of cosmism, the noosphere doctrines, and that of the humanistic, environmental pedagogy and psychology, as well as quantum physics. The nucleus component of the noohumanism, as figured above, is the idea of the socio-natural accordance that prerequisites conceptual and axiological array within the "human-society-nature" system, and which lays foundation

for the noohumanistic worldview and structures the systemically important components of the noohumanistic pedagogy. At the same time, the noohumanism, being the basis of the noohumanistic worldview, possesses the attributes of various types of worldviews (|i.e. the noospheric, the humanistic, the environmentally oriented, etc.).

Let us examine the genesis of the noohumanism as a worldview system in terms of its noospheric and humanistic components, as has been mentioned above. The noospheric component leans onto the noospheric-environmental constituent and ideas of quantum physics. The said component – while translating the cornerstone idea of the doctrine of noosphere, which prioritizes the human's intelligent activity over any harm to the biosphere and rationale of its future existence – includes the following concepts: "the noosphere", "the principle of harmonization", "the unitotality", "the homeostasis", "the co-evolution", "the ecological and moral imperatives", "the survivability imperative," etc.

Being that the noohumanism was born amidst of the noosphere teaching, the concept of "the noosphere", with its world-forming value of human consciousness in building the physical reality, becomes the basis for the developing noohumanistic conception (Zwart, 2022).

Volodymyr Vernadsky, one of the founders of the doctrine of noosphere, regarded the noosphere as a new stage in the development of the biosphere, in which the aggregate human mind (the "sphere of the intelligence") begins to influence the biosphere. The consciousness is considered by Vernadsky as a natural result of evolution of the biosphere, which then would influence the biosphere itself owing to the working activities of people: "The historical process is being radically changed under our very eyes. For the first time in the history of mankind, the interests of the masses, on the one hand, and the free thought of individuals on the other, determine the course of life of mankind and provide standards for mere ideas of justice. Mankind, taken as a whole, is becoming a mighty geological force. The problem of the reconstruction of the biosphere arises in the interest of freely thinking of humanity as a single totality. This new state of the biosphere, which we approach without our noticing, is the "noosphere"… and further, emphasizing the status of the human in the era of noosphere as a large-scale geological force, the scientist writes: "He can, and must, rebuild… radically in comparison with the past. Wider and wider creative possibilities open before him" (Vernadsky, 1987).

The "noosphere" concept introduced into scientific disclosure in 1927 by Édouard Leroy and Pierre de Chardin incorporates scientific and religious principles. According to P. Teilhard de Chardin, the noosphere is a sort of a "thinking layer" of the Earth – "the harmonized collectivity of consciousnesses equivalent to a sort of super-consciousness" (Teilhard de Chardin, 1987). It is not just myriads of grains of thought, but a universal thinking layer comprising the thought substance, wherein multiple individual minds are grouped and reinforced into a single reflection. The noosphere is not a mere total of individual reflecting consciousnesses, but a quality new supra-individual phenomenon covering the whole mankind. Therefore, the noosphere is an integral entireness rather than the mere sum of its components (Zwart, 2022). The foregoing gives reason to perceive the noosphere as the collective intelligence (reflection), the Superconsciousness of mankind.

Volodymyr Vernadsky conceptualizes the noosphere as a qualitatively new form of an organization arising from society and nature interaction, which is characterized by strong interconnection of the laws of nature with the laws of reasoning and the socio-economic laws. Understanding labour as the rational act of a thought and will, the scientist believed that the noosphere, or the age of reason will more and more shape not only the social progress, but

the evolution of the biosphere in general. Therefore, the noosphere has not only a global but also a socially oriented sense. The noosphere concept, interpreted by Volodymyr Vernadsky as a growing awareness of man's progressive invasion into the natural biogeochemical cycles and control over global biochemistry, is certainly materialistic in nature (Vernadsky, 1987).

Significantly, the scientist notes inevitability of developing the planetary worldview in mankind, that is – "the unanimity" for solving global problems (Bazaluk, 2023; Lovelock, 2010).

Michael Mensky writes: "The rise of quantum mechanics back in early 20th c. came up to be the greatest scientific revolution that impacted not only the physical laws, but the worldviews of physicists, their philosophical standings. Great credit shall be paid to the pioneers of quantum mechanics, led by Niels Bohr, who succeeded in formulating the so-called Copenhagen interpretation of quantum mechanics. It contained the clear-cut rules for calcultation of particular quantum systems. …Several decades had passed up until the Everett's interpretation gained recognition by the fairly large number of physicists. …which provided a deeper insight into the long-standing issue of an observer's awareness in quantum mechanics. Since then the question of what is the consciousness itself raised in a new a new light. And right out of the blue a new chance (practically speaking, a new demand) has emerged to directly correlate the quantum mechanics with the theory of consciousness. Moreover, it turned out that there is a very direct connection between the laws of the material world and the laws formulated long ago under the spiritual doctrines. And there is no reason to repel matter against spirit; materialism is against idealism. On the contrary, it becomes clear that these two spheres of the human knowledge are in need of each other not only culturologocially, but gnoseologically as well (Mensky, 2011: 238-239).

The super-consciousness provides access to all variants of the evolution of the world we see around us (alternative scenarios of the world), and we can find out what of them is advantageous. This gives the unique information unavailable by the usual perception organs and explains the phenomenon of super-intuition, or "direct vision of truth" "The essence of the Extended Everett Concept (EEC), or CCC proposed by the author ... is that the loss of consciousness (in a dream, trance, meditation) eliminates the separation of Everett worlds from each other… In this case, they are all available for what remains instead of consciousness and what can be called *super-perception*, because it allows you to receive information that is not available in the ordinary (conscious) state. Recoursing to the super-perception and back to the consciousness can be called the *super-consciousness*. The super-consciousness provides access to all options of the outworld evolution (i.e. to all alternative scenarios of our world) and allows to determine which of these scenarios is the most preferable. It enables access to the unique information that is not available to conventional organs of perception, and explains the phenomenon of super-intuition or "direct vision of the truth" (Mensky, 2011: 8-9). The said unbiddenly evokes a stable association of Mensky's "super-consciousness" with similar concepts such as "the noosphere", "the collective consciousness", and "the information field of the Universe consciousness."

Volodymyr Vernadsky beleived that the universality of scientific thought allows it to be localized in the noosphere (the "thinking" telluric envelope) and be capable of various projections. Therewith, one may observe that "one and the same discovery, the same thought emerges in different places of the globe, in different eras, without any case for borrowing" (Vernadsky, 1987: 71). History of the science tracks the count of massive discoveries made independently by the scientist of various countries (e.g. discovery of Neptune by the English astronomer John Adams and the French astronomer Urbain Le Verrier, or invention of the

photography by Nicéphore Niépce as well as Louis Daguerre in France and William Talbot in England, discovery of oxygen, invention of telephony, etc.). These prove the existence of the noosphere, where, according to Vernadsky's doctrine, scientific thought acquires planetary significance. Oftentimes, connection to the noosphere explains the nature of various creative enlightenments (insights) that come to a scientist in a dream, as was the case with the periodic table of Dmitri Mendeleev or the structure of the atom – Niels Bohr, etc. We have to state that certain scientific discoveries in the history of mankind, responding to the challenges of our time, form the key moments of social consciousness, defining its worldview constants. No wonder in V. Vernadsky's writing that "the scientific worldview is a complex and unique reflection of social psychology" (Vernadsky, 1987: 73).

Conclusions

Thus, it follows from the Extended Everett Concept that:

1. Identification by a consciousness of the alternatives generates a new concept of "the quantum consciousness", which is the common subject of study and, therefore, builds the bridge between the natural sciences and humanitarian sciences, between the matter and the spirit."
2. It is the quantum consciousness that localizes the reality (world). "Any observer perceives only one of multiple alternatives, so the choice (selection) of an alternative is pertinent to the consciousness of the observer."

We have considered the noospheric component of noohumanism, which forms its conceptual grounds together with the humanistic component.

The "humanistic" component of the noohumanism includes fundamental propositions of humanism, the humanistic universalism and the humanistic pedagogy and psychology. It is known that humanism represents a "reflected anthropocentrism, which arises out of the human consciousness and has as its object the value of human being" (Ursul & Ursul, 2014). It results from the humanity, humaneness to which the Man immanently strives for. Humanistic values encompass mercifulness, benevolence, loving-kindness for mankind, and decent living conditions for mankind. To be the humanist, i.e. to be humane, humanitarian – is to whole-heartedly value and love the creation, to be passionate for the very concept of "live".

The humanistic universalism is a worldview paradigm that explicates the idea of unitotality "based on the generalization of fundamental ideas and principles of the contemporary science and democracy", which embodies the principles of universality, dynamic equilibrium, indeterminacy, critical humanism, spiritual freedom, etc. (Ursul & Ursul, 2014). The humanistic universalism casted a great impact on the noohumanism. A great many findings of the humanistic universalism resonate with the propositions of the noohumanism: 1) main category of the noohumanism – the socio-natural harmony, the same as the humanistic universalism, relies on the principle of the dynamic equilibrium, which "explains and postulates the stability and harmony in the Universe" (Zwart, 2022). The unity of opposites – one of the aspects of the harmony that is characteristic of the existence as per the humanistic universalism.

The humanistic universalism has enriched the axiological thesaurus of no humanism with a critical-worldview horizon of human life and formed the critical-humanistic attitude towards the world, which corrects the classical humanistic values that acclaim the Man to be the criterion of all things in terms of the human responsibility before the Universe as a sentient

being. In this regard, "the portrait" of a noohumanistically-centered person synthetizes from classical humanism such qualities as kindness, mercifulness, the pursuit of individual well-being, on the one hand, and attainment of the commonwealth, on the other hand.

🕮 References

Abi-Hashem, N. (2017) Worldview, The Concept of. In: *Leeming, D. (eds) Encyclopedia of Psychology and Religion*. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-27771-9_9357-6

Bazaluk, Oleg (2023) *Discursive Thinking Through of Education: Learning from Those Who Transform the Universe*. London, New York: Routledge, Taylor & Francis.

Cannon, Walter B. (1934) The Wisdom of the Body. *Nature* 133, 82. https://doi.org/10.1038/133082a0

Ilievski, Petar Hr. (1993) The Origin and Semantic Development of the Term Harmony. Illinois Classical Studies, 18, 19-29. Available online: https://www.ideals.illinois.edu/items/13022

Kalmykova, L., Kharchenko, N., and Mysan, I. (2021) "I-language" i.e. "Individual language": the problem of functional generalization. *Psycholinguistics*, 29(1), 59-99. https://doi.org/10.31470/2309-1797-2021-29-1-59-99

Lovelock, James (2010) *The Ages of Gaia: A Biography of Our Living Earth*. New York: Oxford University Press.

Mensky, Michael (2011) *Consciousness and Quantum Mechanics: Life in Parallel Worlds (Miracles of Consciousness from Quantum Reality)*. World Scientific Publishing Co.

Teilhard de Chardin, Pierre (1987) *The Phenomenon of Man*. Nauka.

Ursul, Arkady and Tetiana Ursul (2014) Cosmoglobalistics: Interrelation of Global and Cosmic Processes. *Philosophy and Cosmology*, Volume 13, 90-118.

Vernadsky, Vladimir (1987) *Chemical Structure of the Earth's Biosphere and its Surroundings*. Nauka.

Vlastos, Gregory (2005) *Plato's Universe*. With a new introduction by Luc Brisson. Las Vegas NV: Parmenides Publishing.

Zwart, Hub (2022) Pierre Teilhard de Chardin's Phenomenology of the Noosphere. *Continental Philosophy of Technoscience. Philosophy of Engineering and Technology,* Vol 38. Springer Cham, Switzerland, 207–227. https://doi.org/10.1007/978-3-030-84570-4_7

From Universe to Society: Developing a Methodological Approach

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The paper raises the question of whether general patterns exist in the historical development of society. To address this, it proposes an analogy between cosmology, the science of studying the universe as a whole, and the study of societal development (particularly as presented by history). This analogy is based on the seemingly unique nature of the subject of study in both fields. The paper argues that a scientific description of the entire universe is only possible if it is spatially homogeneous, which then implies homogeneity in time. Because of this spatial and temporal homogeneity, universal laws govern the universe's behavior, allowing scientists to describe its evolution using the same fundamental concepts. One of the key characteristics used to describe the properties of matter is energy, which manifests in cosmology as "energy density."

The article shows that due to the diverse nature of social structures and their interrelations, the description of societal dynamics is a heterogeneous field. This significantly complicates the formulation of general social patterns and makes such patterns open to multiple interpretations, including in verification by empirical experience. However, society exists in a physical (geometric) space and time frame. Despite the heterogeneity within its social structures, when viewed across this larger scale, society can be considered more homogeneous. This allows for the application of general universal physical laws to society, and therefore general universal categories. These categories include space, time, and energy. Similar to categories like space and time, energy has characteristics that can be quantified in various ways. These characteristics reflect the different qualities of energy used by society. They can include the total amount of energy used, population size, or energy availability (EROI). The paper introduces another potential characteristic: the ease with which energy can be concentrated, which is analogous to energy density in cosmology. The paper then explores how this characteristic can explain and describe the development of society as a whole, but acknowledges that this perspective requires further investigation.

Keywords: Universe, society, space, time, energy.

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Introduction. The problem of generalization in some sciences

The current situation in global society is characterized by a high degree of turbulence and variability. We are witnessing live a surge of conflicts of varying intensity and nature. It is clear that behind these conflicts lie complex contradictions between different social groups, the parties to the conflicts. These contradictions are economic, political, cultural, ideological, and of other natures. The unfolding conflicts are bringing about transformations of all kinds of social institutions, both national and international. The latter circumstance allows us to assert that crisis and transformation phenomena are global and comprehensive in nature. Based on this, we can propose the assumption that their entire set has one cause. Knowing this cause, we can predict the development of events with greater or lesser probability, and, accordingly, by influencing the cause, correlate the result. However, this assumption remains only an assumption, and in contrast to it, we can argue the thesis that the changes taking place are a set of random circumstances, each of which is independent of the others. Accordingly, there is no single cause for the events taking place, and their final result is unpredictable.

The current state of global society, characterized by advanced development in technology, intellect, communication, and other social aspects, is unique. This presents an interesting task from the point of view of scientific description and understanding. This awareness of the inevitability and importance of social changes has long been the subject of scientific analysis. This scientific analysis has given rise to two approaches to understanding social change. One approach emphasizes the existence of general social patterns. Accordingly, the task of the scientist is seen as finding these patterns, making science explanatory in nature. The second approach emphasizes the absence of such general patterns, making science primarily descriptive in this case. These approaches are respectively called nomothetic and idiographic. This distinction was established in Immanuel Kant's "Critique of Pure Reason," which emphasizes the nomothetic nature of the propositions of reason: "The antinomy that reveals itself in the application of the law is for our limited wisdom the best way to test nomothetics,

in order to make reason, which does not easily become aware of its false steps in abstract speculation, attentive to the moments involved in determining its principles" (Kant, 1998: 469). Neo-Kantianism, particularly the work of Wilhelm Windelband, gave rise to the later distinction between the nomothetic and idiographic approaches (Windelband, 1998).

Subsequently, the nomothetic and idiographic approaches have gained widespread use. A fairly large body of literature describes these approaches, as exemplified by the work of Lee R. Lyman and Michael J. O'Brien: "The disagreement typically begins with a consideration of the differences between history and science. Rather than defining each in terms of its necessary and sufficient conditions, most discussants characterize science as generalizing and involving laws and characterize history as particularistic and having no laws. Depending on the personal whim of the author – whether or not he or she believes in the existence of laws that govern humans and their behaviors – anthropology is then declared to be either science or history. Two terms – "nomothetic" and "idiographic" often crop up in these discussions" (Lyman & O'Brien, 2004: 77). We believe the authors successfully reflected these concepts with two terms: Science (a perspective that emphasizes general laws, explanatory in nature, nomothetic) and History (a perspective that focuses on description; it's idiographic). Due to their convenience, we will use these terms below. Obviously, the debate between "nomothetic" and "idiographic" approaches is long-standing and profound. It remains relevant today and is unlikely to ever reach a universally accepted conclusion.

However, there is a sphere of knowledge where the question of general patterns has been resolved unambiguously and indisputably. This is natural science, especially basic physics and chemistry. (Although the viewpoint exists that evolutionary biology and geology are less nomothetic and more idiographic like history, this is debatable). All natural sciences share a similar methodology that emphasizes finding general patterns. Every natural science discipline studies a subject consisting of a multitude of objects. Generalization occurs from the individual and particular to the general, from individual things and phenomena, to classes of things and phenomena of the same nature, and from them to the general as a whole, with the formulation of general laws. These general laws provide a powerful tool for understanding, predicting, and manipulating the natural world.

Nonetheless, exceptions exist to this scheme. These exceptions involve the absence of classes of things and phenomena with similar characteristics. This is possible when the subject of study is a set consisting of only one element. Earth sciences, planetary sciences, and solar sciences are examples of such disciplines. Despite the uniqueness of their study objects, these sciences can still make certain empirical comparisons. However, for space or the universe as a whole, such comparisons are currently impossible, at least within the observable universe. The universe as a whole is presented to us in empirical experience with only one instance. The science that studies the universe as a whole is called cosmology. We can therefore assert that the specificity of cosmology lies in generalization based on a single subject of study.

All the above descriptions of natural sciences are necessary for us in order to draw a certain methodological analogy between cosmology and the cognition of social reality. The universe or space consists of many different structural objects – stars, galaxies, clusters of galaxies, clouds of interstellar gas, etc. Each of these objects is a set containing more than one element. However, all of this, taken as a unity, exists only in one copy. The same is true for society. It also consists of many social groups, each of which is a set containing more than one element. However, society as a whole is represented only in one copy. The similarity of these situations gives rise to a methodological analogy. I. Wallerstein was the first to draw

attention to this analogy in the preface to the first volume of his work "The Modern World System". In it, he notes: "There had only been one "modern world." Maybe one day there would be discovered to be comparable phenomena on other planets, or additional modern world-systems on this one. But here and now, the reality was clear – only one. It was here that I was inspired by the analogy with astronomy which purports to explain the laws governing the universe, although (as far as we know) only one universe has ever existed" (Wallerstein, 2011: 8). It is evident that in this passage, Wallerstein is conflating astronomy and cosmology, especially since he later corrects this mistake: "What do astronomers do? As I understand it, the logic of their arguments involves two separate operations. They use the laws derived from the study of smaller physical entities, the laws of physics, and argue that (with perhaps certain specified exceptions) these laws hold by analogy for the system as a whole. Second, they argue a posteriori. If the whole system is to have a given state at time y, it most probably had a certain state at time x.

Both methods are tricky, and it is for this reason that in the field of cosmology, which is the study of the functioning of the system as a whole, there are wildly opposing hypotheses held by reputable astronomers. Just as there are in the explanations of the modern world-system, a state of affairs likely to remain so for some time. Actually, students of the operation of the world-system possibly have it easier than students of the operation of the universe in terms of the amount of empirical evidence at their disposal" (Wallerstein, 2011: 9).

The question of who (cosmologists or historians) find themselves in a more difficult situation with regard to empirical confirmation of theoretical constructs within the framework of this analogy is, to a certain extent, a rhetorical question. However, another question is of interest. The scientific status, in the above sense, of cosmology is indisputable; in a certain sense, it can be considered a model, a reference science with universal, all-encompassing laws that have an explanatory nature. And in the context of all of the above, the question can be formulated as follows:

1. Why is the science of the universe as a whole nomothetic?

To find an answer to this question, let us turn to the understanding of what nomothetic science is, that is, a science that is not descriptive (idiographic) but explanatory in nature through the introduction of general, abstract laws. Of course, this question is very complex and multifaceted, but the authors of this work proposed a hypothetical answer to it (Tararoev et al., 2024). The response to this question is tied to the understanding that nomothetic science is fundamentally concerned with the potential for objective, universal, and abstract concepts to exist. Science can be understood as a text, an expression of thought, a way of thinking, and ultimately, a specific form of knowledge. This knowledge is built upon a set of concepts that are objective, not subjective. In turn, the objective existence of these concepts can be assumed if, and only if: "…concepts exist objectively as a property of the homogeneity and isotropy of space and time in a broad sense, as a set of objects of one nature. ... Objects grouped in these spaces have both common and private properties, and common properties or their combinations can be called the properties of homogeneity and isotropy of these spaces. Of course, these spaces are abstract and ideal. We create them to organize and systematize our perception of reality" (Tararoev et al., 2024: 69). The homogeneity and isotropy of the universe, the very object of cosmological study, is precisely what grants cosmological knowledge its nomothetic nature. We will delve deeper into the meaning of these terms below.

An integral part of any object of study, as noted above, is its spatial and temporal embodiment. This embodiment can be understood in two ways: in a narrow sense – as

physical or geometric space, as a "geometric place of points", "extension", "container", and time as a sequence of changes of events in it. Whether we consider space and time as physical substances or properties of objects, their exact nature isn't crucial here. More broadly, space, as mentioned above, forms a framework of interrelated objects, and time is a change of these objects in this set. Within the framework of science, these objects are called general, universal and abstract concepts. This space's homogeneity, then, translates to the homogeneity of these concepts. In other words, these concepts describe a vast number of objects consistently across vast stretches of time. Therefore, in the context of this definition of space's homogeneity and isotropy, we can introduce the concept of "semantic homogeneity and isotropy."

Cosmologists posit that space in the narrow sense, the foundation of space in the broad sense, is homogeneous and isotropic. This homogeneity and isotropy are believed to imply the same properties for space in the broad sense.

The basis of modern scientific cosmological knowledge is the "cosmological principle". As Steven Weinberg defines it: "The Cosmological Principle is the hypothesis that the universe is spatially homogeneous and isotropic" (Weinberg, 1972: 409). Of course, we are talking about physical (or geometric) space here. The methodological basis of this principle is twofold. On the one hand, empirical observational data tell us that "…the homogeneity of the universe has to be understood in the same sense as the homogeneity of a gas. It does not apply to the universe in detail, but only to a "smeared-out" universe averaged over cells of diameter 10^8 to 10^9 light years, which are large enough to include many clusters of galaxies. Also, it appears that the universe is spherically symmetric about us, so included in the Cosmological Principle is the assumption that the "smeared" universe is isotropic about every point" (Weinberg, 1972: 407). Over the past 50 years, observational data on the large-scale uniformity (homogeneity) and isotropy (no preferred direction) of the universe has grown significantly, enriching our understanding but also raising some controversial issues that we will explore later. Despite this, the Hubble law, a cornerstone of modern cosmology, remains valid. This law only holds true in a homogeneous and isotropic Universe, so its continued validity strengthens the case for these fundamental properties. In essence, as we did 50 years ago, we can still confidently claim that observations support the homogeneity and isotropy of the universe on a large scale.

On the other hand, the "cosmological principle" is justified theoretically. This is how Steven Weinberg imagines this theoretical justification: "The real reason, though, for our adherence here to the Cosmological Principle is not that it is surely correct, but rather, that it allows us to make use of the extremely limited data provided to cosmology by observational astronomy. If we make any weaker assumptions, as in the anisotropic or hierarchical models, then the metric would contain so many undetermined functions (whether or not we use the field equations) that the data would be hopelessly inadequate to determine the metric. On the other hand, by adopting the rather restrictive mathematical framework, ... we have a real chance of confronting theory with observation. If the data will not fit into this framework, we shall be able to conclude that ... the Cosmological Principle ... is wrong" (Weinberg, 1972: 408-409). Thus, we see that the cosmological principle facilitates our understanding and representation of the universe, primarily through simplification. In this light, it can be called a truly fundamental scientific principle, a generalization of earlier ideas about the homogeneity and symmetry of space. It is precisely with the emergence of such concepts, even in their most rudimentary and incipient forms, that we can speak of the genesis of cosmology as a nomothetic science, in contrast to the ideographic, descriptive science of the ancient Egyptians and Mesopotamians. The first step in this direction was made by

Pythagoras, who first introduced the concept of "cosmos" and the idea of a sphere, reflecting the sphericity of the Earth: "[Pythagoras] is said to have been the first to call the heaven "the cosmos" and to have said that the earth is spherical" (Diogenes Laërtius, 2018: 48–49). The very concept of "cosmos" (gr. κόσμος – "order") was widely used by Plato, who, following Pythagoras, imagined it as a sphere. This sphere was alive and animated (Plato, 1991; Plato, 2009). Aristotle used the term "uranos" (gr. οὐρανοῦ – "sky") (Aristotle, 1922). Aristotle's "uranos" differed from "cosmos" in that it was not alive and animated, but was also ordered and had the shape of a sphere. The sphericity of the universe, as the "first type" of spatial ordering in scientific cosmology, was preserved until Copernicus. And only with the discovery of Kepler's laws, which assert the ellipticity, and not the circumference, of the orbits of the planets of the solar system, the principle of circular ordering became a thing of the past. It is already replaced in the Newtonian cosmological scientific picture of the world by the modern cosmological principle of spherical homogeneity and isotropy of the universe, which is the methodological basis of modern scientific cosmology. As already mentioned above, this principle has strict empirical confirmation.

However, in the past, there were situations when observational data allowed this principle to be questioned, as, for example, this happened with the discovery of the so-called Axis of evil (Sutter, 2017). Nonetheless, in this and other cases, after a detailed analysis of observational data and their interpretation, the cosmological principle was rehabilitated. Even if, in the future, with the expansion of the observational base and capabilities, any deviations from global isotropy and homogeneity are discovered, these deviations, of course, will not be so significant and fundamental as to force us to completely abandon the cosmological principle. We have already accumulated a wealth of observational evidence on this issue, and as our observational tools improve, new data can only make some adjustments to what we currently know about the homogeneity and isotropy of the universe. These adjustments can be taken into account in more complex models, with a violation of homogeneity and isotropy, for example, the toroidal Universe models (Aurich et al., 2021). However, even in such models, symmetries (plural) and, therefore, order are preserved, but not in the form of a sphere, but in a more complex way. This means that the cosmological principle will be limited, but it will not become entirely false. But at the moment, there are no prerequisites for such a development of events. Thus, the hypothesis that the universe is isotropic and homogeneous on the largest scales is currently the fundamental basis of modern cosmology.

The spatial homogeneity and isotropy of the universe, meaning that it appears uniform and the same in all directions on large scales, suggest a similar homogeneity of time. This concept of "cosmological time" is an abstraction, much like the idea of "the Universe as a whole." By studying the interactions and individual behaviors of separate elements of the universe, we can build a comprehensive picture of its evolution as a whole. Einstein's General Theory of Relativity (GTR) is the cornerstone of our understanding of time, especially on a cosmological scale. As its title, "Gravitation and Cosmology" by Steven Weinberg suggests, the theory primarily focuses on gravity. According to GTR, time is relative. As a result, for each physical object there are two classes of time reference systems: an external one not associated with the object, and an accompanying reference system associated with the object. Each of these time reference systems, in most cases, can give different quantitative readings, and all of them will be true.

This thesis is well illustrated by the well-known twin paradox. According to this paradox, two identical twins live on Earth. One twin embarks on a high-speed trip to a distant star system on a rocket that flies at a speed comparable to the speed of light. Due to this, and

the fact that the rocket needs to accelerate to this speed (and overloads will occur during acceleration), time in the rocket's reference system (the concomitant system) will go slower than on Earth (the external system). As a result, upon the traveler's return to Earth, a situation may arise in which the journey took several years in the reference frame associated with the rocket. However, in the reference frame of the Earth, it took several decades. The twin traveler will be young, while the homebody twin will be old. The paradox of the situation is that there are two answers to the question of how long the space journey lasted, and both of them will be correct. In the reference frame of the rocket, it took several years, while in the reference frame of the Earth it took several decades. The accompanying reference frame is not privileged, and in terms of truth status it is the same as all other external systems, provided that they are inertial. And given that there can be many external reference frames, we can talk about a quantitative difference in the time intervals between two identical events. This is called the relativity of time. All objects in the universe have this property. Each object has an accompanying frame of reference, and for each object, there are many external frames of reference.

However, the universe as a whole is an exception. By definition, the universe is everything that we are able to observe, and therefore there are no external time reference systems. We cannot observe the Universe "from the outside." It has only one system: itself. Therefore, we can say that cosmological time is not relative in the way that time intervals can have different numerical values. It is absolute in the sense that its value is always only one. In terms of its universality, it is similar to Newton's absolute cosmological time, but unlike it, it does not have a substantial property. For Newton, time does not depend on matter, and in modern cosmology, which is based on GTR, the properties of time are determined by the properties of matter that is "distributed" throughout the space-time continuum. However, as we said above, the cosmological principle asserts spatial homogeneity and isotropy in the universe. This implies a uniform distribution of matter in the universe: therefore, uniformity of the properties of time. This uniformity can be described as the homogeneity of the properties of time in all areas on large scales of the universe as a whole. Regarding the past evolution of the universe, let us again give the floor to S. Weinberg: "The question still remains, whether the universe is spherically symmetric and homogeneous at all times, or merely over some temporary present phase of its history. There has been an interesting suggestion, … that the universe may have been highly anisotropic during some dense early phase, but that the anisotropies have since been largely smoothed out through the action of neutrino viscosity and other dissipative effects. However, even in such theories, the universe has been highly isotropic and homogeneous over all of that part of its history which is directly accessible to astronomical observation" (Weinberg, 1972: 407). Thus, we can state that time appears to be homogeneous throughout the universe.

With regard to temporal isotropy, the following can be said. Time is one-dimensional, it has only two directions: past and future (mathematical models of multidimensional time are possible, but they have no empirical component). In kinematic models time is reversible, the past and future are equivalent, and time is isotropic**.** In dynamic models, the emergence of "forces" leads to the emergence of the concept of "energy" (as the product of forces and displacement), and energy is characterized by dissipation (according to the second law of thermodynamics), which leads to the irreversibility of time, and, consequently, to its anisotropy. Thus, we can state that modern cosmology, as a science, is characterized by the properties of homogeneity and isotropy of space and the property of homogeneity of time. These properties of homogeneity (space and time) lead to the concept of semantic

homogeneity discussed earlier. This property is a consequence of the fact that in a spatially homogeneous and isotropic and temporally homogeneous Universe, the laws of nature are fulfilled everywhere and always. These laws are the same in any area of the universe and at any moment of its existence. We can refer to this property as the invariance of laws relative to space and time. If by laws we mean certain statements about phenomena, processes or relationships, then we can state that statements consist of concepts. The invariance of laws implies the immutability and universality of the fundamental concepts describing the universe. These concepts retain their meaning throughout the universe across time. While their specific values may change, their essential nature remains constant.

The universe as a whole is described by many physical concepts, but we'll focus on a few key ones. The cosmological scale factor is a spatial, dimensionless quantity that characterizes the expansion of the universe, or the rate at which astronomical objects move away from each other. The cosmological scale factor is a function of cosmological time. While the specific form of this function can change throughout the universe's evolution, the underlying concept – a factor that describes the universe's expansion – remains constant. Another spatial characteristic is curvature. In different models, it can change over time or remain constant, but its meaning remains universally the same. Similarly, energy density describes the universe and changes over time. The law governing this change may also evolve, but the concept of energy density itself remains constant.

It's also worth noting the importance of energy density, as Steven Weinberg has observed: "Hence homogeneity and isotropy require the components of the energy-momentum tensor *everywhere* to take the form … ρ(t)" (Weinberg, 2008: 8). That is, the energy density ρ(t) does not depend on spatial coordinates and depends only on time. According to the mathematical formalism of cosmological theory and general physical considerations, the energy density acts as a driving force of the evolution (in the broad sense) of the universe. In the broad sense, this refers not only to metric evolution, i.e., a change in the scale factor over time, but also to the transition from "from one stage to another" of the evolution of the universe. According to mathematical formalism, the driving force behind metric evolution is pressure, which is in turn determined by the equation of state of the universe. This equation specifies the relationship between pressure and energy density of the universe, where energy density is the causal factor, and pressure is the effect. In turn, energy density characterizes the material content of the homogeneous and isotropic space of the universe. As the universe evolves, it is filled with different states of matter in varying ratios. Each epoch is a time interval where one type of matter dominates, meaning its percentage is greater than the others. We distinguish between these epochs using terms like "epoch of the predominance of matter" and "epoch of the predominance of radiation." Other names are also possible. Each of these epochs has its own unique energy density, and therefore its own pressure, leading to its own rate of evolution for the universe. The transition from one epoch to another is due to a change in energy density, which in turn alters the energetic and, more broadly, the material characteristics of the universe, ultimately driving qualitative changes in the world.

Thus, we can assert that only if the universe exhibits spatial homogeneity, isotropy, and temporal homogeneity can it be described as a single whole governed by general, universal concepts applicable throughout its evolution. This description constitutes our scientific nomothetic understanding of the universe as a whole. Consequently, cosmology, as nomothetic knowledge, is only possible for a relatively homogeneous object of study.

A natural question arises about how this conclusion is consistent with the theory of the Multiverse. You can read about the theory itself, for example, in the work of Vilenkin Alex

(Vilenkin, 2006). The depth and originality of the theory are undeniable; however, one key point must be considered. Other worlds, or universes, like the Multiverse as a whole, are a purely theoretical construct that cannot be directly verified in the foreseeable future. Therefore, the description of "many worlds" and the Multiverse as a whole is possible only within the framework of our existing laws and concepts. We can modify these laws and concepts, but we cannot describe what we fundamentally do not know, what is entirely different from our current understanding. Consequently, the theory of the Multiverse can be considered as a natural extension to the theory describing our universe, which is based on empirical data.

This exemplifies the concept of nomothetic science, and the next question we ask will be:

2. Why is the study of societal development idiographic, and how can we fix this?

A fundamental issue about the nature of the social sciences could be phrased as follows: Why do we study societies as unique entities rather than attempting to discover universal laws governing all societies? The underlying assumption is that there is a desire to make these studies more nomothetic, more like the natural sciences that seek to establish general laws. Human societies are incredibly complex systems influenced by a vast array of factors, including history, culture, geography, and individual choices. This complexity makes it challenging to isolate specific variables and establish universal laws. Each society has a unique historical trajectory, shaped by a series of contingent events and decisions. This makes it difficult to compare societies directly and to identify universal patterns. However, when it becomes necessary to illustrate societal development, we rely on historical knowledge.

If we understand the term "history" in the generally accepted sense, then the subject of this scientific discipline will be, first of all, social institutions, social groups and relations between institutions and groups both within them and among themselves. That is, we are talking about macrohistory, which covers historical reality as widely as possible, in contrast to microhistory, which involves the study of private phenomena that occurred in the lives of individuals of the past, or the history of everyday life (the history of mentalities), which studies the factors influencing consciousness, norms of behavior, etc. (Macrohistory and macrohistorians, 1997; Levi, 1991). The history of the European continent, for example, using the macrohistorical approach, is understood, first of all, as the study of the sequence of events in the relations between social institutions – the states that existed on this continent, as well as the relations between social and cultural groups (religious, national, class, others) within these states, and between other institutions (for example, property), both within states and in interstate interaction.

The conceptual designation of social groups is fixed both formally and informally. Informally, this occurs through understanding a particular social term in its use within a language. Formally, definitions are established within the legal field, through the framework of laws. It is evident that the formal method appears at a later stage of societal evolution, coinciding with the advent of writing and the institution of law. For instance, we can cite the term "family." Leslie White in Chapters 5 and 6 (White, 1959) describes in detail the evolution of the family in the early eras of society. The notion of family has evolved dramatically throughout the history of human civilization. Moreover, its definition has varied widely across different cultures. In modern society, there is a wide variety of family structures, with both legally fixed and unfixed statuses. Therefore, we can assert that the concept of "family" is polysemantic, with different meanings. Building on this idea, we can formulate that this concept exists in a heterogeneous social space, meaning it varies across social and cultural

contexts and throughout history. Understanding that this applies not only to the concept of "family" but also to all social constructs (property, state, army, power, religion, and much more), we can assert that social space and social time are inherently heterogeneous. Society as a whole can indeed be characterized by the words of Alex Vilenkin: "Many Worlds in One." However, unlike the theory of the Multiverse with its many universes, in society these "Many Worlds" are directly experienced, while "in One" is an abstraction. In the theory of the Multiverse, it's the other way around: we deal with one world empirically, and its diversity is an abstraction.

The diversity of sensory perceptions of social reality significantly complicates the description and understanding of human society as a unified whole and gives this description an idiographic character. This is because concepts describing social structures, institutions, and groups, their cultural peculiarities, and the relationships between them, take on different meanings. However, we can still establish a comparison (or analogy) between them, for example, between a family in the European Neolithic and a family in 19th century China. This would be easy to do if there existed some special, standard social system, relative to which we could record the differences in the content of one concept from another. Of course, intuitively, each representative of a certain culture chooses their own as a standard socio-cultural system, with meanings readily understood within that system. For example, we take the understanding of the family in modern Western society as a model and then indicate how the family of the European Neolithic differs from it. Then we indicate how the family in 19th century China differs from it, and then, based on these differences, we can compare them with each other. This entire procedure can be conditionally called "constructing a table of correspondences."

However, in reality, such a reference system does not exist; social concepts are very dynamic over time and have many nuances even within one culture. This recognition allows us to develop a central argument about the essential heterogeneity of social space and social time. Of course, we are forced to "work" with social concepts; we cannot describe society in any other way; yet, due to the essential heterogeneity of social space and social time, this description will always be non-strict and ambiguous. Within this framework, any thesis can always be challenged; switching to a different "accompanying system of meanings" would suffice. Of course, these are obvious things, and they are quite clear: "The historical sciences are historical because they deal with entities and groups of entities that have traceable continuity over time, but that also change" (Aberle, 1987: 551).

This situation can be characterized as a problem and shortcoming of the idiographic (specifically historical) understanding of the human community as a single whole. Several methods exist and are being developed to overcome it and minimize the negative consequences. However, based on this, a "homogeneous field of semantic constructions" offers a way to minimize these shortcomings. This field contains meanings that inherently depend weakly on space and time and are universal. We see that in the socio-cultural field, this is impossible. Conversely, the analysis of cosmology demonstrates that the homogeneity of physical space and time allows us to describe the universe as a single whole, governed by all-encompassing laws of nature. The same will be true for society. Its objects – people, social groups, institutions, structures, relationships, and cultural practices – form not only social space and time but also exist within physical space and time. Even if space and time are heterogeneous, it is likely to an extremely small extent.

The modern scientific understanding of the nature of physical (geometric) space and time is largely based on the General Theory of Relativity. As discussed previously, this theory

implies that space and time are not uniform, especially in the vicinity of massive objects or at extremely high speeds. However, the relativistic effects on space and time intervals become readily observable only under special conditions, such as at speeds close to the speed of light or in strong gravitational fields. We can call the totality of these conditions a mega world. This mega world encompasses stars, galaxies, clusters of galaxies, and so on. On the surface of the Earth and not far from it, there are a huge number of external reference systems in which space and time intervals differ from each other. Despite these minute, practically undetectable differences, we can assume society exists in a homogeneous and isotropic physical (geometric) space and homogeneous physical time. This allows us to assert that the laws of nature, unlike social laws, are universal in society's environment, operating everywhere and always.

3. Energy description of society

It's worth reiterating that society is understood here as a multi-level socio-cultural system – a physical and/or theoretical structure within which humans interact using culture. This definition also aligns with the works of Frank W. Elwell and Marvin Harris (Elwell, 2013; Harris, 1979). Simultaneously, the proposed "energy approach" originates from the premise that social beings can be described using the same general, ontological, universal categories applicable to nature. These are the categories of "space", "time", "matter". Space and time have already been mentioned above, and the concept of "energy" is "crucial" for describing matter, including its social manifestations. Thus, we come to the formulation of a unique "energy approach" to understand the functioning of social structures, institutions, and groups and the relationships between them. This approach is not new. It is presented by many authors. One of the most famous is Leslie White, the author of the term "culturology" to denote the science of culture. Analysing societal development, it's important to emphasize that "culturology accepts the view that cultural forms, events and phenomena align with the life, activity and characteristics of the human, of the society, civilization and history, i.e. they enter in a multitude of relations with phenomena other than culture itself" (Kasperski, 2019: 14). That's why in his work "The Evolution of Culture: The Development of Civilization to the Fall of Rome" White notes: "A culture, or socio-cultural system, is a material, and therefore a thermodynamic, system. Culture is an organization of things in motion, a process of energy transformation. Whether it be chipping of arrowhead, catching a fish, hoeing a hill of beans, avoiding your mother-in-law, calling your father's sister's son "father", performing a ritual, playing a game, regarding a churinga with awe, or breathing a silent prayer, the event is an expression of energy expended. "Culture" is… an organization of energy transformations that is dependent upon symbolling" (White, 1959: 38). There, quoting Soddy, he adds: "The laws expressing the relations between energy and matter are not solely of importance in pure science [i.e., physics]," says Soddy, "they necessarily come *first in order… in the whole record of human experience,* and *they control*, in the last resort, *the rise and the fall of political systems, the freedom or bondage of nations, the movements of commerce and industry, the origin of wealth and poverty, and the general physical welfare of the race* [italics supplied]" (White, 1959: 38–39). There, quoting Soddy, he adds: "Cultural systems operate, therefore, only by harnessing energy in one form or another, and by transforming it in the production of human need-serving goods and services" (White, 1959: 41). Here it is necessary to explain what exactly energy is consumed for in the human community – first of all, to perform work. Every production of objects and services relies on mechanical movement, whether it's linear (translational) or circular (rotational). This movement occurs due to forces acting on the

object of labor. Since it happens within an environment, there's resistance that needs to be overcome. The product of force and the resulting displacement is called work. This work done is equal to the energy spent, and therefore, it can be called used mechanical energy.

The second component of energy is thermal energy, used for many applications. From the moment humans and societies emerged until roughly the end of the 18th century, the primary source of mechanical energy was muscle power, derived from humans or animals. However, wind and falling water were occasionally used as auxiliary forces. Throughout the existence of man and society, these two primary energy sources, mechanical and thermal, were used relatively independently of each other. With the advent of steam engines, thermal energy could be transformed into mechanical energy. Later, the development of electricity generation allowed mechanical energy to be transformed into thermal energy. These transformations are the foundation of modern civilization, powering hydroelectric, coal, gas, and nuclear power plants, internal combustion engines, and many other applications.

Thus, we can agree that energy characteristics are a fundamental aspect of socio-cultural systems. However, a key question remains: "What specific energy characteristic is most important and necessary to describe societal development and make future forecasts?" The simplest approach might be to consider the absolute energy expenditure required for a particular human process. However, this accounting is very difficult and sometimes impossible to do in practice. In addition, due to the significant social heterogeneity mentioned above, taking into account the absolute values of energy, is of little informational value. On the one hand, high energy costs can indicate both the degree of development of a social system and its low efficiency. Therefore, in order to impart greater homogeneity, i.e. comparability across energy transformations, the amount of energy must be standardized by some indicator. And with regard to this standardization, there may be different points of view. For example, Leslie White talks about the standardization of energy per capita: "Cultural systems very as means of harnessing energy; some are more effective than others. They may be compared in terms of coefficients derived by relating amount of energy harnessed and expended in a given period of time to the number of human beings embraced by the system… we can compare cultures in terms of amount of energy harnessed and expended per capita per year. Or we can make comparisons in terms of *power*, the rate of doing work, and classify cultures in terms of horse-powers per capita" (White, 1959: 41). And further: "Since the amount of human need-serving goods and services produced is proportional to the amount of energy harnessed, or horse-power generated, per capita, other factors remaining constant, a cultural system activated by energy derived from the human organism alone would represent the minimum in the range of capacities of cultural systems. From the standpoint, then, both of energy, or power, per capita and amount of human need-serving goods and services produced per capita, cultures that have the energy of human organisms only, under their control and at their disposal for use in the service of human needs, are at the bottom of the scale… The energy factor provides us, therefore, with an objective and meaningful yardstick with which to measure these, and all other, cultures. A culture is high or low depending upon the amount of energy harnessed and put to work per capita per year, together with all the consequences attendant upon these increase" (White, 1959: 42).

Another way to normalize energy is to normalize it to itself. A parameter is introduced, denoted by the abbreviation EROEI (energy returned on energy invested), which is also sometimes called EROI (energy return on investment). This parameter represents the ratio of the usable energy obtained to the total energy costs. With an EROI value of 1, all the energy spent is converted into useful energy (or work), only those technologies with an EROI greater

than 1 provide an energy gain. The EROI indicator itself does not characterize absolute energy values but the degree of availability of useful energy for the human community. There is a viewpoint that EROI indicator determines the level of development of culture and civilization. For example, Thomas Homer-Dixon argues that a falling EROI in the Later Roman Empire was one of the reasons for the collapse of the Western Empire (Homer-Dixon, 2006).

In another work, a group of authors presented their vision of the dependence of the level of social organization on the value of the Energy Return on Investment (EROI) indicator, though only for oil. They propose an "energy pyramid" according to which, a minimum EROI of 14 is necessary to satisfy society's cultural, spiritual needs (art, etc.). If EROI decreases below this level, sectors like healthcare, education, social protection, food production, and transport would consistently decline or fail to function properly, leading to social collapse (Lambert et al., 2013). The true challenge with EROI lies not in its value, but in expressing it in absolute terms (Lambert et al., 2013). This situation arises because, firstly, it is difficult to separate the contribution of people and nature to the received useful energy. Secondly, in each specific case of place and time, the energy expended may be different due to the diversity of natural conditions, which ultimately affects the value of EROI. Thus, EROI significantly depends on space and time.

In general, we can say that the per capita energy consumption determines a community's operationality or the *amount* of energy available for its activities. While EROI helps determine the *quality* of energy availability, both society and its energy characteristics are complex systems. These two parameters alone are insufficient for a complete characterization. It is possible to introduce more characteristics that describe the energy balance in society. And one of such characteristics can be an analogue of the energy density in cosmology – the ability of energy to concentrate. One *qualitative* characteristic of energy concerns its distribution in space and time. It's important to remember that in a homogeneous and isotropic Universe, energy density does not depend on space, but only on time. In the spatial and temporal scales of society's existence, part of the energy used by a person depends on spatial and temporal parameters, and part does not. Forms of energy with weak dependence on space and time offer advantages over those with strong dependence. This is because the former can be concentrated in large quantities within specific space and timeframes, thereby increasing energy availability per capita for a constant or growing population. The transition from the use of some types of energy to others is a critical factor that will determine the qualitative evolution of socio-cultural system, its complication and development. Of course, outline of the idea requires serious justification and argumentation, which go far beyond the scope of this work and which must be done separately. However, it is possible to present a general thesis scheme to illustrate this statement.

The first fundamental transition is the Agricultural revolution, the emergence of productive agriculture, which led to the formation of new social institutions. This fundamentally changed humanity's way of life. The subsequent Industrial Revolution further complicated the socio-cultural system, shaping the world we live in today. Both of these revolutions are associated with the energy revolution and the transition from less concentrated sources of energy to more concentrated ones. The first is the transition from gathering and hunting to agriculture and cattle breeding. Before this revolution, the main source of food was hunting. Afterward, people began relying primarily on agriculture, particularly cereal crops, for their sustenance. In terms of energy value, meat, the main product of hunting, is more caloric than cereals, although cereals are not much lower in calories. Hunting also requires less energy than cultivating crops, such as cereals, and raising livestock. Hunting likely had a higher

EROI than agriculture. Additionally, the small population in the Paleolithic period suggests a higher energy expenditure per capita than in the Neolithic period.

However, the disadvantage of the hunting lifestyle is that the hunter cannot make significant reserves of meat. Whereas, cereals, under favorable circumstances, can be stored for a long time and their nutritional value degrades slowly. Concentrating energy in one place allows large numbers to gather and work for extended periods, as seen in the construction of the pyramids in ancient Egypt. Storing large amounts of meat energy for extended periods is impractical. Unlike grains, live animals require constant food, necessitating migration. Meat provides less concentrated energy per unit space compared to grains. Additionally, grains have a longer shelf life than meat, making them less dependent on immediate consumption. The high energy density and long-term storability of grains were key factors enabling the social impact of the Agricultural revolution. These features allowed for the development of diverse social and cultural forms and institutions.

The same is true for the Industrial Revolution. Its emergence and development are associated with a new source of energy – coal. Coal has a higher heat capacity than previously used wood, peat and some others. Fossil fuel is a source of energy that is virtually independent of time, at least on a societal scale. Initially, it was used for heat to obtain materials like metals, but with the invention of the steam engine, it became a source of mechanical energy. During industrialization, other sources of thermal energy emerged, including natural gas, oil, and the energy harnessed from the nuclei of heavy radioactive elements. Similar to coal, these sources are practically independent of time, possess high heat content, and consequently allow for concentrated production of significant amounts of usable work. The same is true for the energy of vertically falling water. It's also virtually independent of time and can be collected in large quantities. Unlike solar and wind energy, tidal power, which harnesses the energy of water movement due to the Sun and Moon's influence, lacks inherent dispatchability. Its energy output depends on the tides, making concentration without significant additional costs impossible.

All of the above is also true for modern socio-cultural system. The speed of change and global turbulence make adjustments to the classical nomothetic and idiographic approaches to studying modern processes and including purely social categories, be studied from the perspective of the energy approach. This approach lays the groundwork for understanding modern social processes, though a complete understanding requires using potentially ambiguous social categories. The energy approach, while it may lose important particular details, is able to focus attention on long-term general patterns. As Leslie White said: "It is not always possible to observe microscopic events effectively with a macroscopic spyglass" (White, 1959: 21).

Conclusions

Since there is only one global society, it's difficult to draw general conclusions based on specific examples (inductive generalizations) about the long-term, "global" causes of social transformations within individual communities, especially modern ones. Following E. Wallerstein's suggestion, we can draw an analogy between society as a socio-cultural system and the universe since both exist as unique entities. This analysis suggests that describing the universe as a single whole is only possible if it exhibits spatial and temporal homogeneity, as well as spatial isotropy. The main factor that determines the evolution of the universe under these conditions will be the energy density of the universe. Thus, the universe as a whole,

assuming it's homogeneous, is described by three fundamental categories: "space", "time", "and energy".

Human society as a socio-cultural system, described in social categories, i.e., categories of social institutions, social groups, and relations between them, cultural practices, is not homogeneous. Each group, institution and type of relations are specific to the culture, place and time in which they exist. A connection can be established between them, but this connection will always be polysemantic. Social space and time are essentially heterogeneous. In this case, only a description presenting a subjective point of view can be reliable. However, society also exists in physical (geometric) space and time, which are homogeneous for it. Similarly to the universe, this homogeneity allows us to describe the general patterns of development of society in the same categories: "space", "time", "and energy". Due to the inherent complexity of societies, they exhibit a variety of energy characteristics. Among them are the amount of energy, the availability of energy, the ability to concentrate it. While it's impossible to fully capture the complexities of society through these categories alone, but on their basis, we can identify random factors and general patterns in social processes, including modern ones.

🕮 References

Aberle, D. F. (1987) Distinguished lecture: What kind of science is anthropology? *American Anthropologist*, Volume 89, Issue 3, 551-566. https://doi.org/10.1525/aa.1987.89.3.02a00010

Aristotle (1922) *De Caelo. The works of Aristotle translated into English – De Coelo; De Generalione et Corruplione*. By J. L. Stocks and H. H. Joachim. New York: Oxford University. Press.

Aurich, R., Buchert, Th., Martin J. F., and Steiner, F. (2021) The variance of the CMB temperature gradient: a new signature of a multiply connected universe. In *Internet Archive of The Cornell University* https://arxiv.org/abs/2106.13205

Diogenes Laërtius (2018) *Lives of Eminent Philosophers.* Book VIII. Trans. Pamela Mensch. Oxford University Press.

Elwell, Frank W. (2013) *Socio-cultural systems: Principles of structure and change*. Athabasca University: AU Press.

Harris, Marvin (1979) *Cultural materialism: the struggle for a science of culture.* New York: Random House.

Homer-Dixon, Thomas (2006) *The Upside of Down: Catastrophe, Creativity, and the Renewal of Civilization.* Island Press.

Kant, Immanuel (1998) *The Critique of Pure Reason*. Edited and translated by Paul Guyer, Allen W. Wood. Cambridge University Press.

Kasperski, Edward (2019), What is Culturology? *ZAŁĄCZNIK KULTUROZNAWCZY. Cultural Studies Appendix. Special Edition – English Issue*, 1, 9-39.

Lambert, J., Hall, C. and Balogh, S. (2013) *EROI of Global Energy Resources: Status, Trends and Social Implications.* https://doi.org/10.13140/2.1.2419.8724

Levi, Giovanni (1991) On Microhistory. *New Perspectives on Historical Writing.* Ed. by Peter Burke. Cambridge: Polity Press.

Lyman, Lee R., O'Brien, and Michael J. (2004) Nomothetic science and idiographic history in twentieth-century Americanist anthropology journal. *History of the Behavioral Sciences,* Volume 40, Issues 1, 77-96. https://doi.org/10.1002/jhbs.10180

Macrohistory and macrohistorians: perspectives on individual, social, and civilizational change (1997) Edited by Johan Galtung and Sohail Inayatullah. Westport, Connecticut; London: Praeger Publishers.

Plato (1991) Republic. In *The Republic of Plato, 2nd ed., Translated with notes and an interpretive essay by Allan Bloom*. Basic Books, a Division of Harper Collins Publishers.

Plato (2009) Timaeus. Translated by Benjamin Jowett. In *The Internet Classics Archive* http://classics.mit.edu/Plato/timaeus.html

Sutter, Paul (2017) *The (Cosmological) Axis of Evil.* In *Space.com.,* https://www.space.com/37334-earth-ordinary-cosmological-axis-evil.html

Tararoev, Jakov, Horodyska, Olga and Dolska, Olga (2024) Ontological Prerequisites for the Emergence of Scientific Cosmology in the Context of the Emergence and Development of the Scientific Thinking. *Philosophy and Cosmology*, Volume 32, 60–73. https://doi.org/10.29202/phil-cosm/32/4

Vilenkin, Alex (2006) *Many Worlds in One: The Search for Other Universes.* New York: Paperback.

Wallerstein, Immanuel M. (2011) *The Modern World-System I.* University of California Press.

Weinberg, Steven (2008) *Cosmology.* Oxford University Press.

Weinberg, Steven (1972) *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity.* Massachusetts Institute of Technology: John Wiley and Sons, Inc.

White, Leslie A. (1959) *The Evolution of Culture; the Development of Civilization to the Fall of Rome.* McGraw-Hill Book Company, Inc.

Windelband, Wilhelm (1998) History and Natural Science. Translated by J. T. Lamiell. *Theory and Psychology,* 8, 6-22.

Part 3:
COSMOS AND HISTORY

From Genes to Cosmos: Broadening Contexts in the Study of Happiness

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In this article, the authors address the content of the presentations and subsequent debate of the international online meeting "From Genes to Cosmos: Broadening Contexts in the Study of Happiness." Four guest speakers talked about the main implications their respective research backgrounds have for well-being and happiness as a field of study. The ideas defended by the speakers can be grouped into these points: a) the basic outline of a framework for thinking about scholarship on this topic in general; b) a plea in favor of a shift in paradigm, from a well-being society for some to a society based on well-being for all; c) a critique of the Western-centric orientation of research on these topics; d) arguments for the need of mutual enrichment between Humanities and Social Sciences in the study of well-being and happiness, and e) some ideas from neuroscience and psychology about how well-being and happiness are related to education, and about the role that mindfulness can play in this area. In their conclusions, the authors express their concerns about the future research agenda in the field of well-being and happiness and offer some questions and proposals about the broadening of the field.

Keywords: well-being, happiness, flourishing, mindfulness

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Introduction

In this article, we summarize the content of the presentations and subsequent debate of the international online meeting "From Genes to Cosmos: Broadening Contexts in the Study of Happiness," (available on YouTube),[1] which took place in Almería (Spain) on June 19th, 2024. The event was organized by the International Society of Philosophy and Cosmology and the Universidad de Almería (Spain) in collaboration with the Human Flourishing Program of Harvard University. We are very grateful to Oleg Bazaluk for coming up with the idea of this international event and for helping us organize it. In his opening speech of the event, Dr. Bazaluk reminded us that its theme connects back to Plato's Academy, where happiness was first linked with living a good life. The main goal of this event was to bring together some renowned specialists in the study of happiness and well-being to discuss new dimensions and perspectives in this field of research. We were convinced that events like this one can serve to create new international collaboration networks that will promote ambitious projects in the future.

If we look at the organizing institutions of the event and the research backgrounds and affiliations of the four guest speakers, this online roundtable was an academic event. However, the idea was to create an environment for a fresh conversation in which a group of colleagues express their views about the complexities of a field (happiness/well-being) and develop a debate. First, we will summarize the arguments offered by the four guest speakers in their presentations, followed by a recapitulation of the main ideas that emerged in the debate. We will conclude with some final remarks that can be helpful for the future research agenda in the field of well-being and happiness.

1. Waves of scholarship on well-being and happiness

The first guest speaker was Tim Lomas. Tim Lomas is a Psychology Research Scientist in the Department of Epidemiology at the Harvard T.H. Chan School of Public Health and part of the Human Flourishing Program at Harvard University. Between 2008 and 2012, he undertook his PhD at the University of Westminster, where his thesis focused on the impact of meditation on mental health. From 2013 to 2020, he was a lecturer in positive psychology at the University of East London. Among his extensive academic writing, we can emphasize three books (Lomas 2016, 2019, 2022).

He introduced his work on happiness and well-being in the context of presenting a framework for thinking about scholarship on this topic in general. In his view, this topic has not often been given the kind of credibility or the seriousness it deserves in academia, but he thinks that this is gradually changing, and the conference itself is a nice example of that. He presented a framework to understand the evolution of scholarship around this topic. This framework involves various "waves". The wave metaphor is a way of understanding development and progress in academic fields, a nice metaphor because it's quite organic, and it does not imply that any one wave replaces or supplants or gets rid of or negates an earlier wave in the sense that waves organically build on each other

Now, we are witnessing the fourth wave of global scholarship. According to Lomas, to an extent with globalization the oceans are intermingling in really interesting ways, so even if the scholarship in the West has been Western-centric, he thinks that there's much more of a communication and a dialogue and an interaction between scholars of different regions, and the picture is becoming much more global.

[1](https://www.youtube.com/watch?v=A7_bKaE9KXE&t=1794s

The first wave of modern scholarship on happiness and well-being came into being around the end of the nineteenth century. There was an interest in well-being but in the negative aspects. There was a focus on the negative aspects of well-being, conceptualizing and addressing mental illness and mental disorder, which paved the way for the emergence of Psychiatry and Psychotherapy.

From the 20s, 30s, and 40s of the 20th century onwards, a second wave, more focused on positive aspects of well-being, starts to gather strength. One of the defining characteristics of this second wave was that it was not about scientific study for its own sake, but about therapy and therapeutic practice, about helping people. This provides space for an emergent third wave, which Lomas considers to start really in the 1960s, and kind of culminated in positive psychology merging in the late 1990s. What distinguished this third wave was a recognition of the value of studying well-being scientifically for its own sake. From the 70s and 80s, we started to see things like the "satisfaction with life scale", which have been hugely influential, and probably the main measure of well-being we might find in the literature. Here, we do find well-being scholarship taking on a much more scientific tone for its own sake, not just in association with therapeutic practice and

According to Lomas, this process culminated in the emergence of positive psychology in the late 1990s when Martin Seligman took up the presidency of the American Psychological Association. This is the culmination of a third scientific wave the scientific wave but, as we have seen so far, new waves were emerging in response to what might be seen as deficiencies or things that are missing in earlier waves. Lomas thinks that the third wave of scientific scholarship "has been wonderful and still it's got so much to contribute", but one of the criticisms of this third wave, concerning psychology and probably even Academia in general, is that it has tended to be very Western-centric. As Tim said, "If we don't have the concept in English, it's not going to be in our scientific studies and our journals, we're going to overlook it we're missing out on those insights".

Lomas made a brief digression to explain the reason he got so interested in cross-cultural psychology. When he was 19 years old, he went to China to teach English for six months. When he visited monasteries, he encountered many words in Sanskrit and Chinese relating to Taoism and Buddhism for which he had no frame of reference that could help him to understand. He came back to the UK to study psychology he realized there was a whole wealth of ideas and concepts and insights and theories about the mind, about well-being, in those Asian traditions and in those cultures that were missing in his Western textbooks.

Lomas thinks that the psychology of well-being that we're developing it's good, but it's incomplete and culturally partial or biased, so there are many things that we're missing out. However, in the last twenty years, there have been increasing efforts to redress this partly by scholars in the West who engage with other cultures and collaborate with scholars, but also just giving a greater voice to people in other cultures. One of the things Lomas tried to emphasize in his book "Happiness" is the partial or incomplete nature of his views, because they are mainly based on Western scholarship. In one of the chapters, he presents a taxonomy of 16 different types of happiness. He admits that there could be others that are worth identifying and conceptualizing and researching, but he confesses "that this was the best I could do with the work that's been published so far, but it's a work in progress so we should try to increase our efforts to engaging cross-cultural scholarship."

Looking ahead to the future, Lomas suggested that, apart from extending our scholarship on well-being and happiness cross-culturally and globally -which still is very human-centric- the next phase of scholarship really should be thinking about non-human forms, like obviously the

well-being of animals, of Earth as a whole, but even other interesting life forms like artificial intelligence. What do we do with artificial intelligence? – Lomas asks – Is it conscious? Is it sentient? What responsibilities does confer upon us the way we engage with it? What kinds of research and scholarship should we engage in to think about the nature of artificial intelligence? How do we engage with it?

We need the planet to be doing well for us. We can't be well if the planet isn't well. But also morally for its own sake. Lomas thinks that this could be the future "fifth wave" of scholarship on well-being and happiness. It implies thinking in a much more cosmic sense, in terms of not just human beings but all life forms, terrestrial or even extraterrestrial, for its own sake and also for its relevance and impact upon our well-being.

2. Genetics and its relation with well-being and happiness

The second guest speaker was Meike Bartels. Meike Bartels is University Research Chair Professor in Genetics and Well-Being at the Department of Biological Psychology, Vrije Universiteit Amsterdam. After an internship at the Queensland Institute of Medical Research in Brisbane, Australia, Bartels graduated in psychology from the Vrije Universiteit. Her master's degree was in Physiological Psychology, with a special focus on behavior genetics. She has published over 350 papers in peer-reviewed journals, including the first molecular genetic evidence for well-being published in Proceedings of the National Academy of Sciences, and the first genomic variant for well-being, published in Nature Genetics.

Based on her research into the causes of differences in well-being, Dr. Bartels envisions a shift in paradigm from a well-being society for some, to a society based on well-being for all. She began her presentation by saying that she completely agrees with Lomas about the Western-centric orientation of research on well-being and happiness. She works in the field of genetics, where we need large samples, so what they tend to do in those studies is "to just pile everything together to get huge samples with any measure of well-being, it could be hedonic or eudaimonic". But in practice, it means that it mainly measures the hedonic part of well-being because not many studies -not even in the Western world- are focusing on eudaimonic well-being, except of course for "the wonderful Human Flourishing Program that Tim [Lomas] and Brendan [Case] are part of".

Bartels and her team are interested in the differences between people, genetic differences, and environmental differences. They have shown in several studies that the genetic underlying well-being is similar for both hedonic and eudaimonic measures of well-being. In the so-called "well-being society" of the Western world, the aim, in the end, is "to become happy". The World Happiness Reports show the average well-being of a country, and several countries are currently using that to say, "Well, this is well-being".

Bartels used "education" as an example. We see education as one of the ways to become happy and especially highly educated people become happier than people with less formal education. It is assumed that education comes first and happiness follows, but we looked really at the causal effects of education on well-being and we found that there's no significant evidence that there is a causal relationship between education to well-being. It doesn't mean that both are not associated. It's easy to see that several factors are related to education and also to well-being, even at a genetic level, but the "well-being society's" idea that education leads to a higher level of well-being is not supported by current very large data sets.

When comparing groups, Bartels thinks that we are missing a lot of things by not measuring other cultures, not only because we use only Western data, but also because we keep focusing on group differences between people. For example, concerning socioeconomic status and

money, many studies are focusing on the question: are people with more money on average happier than people with less money? Are people that are healthier on average happier people than unhealthy? Bartels thinks that we completely miss the picture if we only look at mean levels, so if we look at the relationships between income and life satisfaction, there again is no linear relationship, there's no causal relationship and it depends on what part of the population you are to see how strong this association is. So there's no causal relation between money and well-being and also no group differences. In many studies, the within-group differences are larger than the between-group differences. So, by comparing groups and focusing on the mean levels, we don't get to the answer of what well-being is and where these differences come from.

According to Bartels, we should focus on the differences between people and not on the mean levels. She agrees that well-being should be the center of all political and social research endeavors, because if we study well-being in the right way, if we appreciate and embrace the individual differences between people, what we could do in the end is to make the whole population move to the "better part" of the picture, so to speak. What we have to realize is that there will be no "one size fits all" approach. Everybody is genetically and environmentally different, and these differences are very important. We have this innate drive to be happy, but my happiness does not have to be the same as your happiness. We should study individual-level data and individual-level changes to understand where well-being comes from and how we can magnify well-being for people. We need to put well-being in the center. If we do that, well-being can even be the catalyst for many changes in the world. If we look at all the challenges that we face all around the world, we need happy people, we need people that know who they are, and we need people that use their full potential. We can achieve that -Bartels holds- only if our society is truly based on well-being, where well-being is the center point, and the rest will follow.

3. Mutual enrichment between Humanities and Social Sciences in the study of well-being and happiness.

The third guest speaker was Brendan Case. Brendan is the Associate Director for Research in the Human Flourishing Program at Harvard University. A Christian theologian by training, Dr. Case's research ranges across and integrates scholarship in theology, philosophy, history, and the social sciences, intending to develop thick, historically-textured accounts of human nature and human flourishing. He is the author of books like The Accountable Animal: Justice, Justification, and Judgment, and co-author of Least of the Apostles: Paul and His Legacies in Earliest Christianity (see References).

He began his presentation by reminding us that the mission of the Human Flourishing Program is to understand and promote human flourishing and to develop systematic approaches to the integration of knowledge across disciplines. That means "finding ways to help the humanities and social sciences to work together more skillfully and coherently in pooling their intellectual resources to develop genuinely an adequate picture of what flourishing consists of".

He alluded to Lomas's words when he said that social sciences, and psychology in particular, have more than a century and a half of history behind them, and Case noticed that, compared to philosophy and theology, "that is just getting started!" The interaction between the social sciences and these older siblings is still tentative. Case thinks that a broad paradigm for dialogue, however, in at least some specific areas, is now coming into focus, guided by the conviction that "moral philosophy without psychological content is empty whereas psychological investigation without philosophical insight is blind", using Mark Alfano's words (2016).

On the one hand, Case strongly argued that humanities can help guide, direct, and motivate the research of the social sciences. For instance, he explained that recent debates over the measurement of well-being have been explicitly, if often imperfectly, influenced by ancient moral philosophy. He reminded us that in a very interesting recent essay, some authors have drawn on Aristotle explicitly to argue that measures of life evaluation or life satisfaction ought to be given priority over other measures of well-being such as GDP per capita. Case suggests that life satisfaction measures follow Aristotle in allowing that a good life is likely to combine elements of the viewpoints identified as Epicurean and Stoic, that is, as involving both external goods, such as pleasant experiences (related to hedonic happiness), and internal goods such as character and virtue (related to eudaimonic happiness).

Case mentioned the intuitive requirement that the human good must be good for one's life as a whole and not simply for the passing moment. We might hypothesize –he argued- that measures of eudaimonic well-being would be more valuable and more predictive than other well-being outcomes to the extent that they could incorporate not merely the thin character strengths beloved of much recent positive psychology but rather the more robust excellences of character captured in the classical conception of a virtue.

On the other hand, Case asked, "What can the social sciences teach the Humanities about their areas of concern and interest?" Even as the Humanities can provide those concepts without which social scientific intuitions are blind, the social sciences can furnish those intuitions that are empirical evidence apart from which humanistic concepts are empty.

Case mentioned some of Miroslav Volf's books on flourishing and faith (2016, 2023). According to this author, there are three essential and inextricably linked dimensions to the good life. The three dimensions are circumstantial, agential, and emotional. He suggests that modernity tends to overemphasize the circumstantial dimension, which could threaten to limit our individual and communal flourishing. A life of faith can become a pathway to flourishing. Case said that Volf emphasizes that each of the great world religions teaches that we live our ordinary lives well when we have a purpose that transcends the good of ordinary life.

How does religious practice affect ordinary flourishing in general, rather than in its ideals and its deformations? We need a clear answer to this question. Volf distinguishes three domains of flourishing, which Case mentioned: a) a virtuous life; b) a prosperous healthy productive life-; and c) a life of subjected well-being. Case considered briefly the empirical evidence for how religious practice bears on each of these. First, regarding a virtuous life, there's a great deal of evidence suggesting that religious belief and practice generally make participants less prone to crime, rendering them fairer and more honest and generous in their dealings with others. Regarding a life that's going well –a prosperous life- data is again abundant, and this is an area in which Case and Lomas's work at the Human Flourishing Program have published a great deal. The trend shown by those data indicates that those who attend religious services at least weekly are about 34% less likely to bin shrink than those who never attend. Regular attendees are about 50% less likely to divorce, 27% less likely to be depressed, and five times less likely to commit suicide than non-attenders. Case said there is quite strong evidence that religious participation contributes in various ways to a life that feels good at least on average religious practitioners. The latter consistently report higher levels of meaning and purpose in their lives than non-practitioners, as well as higher levels of overall life satisfaction.

Case concluded by admitting that we have a great deal to learn from each other and a great deal of work to be done. His contribution gave us undoubtedly a taste of the kinds of conversations they are having in the Human Flourishing Program and elsewhere in the academy.

4. The role of education and mindfulness

The last guest speaker was one of us (Elena García-Sánchez). Senior Lecturer in the Department of Philology at the University of Almería. She graduated from the University of Málaga (Spain) and completed her Ph.D. at the University of Granada (1999) with the thesis Teachers' Beliefs on Motivation and their Behaviours Towards this Construct in the English Class. Elena has spent several research stays in the United Kingdom and the United States. She has a teaching career of thirty years, most of them at the University of Almería, where she served as Chair of the Department of English and German Philology. Dr. García-Sánchez has authored many articles and book chapters on topics such as teachers' beliefs, motivation, and emotions.

Her presentation began by quoting Lomas, Pawelski, and VanderWeele's work, who said that "concepts like flourishing, well-being, health, and happiness are of increasing interest across many fields, from psychology and medicine to politics and economics" (2024: 1). She talked about the concepts of happiness and well-being in education, and to do so, she paid attention to important constructs in education such as neuroscience, mindfulness, and conscious or reflective teaching.

She wanted to emphasize the concepts of happiness and well-being in education because she strongly believes that schools or universities are not just institutions where students come to receive education; they are places where young people learn, grow, and make friends and memories to cherish for a lifetime. They are places where young people develop a personality, character, values, and beliefs that stay with them throughout their lives. Her research emphasized the importance of solid relationships with teachers and peers in fostering student happiness. Needless to say, the experiences gained in the academic world play a major role in determining a person's success and well-being later in life.

She mentioned some authors on neuroscience and its implications for the practice of mindfulness in education. Following Cabrera (2021), García-Sánchez explained that having certain knowledge of the brain, of how our primitive brain or limbic system, drives our emotions and instincts, is important to develop personally in any field. Having that in mind, it is also important to know that there are two branches in neurobiology: neurophysiology and neuroanatomy, referring to the brain structure, and the functioning of that structure respectively, being this last part of neuroscience that teachers should be interested in. According to Betham (2018), the branch of neuroscience that studies meditative practices is known as contemplative neuroscience. The link between the so ancient contemplative practices and science is contributing to the birth of a modern set of tools that can be applied to our hectic lives and teaching methodologies. Mindfulness as a method in education comes out from this area, with the purpose of learning strategies to learn and perform better and being more motivated and more receptive to learning which, at the same time, will be related to happiness and well-being in education.

When we are mindful, we are open to surprise oriented in the present moment, sensitive to context, and above all, liberated from the tyranny of old mindsets. In this line, it is also important to mention that Langer (1997) coined the term mindful learning not related specifically to teaching, but implying that learning without awareness is limited, and many times useless.

Another important point that García-Sánchez made about mindfulness was attention regulation, a cognitive process that could be connected with three relevant components: alerting, orienting, and conflict monitoring (Tang et al., 2015). Alerting has to do with the readiness when we receive a stimulus, orienting is the choice between the stimuli, and conflict monitoring

is related to the solution of the neural conflict concerning the fact of paying attention to one thing or the contrary.

Anxiety or stress are other crucial factors from psychology and neuroscience to understand the way we may feel, the way the body may react to them, and the way we could deal with the body and mental state when talking about them in a general way, and from the perspective of education, and foreign language teaching and learning. In García-Sánchez's view, it is very important to talk about the relationship between emotion and cognition to improve our physical and mental well-being. Neuroscience is, therefore, starting to play an important role in education studying which are the best situations in which the brain will function better, to improve motivation in class, for example, or just students' well-being, derived from valuing the treatment of certain behaviors or mental imbalances, such as the absence of drive when treating depression through meditation.

García-Sánchez thinks that mindfulness and meditation could help a lot to promote well-being in a classroom. She defended the so-called "cooperative learning", where academic performance and success could be shared, and supported by all classmates. Any teacher who wants to improve students' well-being and happiness should foster a web of interconnected relationships among the students, not work isolatedly, leaving apart competition and mockery or ridicule, as very often occurs when speaking a foreign language specifically, which sometimes causes anxiety and stress in students. García-Sánchez believes that the recognition of the positive effect generated by mindfulness activities and the creation of a conscious environment is vital for the teaching world to take them into account as pedagogical resources and use them regularly in the classroom. We must say that it definitely could help teachers improve their recognition of the student's learning process and foster student happiness.

She concluded her presentation by agreeing with the idea that "we always teach who we are," and therefore, it is our duty as teachers to be reflective and to understand our students. As it is very relevant for their present and future learning and life, it is our duty to look inwardly so to speak, before we decide how to offer them the best experience.

5. Some questions from the subsequent debate

After the four presentations, our speakers discussed some crucial issues that emerged. One of us (Pulido-Moyano), as moderator, talked about the reasons for happiness not being at the very core of academic research. I said that one reason is that happiness, as a research field, is probably at least as complex as quantum mechanics and a second reason is its closeness to us. Happiness and well-being –and their opposites- are so intimate to our experience as human beings that it's very difficult to create a sort of objective distance to make science about it. This has to do with the "personal equation" of researchers on well-being and Happiness. In this sense, some questions arise: what impact does our personal experience of well-being and happiness have on our academic or scientific approach to them? Is it possible (or desirable) to keep some sort of distance between our object of study and our own experience? Can we adopt a neutral or "objective" epistemological stance about something that affects us as human beings?

Bartels said that, although genetics sometimes sounds complicated to people, that's the basis, because the humility and the acceptance that we are all different makes your life better. If you want a well-being journey –Bartels says- it starts by appreciating and embracing the differences between people. (…) Concerning how science and private life come together, Bartels said she became happier by accepting and seeing and embracing and enjoying all the differences, and academic life allows you to meet many people around the world. Her biggest pleasure in the

academy is always meeting different people, and the joyful recognition of differences is her "tiny contribution to how to make the world a better place".

The debate had a series of questions and comments from Lomas, Pulido-Moyano, and Case concerning the comparison between religions and their definitions of happiness and well-being. Lomas and Case warned of the dangers that such comparisons can entail. Not only because of the difficulties when translating certain terms or concepts but also because different religions have different institutional organizations and different scriptural foundations. In a previous work, Lomas and Case (and their colleagues VanderWeele, Chen, Cowden, Johnson, Lee, and Long, 2023) said they believe that understandings of, and experiences of, flourishing will indeed vary across cultures and religious and philosophical traditions.

When we refer to serenity (ataraxia in Greek) or imperturbability (atammayatā, in Sanskrit), the question arises as to whether these mental states, associated with the deepest "eudaimonic" aspect of well-being, can be achieved in difficult contexts such as war zones or social and economically marginal or impoverished urban zones. Prof. Sergii Rudenko, who followed our online meeting from Kyiv (Ukraine), said that he wanted to ask precisely that question about the relationship between the flourishing of happiness, well-being, and war. Sergii said it is a very difficult question, and it seems like a philosophical question, but it is not so philosophical or theoretical for Ukraine. "For us now, it is a practical question because we need an answer to our circumstances and our situation right now in Ukraine in this context of war". Is it possible to be happy? Is it possible to increase happiness? Is it possible to have mindfulness in the condition of ongoing war? That's a relevant question for us and I don't have an answer to this question, but I'd love to hear maybe your thoughts on that.

In his answer, Lomas was very wary of just speculating because he had never been in a war zone. "I'm sitting here in in my basement, a safe environment, I don't have your experience … but I can just try and offer some thoughts based on some of the research we found and some of how we've tried to think about these concepts. From the way we've tried to think about flourishing in our program –Lomas explained- it would be very hard and maybe impossible to flourish in a situation like that [Ukraine under war] and I say that because of how we try to define flourishing is to not just be about the person but also their context. (…) A person couldn't be truly flourishing unless the context is also doing well, and that would apply to a war zone, but it would also apply to the city where I'm at. With lots of homeless people, I can't flourish. If I know that people are suffering on the street near me, I can't consider myself to be flourishing. You could even make a case globally with the environmental challenges, can we flourish if the environment isn't doing well? That would apply to a war zone and lots of people's contexts. But when we think more narrowly about well-being and happiness, as I mentioned in my talk, we're trying to create a taxonomy of different types of happiness and I think that, in very difficult circumstances, some of them would be certainly very difficult to achieve, but others may be within reach.

Lomas reminded us that "it's often been found that people in challenging situations might have a greater sense of meaning, whether that's from doing something valuable or helping your community, or serving a greater cause (…). So I think—Lomas said—there are definitely some aspects of happiness and well-being that would of course be terribly hard to achieve in difficult circumstances, but even in those difficult circumstances that might lead perhaps people to feel like certain elements might be strengthened, whether that's sense of community or identity or meaning. I don't know if that helps, but those are just some thoughts, and that's an interesting point to compare with the situation in Ukraine now."

The whole thing of flourishing becomes more complicated if we consider –as we should- the context of the planet. Pulido-Moyano said that, ideally, more and more people should consider the planet as his or her context, for the better or the worse, and that's why it's so difficult to be a truly conscious happy human being because you have to take into account many realities. The wider the context, the more difficult to have or to find that peace, serenity, or any sense of well-being and happiness in your life. But it's worth growing up by expanding the sense of context in your life, and "flourishing" is probably the best metaphor we can use to talk about all these things.

Another attendee of this meeting, Almudena Pérez-Moreno, from Spain, asked about the opposite views held by the academy and society at large about the importance of the so-called "negative emotions" and how to overcome difficulties and build resilience. She mentioned the book Smile or Die, by Barbara Ehrenreich (2010), to suggest that there is a huge pressure in some Western contexts to be cheerful and happy. "There's pressure to always smile even if you're not feeling cheerful"—Pérez-Moreno said—and that is not a very healthy attitude. She thinks there's a hunger for "real meaningful conversations" because people need to feel the confidence to be truthful and honest about their feelings.

Pérez-Moreno asked Bartels about the fact that some people can naturally produce more serotonin or hormones that could make them have a more positive approach to life. "How does genetics affect this and how this knowledge could help individual well-being? Bartels answered this by saying that "the link between serotonin and happiness is not very strong". In terms of the underlying physiological mechanisms, "you have some people with a genetic predisposition that makes it easier for them to be happy while others don't have this genetic predisposition, so it's harder for them to be happy and what you always should realize is that these differences are there. It's similar, for example, concerning physical condition: if you look at runners, some of them have a better physical condition than other people, but if you have a group of non-runners and you train them all, they will all become physically fitter. The same for well-being: there are fundamental genetic differences between people, so some people are happier than others, but if you train everybody or put everybody in a better context or make the context better for people, then they all can shift to the better feeling of well-being."

Conclusions

The discussion that took place at the international online meeting "From Genes to Cosmos: Broadening Contexts in the Study of Happiness" clearly shows that, as constructs, theoretical concepts or research topics, both "happiness" and "well-being" are highly complex. As realities that human beings experience, happiness and well-being are of the utmost importance at both the individual and social levels. Traditional perspectives in this area of study are diverse and seem to promote fragmentation of the field, especially when they address the negative side of happiness and well-being.

In their work "The architecture of happiness" (2022), two of our speakers, Lomas and Bartels (and their colleagues Van De Weijer, Pluess, Hanson and VanderWeele) said: "Medicine and physiotherapy for physical illness, psychiatry and psychotherapy for mental illness, social work for aspects of social illness, and certain aspects of theology and religion (e.g., both devotional and confessional practices) for spiritual illness" (p.289). Could it be the case –we wonder- that we are missing some key points by maintaining those divisions? They suggest the need for an integral model, as they explain their architectural metaphor:

> Imagine happiness as a building: genetic processes constitute its initial design or 'blueprint'; biochemical processes represent the creation of the actual physical structure; neural networks elaborate upon this structure in complex ways (e.g., its wiring and plumbing); psychological processes are the more visible design aspects; sociocultural processes are the wider systemic forces which shape all aspects of the architectural process; and phenomenological processes are the experience of actually being in the building (p. 292).

This sounds very challenging in terms of doing research based on this integral perspective. We think that "flourishing" is the best candidate metaphor to include all aspects and levels of happiness and well-being. Lomas, Pawelski, and VanderWeele (2024) define flourishing as "the relative attainment of a state in which all aspects of a person's life are good, including the contexts in which that person lives" (p.18) and well-being as "the relative attainment of a state in which all aspects of a person's life are good as they pertain to that individual" (p.19) (authors' emphasis). They admit that this latter notion (well-being) is still very broad, but concerns the individual, whereas "flourishing" also includes that person's context.

This could remind us of Oleg Bazaluk's ideas about "the evolution strategy of Inert Matter" (2016). If we extend the happiness architectural metaphor "downward" beyond the genetic level, we reach the inert matter level. Oleg says that the evolution of inert matter is primarily a complication of physical environments and their transition to more complicated and diverse processes and phenomena of a chemical nature:

The evolution strategy of Inert Matter can be traced in the continuous and nonlinear complication of the initial physical environment, from a space vacuum to the state of chemical environments. To understand the meaning of this strategy, we have to consider more deeply the difference between physical and chemical interactions (environments) (p.53).

Bazaluk added that "[t]he main thing is to understand what interacts in each case, and in what sort of environment." (p.56). In that sense, when we talk about "flourishing" at the level of human beings, the main thing would be to understand how "states" and "aspects of a person's life" interact in each case, and in what sort of that person's context. As we can see, using concepts and analytical strategies from research fields dedicated to "inert matter" can be a nice example of "broadening contexts in the study of happiness".

In the very first line of their work "A Global History of Happiness" (2021), Lomas and Case (and their colleagues Cratty and VanderWeele) give us a key point for the whole issue: "In the modern era, arguably few phenomena are as valued or sought after as happiness." Happiness is a phenomenon for sure, and people undoubtedly value happiness and/or seek happiness. The relationship between "to value" and "to seek after" is very interesting. We could ask: do people -in a rather mechanical way- value happiness because it is something that everybody [is supposed to] seek after? Or, the other way around, do people -in a relatively conscious way- seek happiness because everybody values it?

If we extend the architectural metaphor "upwards", we reach the "spiritual realm". In our view, the whole issue of happiness and well-being can be turned upside down when ideas from some specific spiritual traditions are taken into account. We refer especially to Vedanta and Buddhism. At the very core of these two spiritual traditions, we can see how the ideas of happiness/joy/bliss/contentment are inextricably linked to the attenuation or even dissolution of the ego structure. We agree with this view on the grounds of our personal experience. In a sense, it is quite paradoxical: if "I" am happy when there is no "I", who will value or seek happiness? Probably all this sounds a bit extreme for average Western minds, but from a humble stance as

researchers, we can benefit a lot from considering these perspectives, which would constitute another "broadening the context for the study of happiness".

The idea that happiness and well-being are caused by or depend on some factors seems to be somehow axiomatic. However, the aforementioned spiritual traditions hold that happiness or well-being are not authentic if they depend on causes or previous conditions. We should take these positions more seriously to empower the ontological and epistemological underpinnings of our research efforts. It is a fact that throughout history many people "found" their happiness after following a system of beliefs and spiritual practices, very often within a context of cosmic and/or evolutionary discourse (pure or Nirguna Brahman turned into phenomenal Saguna Brahman, pure Void or Buddha Nature turned into manifested forms, pure Shiva-Consciousness into Shakti-Energy…)

We all agree that science is dependent on "the art of measurement". If something cannot be measured, then it falls beyond the range of the scientific approach, and the extreme materialistic view would hold that things that cannot be measured simply do not exist. Bartels (2015) echoed the ongoing debate on the meaning of well-being and how to measure it, and she noticed how the large variety in well-being questionnaires, scales, subscales, and items "makes a meta-analysis vulnerable to heterogeneity" (p.152).

Are we becoming somehow obsessed with the need to measure things? Validity and reliability are always very questionable in the field of well-being and happiness. Are we aware of the deeply cultural nature of people's interpretation of their mental states? How can we compare self-reports made by people with different cultural/ethnic backgrounds? By the way, are we aware that measurement usually leads to comparison, judgment, and rankings? These doubts and worries should be included in our future research efforts on these topics. We agree with Lomas that the next phase of scholarship on well-being and happiness should take into account non-human forms, not only animals, plants, or the Earth as a whole, but also artificial intelligence. And we could go beyond the Earth and develop our field with a much broader perspective. Who knows? Maybe the key concepts to construct a truly complete theory about well-being and happiness can be drawn from cosmology. We refer to evolutionary concepts like "equilibrium, chance and regularity" (comparable to human beings' psychological and social stability), "progress and regress" (comparable to "shadow" work in psychotherapy), vertical and horizontal interactions of matter structures (comparable to the interplay of body, mind, soul levels in humans), disasters (life crisis), adaptation (comparable to, for example, human resilience), symbiosis, co-evolution, etc. Any broadening of the contexts or perspectives in the study of well-being and happiness will make a great contribution to the field.

🕮 References

Alfano, Mark (2016) *Moral Psychology*. Polity.

Bartels, Meike (2015) Genetics of well-being and its components satisfaction with life, happiness, and quality of life: a review and meta-analysis of heritability studies. *Behav. Genetics* 45(2):137-56. doi: 10.1007/s10519-015-9713-y.

Bazaluk, Oleg (2016) *The Theory of Evolution. From a Space Vacuum to Neural Ensembles and Moving Forward*. Cambridge Scholars Publishing.

Bentham, Emmanuelle (2018) *An Introduction to Coaching for Language Learning*. Independenty Published.

Cabrera, Emilio (2021) *Sobre la vida buena: Reflexiones desde el estoicismo y la filosofía budista*. Plataforma.

Case, Brendan W. (2021) *The Accountable Animal: Justice, Justification, and Judgment*. Bloomsbury.
Case, Brendan W. and Glass, William. (2022) *Least of the Apostles: Paul and His Legacies in Earliest Christianity*. Pickwick.
Ehrenreich, Barbara (2010) *Smile or Die. How Positive Thinking Fooled America and the World*. Granta Books.
Langer, Ellen J. (1997) *The Power of Mindful Learning*. Da Capo Lifelong Books.
Lomas, Tim (2016) *The Positive Power of Negative Emotions*. Piatkus.
Lomas, Tim (2019) *Happiness-Lost in Translation*. Penguin Random House
Lomas, Tim (2022) *Happiness. A concise and engaging exploration of how we understand happiness*. MIT.
Lomas, Tim, Bartels, Meike, Van De Weijer, Margot, Pluess, Michael, Hanson, Jeffrey & VanderWeele, Tyler J. (2022) The Architecture of happiness. *Emotion Review*, 14(4), 288-309. https://doi.org/10.1177/17540739221114109
Lomas, Tim, Case, Brendan W., Cratty, Flynn J. & VanderWeele, T.J. (2021) A global history of happiness. *International Journal of Well-being*, 11 (4), 68-87. https://doi.org/10.5502/ijw.v11i4.1457
Lomas, Tim, Pawelski, James O. & VanderWeele, Tyler J. (2024) A flexible map of flourishing: The dynamics and drivers of flourishing, well-being, health, and happiness. *International Journal of Wellbeing*, 13(4), 3665, 1- 38.https://doi.org/10.5502/ijw.v13i4.3665
https://internationaljournalofwellbeing.org/index.php/ijow/article/view/3665/1183
Tang, Yi Yuan., Hölzel, Britta K. & Posner, Michael (2015) The neuroscience of mindfulness meditation. *Nature Reviews Neuroscience,* 16, 213–225. https://doi.org/10.1038/nrn3916
VanderWeele, Tyler J.; Case, Brendan W.; Chen, Y.; Cowden, R.G.; Johnson, B.; Lee, M.T.; Lomas, T., Katelyn G. Long, K.G. (2023) Flourishing in critical dialogue. *SSM Mental Health*, 3. https://doi.org/10.1016/j.ssmmh.2022.100172
Volf, Miroslav (2016) *Flourishing: Why We Need Religion in a Globalized World*. Yale University Press.
Volf, Miroslav (2023) *Live Worth Living: A Guide to What Matters Most*. Ebury DigitalBurnyeat, Myles Fredric (2003) *Apology* 30b 2-4: Socrates, money, and the grammar of γίγνεσθαι. *The Journal of Hellenic Studies*, 123, 1-25. https://doi.org/10.2307/3246257
Liddell, Henry George and Scott, Robert (1940) *A Greek-English Lexicon*. Oxford: Clarendon Press.
Philodemus' *History of the Philosophers*: Plato and the Academy (PHerc. 1021 and 164) (2020) Translated with Introduction by Paul Kalligas and Voula Tsouna, and Notes by Myrto Hatzimichali. *Plato's Academy: Its Workings and its History*. Edited by Paul Kalligas, Chloe Balla, Effie Baziotopoulou-Valavani, and Vassilis Karasmanis.‍ Cambridge University Press, 276-383.

The Blurred Multiverse, or Whether Plato's *Alcibiades-1* Provides Clues for Reasoning on Morality

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Plato's Alcibiades-1 is being researched in order to illustrate the difficulty of defining good and just actions, especially in the context of existence of ideal and real worlds. The concept of common moral values is questioned, as decision-making often involves ethical dilemmas. The principle of double effect (allowing base consequence for good purpose) is discussed and questioned in more complex situations. The aforementioned problems are discussed in their interaction. The article challenges simplistic justifications for war and emphasizes the need for critical reflection on the morality of conflict. Philosophers like Heraclitus saw war as a necessary part of progress. Hobbes viewed a state of nature as constant war of all against all, driven by self-interest. Hegel considered war a necessary evil and a catalyst for change. In a result, the text acknowledges the positive outcomes of some wars, like the Paralympics emerging from World War II. This is presented as a rare example of positive outcomes from war. However, current armed conflicts underscore the moral complexities and human costs of wars. The article concludes by referencing Plato's view that knowledge of good resides within us, questioning how AI can be programmed with the values we have not fully grasped ourselves. The text argues that any conflict, even internal and emotional, is a complex ethical issue with no straightforward solutions. It highlights the ambiguity of ethical conflicts and immense human costs associated with war, prompting reflection on the true purpose of moral values and existence of multiverse within us.

Keywords: *moral values, necessary evil, artificial intelligence, multiverse problem, ethical cognition.*

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Introduction.
Whether There Is Any Justification of Base Things

Heraclitus claimed that conflict, being a state of flux, was essential to the overall progress and development of humankind. For him, life was a process of constant change. Later, in the course of centuries, Thomas Hobbes was one of the most ardent proponents of essential place of war in social interactions. He famously described the *state of nature* as a condition of constant war, where life is solitary, poor, nasty, brutish, and short. However, Hobbes's understanding of war was not restricted to traditional armed conflict. He defines it as a state of constant fear and uncertainty, where individuals are driven by their own self-interest and lack of trust in others.

In further development, Hegel, one of the greatest and most obscure thinkers, was notoriously aware of the intrinsic role of war in historical development as well as in the formation of national identity. Having examined the Holy Roman Empire and French incursion into German territory, Hegel, as a continuation of the aforementioned view, evolved a dialectical understanding of conflict as a presumably necessary stage in the progress of states and in the progression of history (Tyler, 2004). Hegel saw war as a *necessary evil*, a dialectical contradiction inherent in the nature of states. Hegel saw war as a tragic but necessary part of the dialectical process of history that can serve as a catalyst for change, forcing nations to confront their limitations and weaknesses, leading to self-reflection and eventual progress. Although Hegel's philosophy of war offers a complex and provocative perspective on the nature of conflict and its role in human history, war is rarely considered to be a justified phenomenon. Consequently, the idea of moral war is rejected by some scholars.

However, as it can be seen from historic evidence, the Second World War contributed significantly to the Paralympic sports. In its own turn, this evolved in the growing importance of the concept of inclusivity in general. Such are the premises on war of the greatest thinkers to start with the discussion on moral values that are intrinsic to human's nature. This is sometimes represented by the *multiverse problem* (Leslie, 1996). The book shows a "doomsday" scenario in which humanity is imminently extinguished. According to this interpretation, our universe is one among a vast number of alternative universes, all of them either interacting in a certain way or not (in the quantum multiverse different universes don't communicate, in the inflationary multiverse they do (Susskind, 2005: 317)). In fact, this was the difference between view of Socrates and that of Alcibiades, and they *do* communicate. On the other hand, many people live in their rabbit's holes, only the bravest ones face the reality, and they *do not* communicate. From the perspective of the quantum multiverse as a whole, the mind is a pervasive ordering principle, and common moral values might be one of its aspects. But multiverse, conceived in physical terms, leaves unresolved a fundamental question of why there are common moral values.

Eloquent all that may sound but the first Ukrainian translation of Plato's *Alcibiades'1* as well as Proclus' *Commentary* on it would have been already published had Russia not started the full-scale war with Ukraine. It is more than evident that this very fact can hardly be ascribed to any other kind of progress that is not related to the development of a variety of warfare tools. This is why, seen in a broader perspective, it has become a more complex task to find appropriate justification to the act of war in general unless an attacking side intends to induce erroneous conjectures regarding its true intensions. A more profound look at the history of thought might help us go deeper into the controversial issue of the relation

between good and evil and find the application of the ideas of Plato to modern developments in technology.

1. Origins of Moral Values

It is rather questionable whether discerning of what is correct and wrong can be ascribed to any sort of empiric knowledge exclusively. This is why so-called *ethical values* help us provide more or less feasible answer to the dilemma. These and alike questions have been puzzling prominent thinkers since the beginnings of European civilization. Heraclitus' opponent, Parmenides, denied the concept of movement in general, i.e. the role of war in the process of development of the society. Such polarized opinions contributed to triggering Plato's attempt at clarifying the controversy. The issue has been addressed and vividly represented in his *Alcibiades 1*. There are questions on the authenticity of the dialogue (Bos, 1992), but it seems impossible to separate the genuine writings of Plato from spurious by any exact line (Westerink, 1956).

However, regardless of the significant age of the question, the final answer has not yet been provided. Plato, as usually in his works, never gives the answer. It seems to be particularly logical in this question, since there is no one definite answer for each particular case. Rather, it is essential to apply critical thinking for each particular situation. Astonishingly, this uncertainty evolves into unresolved issues in today's development of self-driving vehicles, and not only. But let the matter be discussed from the very beginning, lest something essential should escape our attention. To start with, Plato's reasoning proceeds as follows.

(110c)

Socrates

So you thought you knew, even as a child, it seems, what was just and unjust.

Alcibiades

I did; and I knew too.

Socrates

At what sort of time did you discover it? For surely it was not while you thought you knew.

Alcibiades

No, indeed.

Socrates

Then when did you think you were ignorant? Consider; I believe you will fail to find such a time.

Alcibiades

Upon my word, Socrates, I really cannot say.

Socrates

So you do not know it by discovery.

Alcibiades

Not at all, apparently.

Socrates

But you said just now that you did not know it by learning either; and if you neither discovered nor learnt it, how do you come to know it, and whence?

Alcibiades

Well, perhaps that answer I gave you was not correct, that I knew it by my own discovery.

Socrates

Then how was it done?

Alcibiades

I learnt it, I suppose, in the same way as everyone else.

Socrates

Back we come to the same argument. From whom? Please tell me.

(110 d)

The text is quoted by Benjamin Jowett's translation (Plato, 2008). This is how Socrates employs his well-known method of inquiry to progressively refine the definition of goodness, ultimately demonstrating the equivalence of virtue and knowledge. This method exposes not the presence of sin but rather the extent of one's ignorance. This is why the initial step towards enlightenment is the acknowledgment of one's limitations, even in the most mundane matters. Recognizing one's ignorance is a prerequisite for attaining virtue and wisdom, as it necessitates a prior confrontation with error. Similarly, the initial step to fixing the problem is recognizing it.

Alcibiades, a young man with an inflated self-image and grandiose ambitions, is on the cusp of entering public life. Socrates, a perceptive observer of human nature, exposes the flaws in Alcibiades' aspirations. The crux of the issue lies in Alcibiades' intention to persuade the Athenians on matters of war and peace. However, such decisions necessitate a profound understanding of justice and injustice. This is why Socrates challenges Alcibiades to explain the source of his knowledge, namely whether he acquired it through formal education or through independent inquiry. Alcibiades admits to neither, claiming instead to have learned from the multitude. Socrates counters this assertion, arguing that while the multitude can teach language, they cannot impart knowledge of complex moral concepts like justice. By his own admission, Alcibiades is thus exposed as lacking the requisite understanding to effectively guide the Athenian people.

As it can be seen, Alcibiades is unable to provide any sustainable answer to the question. Neither learning, nor discovery can supply any feasible explanation. The statement that such things can be learned *from many*, such as language, is rejected by Socrates since many are unable to be competent teachers. To some extent, the just and unjust things they speak about, can be referred to as so-called "common values", i.e. beliefs or principles that are widely shared within a particular group or society. They are often considered important and guide people's behavior, decisions, and interactions. Common values, as we mutually recognize, are by definition shared by all humans in the context of development of European so-called *Four ages of understanding* (Deely, 2001). Despite the fact that these values can vary depending on factors such as culture, religion, education, and personal experiences, they are shared by humans, and *justice* is listed among them. Generally speaking, these are the things, the origins of which Alcibiades is unsure of. Socrates, as portrayed in his dialogues, is depicted as a figure who, despite professing ignorance, can discern the false pretense of knowledge in others.

Consequently, he posits that the concept of goodness can be refined through a series of interrogative processes, ultimately revealing virtue as synonymous with knowledge. In this and other philosophical inquiries, Socrates seeks to illuminate ignorance rather than sin. Acknowledging one's ignorance is the initial step towards acquiring knowledge, even of the most mundane matters. Individuals are often unaware of the extent of their ignorance, and true virtue and wisdom can only be attained through the recognition of one's errors.

Surprisingly, the problem of the origin of knowledge has become even more exacerbated in the age of artificial intelligence. So-called "Black box" problem points at the inability to explain the AI's process of decision-making. Deciding is easy, while explaining is not,

since it is not known where it was learned, when or how. “It’s not that you forgot. It’s that you’ve lost track of which inputs taught you what and all you’re left with the judgments”, says associate professor of Electrical and Computer Engineering, Samir Rawashdesh, who specializes in artificial intelligence (Rawashdesh, 2024).

2. The Inherent Presence of Moral Values

Plato, being really profound thinker, does not stop on this. Proceeding further, he sets the question in this way:

(115a)

Socrates

… Now tell me, do you consider some just things to be expedient, and others not?

Alcibiades

Yes.

Socrates

And again, some noble, and some not?

Alcibiades

What do you mean by that question?

Socrates

I would ask whether anyone ever seemed to you to be doing what was base and yet just.

Alcibiades

Never.

Socrates

Well, are all just things noble?

Alcibiades

Yes.

Socrates

And what of noble things, in their turn? Are they all good, or some only, while others are not?

Alcibiades

In my opinion, Socrates, some noble things are evil.

Socrates

And some base things are good?

Alcibiades

Yes.

(115 b)

(Plato, 2008)

The controversy that arises here is apparent and goes in accord with the *multiverse problem*. By the anthropic principle, it is to be expected that we find ourselves in a place where those things are favorable to our existence (Tegmark, 2003). As we may see, with things getting more and more complex in real life, the notion of decision-making becomes harder to describe. This is why the boundary between correct versus wrong decision has become even more elusive and difficult to grasp. Sometimes, as Socrates suggests, even base things can be good, as it is proved by the aforementioned example of Paralympic sports. The last reasoning presupposes that there can be an action which is really contradictory in its essence. Intriguing and paradoxical may it sound, the boundary between good and evil things is rather flimsy. Of course, this issue did not escape attention of prominent thinkers of upcoming generations. St. Thomas Aquinas developed doctrine, or principle of so-called *double effect,* in his “Summa Theologiae”, II-II, 64, 7.

Thinkers of different ages have been taking attempts at clarifying the difficulty, and here, it would be highly expedient to consider the way of reasoning of Thomas Aquinas (Aquinas, 2019). As Aquinas observes, the permissibility of self-defense is not unconditional: "And yet, though proceeding from a good intention, an act may be rendered unlawful if it is out of proportion to the end. Wherefore, if a man in self-defense uses more than necessary violence, it will be unlawful, whereas, if he repels force with moderation, his defense will be lawful." (Aquinas, 2017) The passage can be interpreted as formulating a prohibition on apportioning one's efforts with killing as the goal guiding one's actions, which would lead one to act with greater viciousness than pursuing the goal of self-defense would require.

The New Catholic Encyclopedia provides four conditions for the application of the principle of double effect: 1) The act itself must be morally good or at least indifferent. 2) The agent may not positively will the bad effect but may permit it. If he could attain the good effect without the bad effect he should do so. The bad effect is sometimes said to be indirectly voluntary. 3) The good effect must flow from the action at least as immediately (in the order of causality, though not necessarily in the order of time) as the bad effect. In other words, the good effect must be produced directly by the action, not by the bad effect. Otherwise the agent would be using a bad means to a good end, which is never allowed. 4) The good effect must be sufficiently desirable to compensate for the allowing of the bad effect. However, the definitions, as it can be seen by the vocabulary being used, are rather vague and underdefined.

Sometimes, it is suggested that this principle be explained by individual approach since it might be assumed that such decisions are inherently personal. But some thinkers suggest that there is no such thing as personality. Misinterpreted indeed, it often has been (Wollard, 2023), but the principle of double effect is sometimes represented by the so-called *trolley problem.* It is frequently invoked to explain the permissibility of an action that causes a serious harm, such as the death of a human being, as a side effect of promoting some good (Mc Intyre, 2023). The trolley is running down the railway tracks uncontrollably at lethal speed. On its way down the track there five people tied up and unable to move. The trolley is moving to run over them. You are an accidental onlooker standing beside a railway line. There is a lever next to you. If you pull this lever, the trolley will change the direction of the trolley to a different track. However, there is one person on that track.

While it seems reasonable to sacrifice only one person instead of five, still it seems that this type of thinking tends to resemble so-called *linear* approach, which has little to no application in reality. One of the most prominent war theorists, Carl Clausewitz, writes in his "On War": "Kind-hearted people might think that there was some ingenious way to disarm or defeat an enemy without too much bloodshed and might imagine this is the true goal of the art of war. Pleasant as it sounds, this is a fallacy that must be exposed" (Clausewitz, 1976). All the aforementioned quotations question the basic definition of deontology, namely whether ethical rules are fixed or not. It is rather clear fact that humanity shares so-called *common moral values*, but whether these rules or regulations clearly established, still remains profound question. Achieving justice is not enough, the aftermath of any conflict is also supposed to be sufficiently tolerable if the conflict is to be proportionate, all things considered. It is an open question how far into the future we have to look to assess the morally relevant consequences of different conflicts. As a result, as some scholars argue, killing in war is justified by the *protection* of individual rights (Lazar, 2020). This is how the *trolley problem* has no feasible straightforward solution.

3. The Still-Pending Question

However, the statement might be questioned again by a variety of factors. One of them is the fact that the notion of protection can be understood differently. Basically, it refers to manipulating others in order to shape their opinions and actions, e.g. shaping an adversary with targeted rhetoric and information operations in such a way that the adversary voluntarily takes the actions that are advantageous to the other part of the conflict. This is what Vladimir Lefebrve, a mathematical psychologist at the University of California, defined as the process of transferring the reasons of making a decision to an adversary via provocations, lies and the creation of false objects of any type (Stepanenko, 2024). Lefebvre is famous for creating a mathematical theory of so-called *ethical cognition*. In its simplified overview, the theory considers a three-level structure: the person, the person's perception, and the person's perception of the communication partner. The theory and the approach to understanding the partner was and is still used in negotiations by American officials. Another aspect of the theory presupposes so-called *reflexive control*, which is a key element in manipulating decision-making of the opponent. This is a key element in a hybrid warfare toolkit that relies on shaping an adversary with targeted rhetoric and operations that results in taking advantageous decisions. Such means are clearly seen in the strategy used by Russia in its hybrid warfare against the West. In the further development, Russian officials stated that they have set a goal of involving 500 thousand foreign students to study in Russia every year. This is clearly seen as a one of many goals of its long grinding war of attrition in Ukraine.

It is evident that almost every country in the world either has or had a historical basis to claim rights to at least some or all of the territory of its neighbors. But the world avoids a sort of Hobbesian war of "all against all" by rejecting the validity of such arguments. The pretense on reclaiming the territory of the former Soviet Union is as non-realistic as reclaiming the Holy Roman Empire. However, Russia portrays itself as underdog facing the West, a much larger and more powerful opponent, which potentially enables her to resort to its whole strength, meaning nukes. Such considerations may seem logical but certainly not rational, since they are divorced from actual reality. The West naturally and understandably gravitates toward peace, its default instinct being to seize the first opportunity in any conflict to "stop the fighting." This is how Russia is hijacking and substituting the key concepts, while the West opposes is by sending weaponry to Ukraine. This comes as an example of Alcibiades' puzzle about what is good, and that of some base things being good, as well as the decision of what to sacrifice – either Ukraine or Peace, while subduing to Russia's demands.

4. Possible Development

To continue with, it is worth mentioning that Leibniz believed that for every truth, there must be a reason why it is exactly so and not otherwise; and for each and every single thing, there must be a reason for that thing's existence. This is what Leibniz called the "Principle of Sufficient Reason". And if this principle is valid, there must be an explanation for the existence of base things which are still good, despite of their being base (Holt, 2012). Whether it can be justified or not, this might be referred to so-called *justified true belief,* but the question was discussed earlier (Sodomora, 2022).

However, the problem with the scientific explanation of the permissibility of the base things would seem to be as it follows. The nature of the question comprises everything that is related to morality. A scientific explanation must involve some sort of moral background. But any moral background is by definition part of the nature of the question to be explained.

Thus, any purely scientific explanation of the permissibility of the base things is doomed to be circular, i.e. it features no feasible background in order to be explained.

In theory, on the one hand, base things, like in the *trolley problem,* can be justified as well as implemented in practice. On the other hand, the likelihood of success from such means is almost always overestimated, and the unintended consequences of such actions are often overlooked. Controversies of the kind, as it can be exemplified, arise in the discussion on combatants and noncombatants. Individual human beings, to start with, enjoy fundamental rights to life and liberty, which prohibit others from harming them in certain ways. Since fighting wars obviously involves depriving others of life and liberty, it can be permissible only if each of the victims has surrendered or lost his rights to liberty. This is how simply by fighting, all combatants "have lost their title to life and liberty" (Walzer, 2006). By contrast, noncombatants are men and women with rights, and they cannot be used for some military purpose, even if it is a legitimate purpose. But, there are several possible objections to this distinction. First, Napoleonic wars involved significant masses of people into the wars, and since then, sometimes whole communities go to war – whole peoples, and especially civilized ones. Second, combatants do not always give their rights up deliberately, as it is known throughout ancient as well as modern history. However, this question will not be discussed any further here; it has been provided to present one of the many aspects of the apparent controversy.

5. Reconsidering Plato's view

Plato posited that some truths transcended mere conditional statements. He envisioned a hypothetical universe, a state superior to one filled with e.g. immense suffering. This implied an ethical imperative for the preservation of emptiness over a universe of infinite pain. However, an opposing ethical imperative might demand the replacement of this emptiness with a good universe, one brimming with happiness and beauty, or ideal, in contrast to the material universe, the one which is rather base one. This is sometimes represented by the *multiverse problem*. Instead of being a physical reality, our world is just an infinitesimal part of an ever-reproducing multiverse (Holt, 2012). The problem of *observability,* i.e. the impossibility of seeing it, was not treated by Plato since he did not consider seeing as a reliable way of perceiving the reality. Plato asserted that the ethical necessity for the existence of a good universe was sufficient to bring it into being. Assuming the world is, on balance, good, the idea that it was created by the need for such goodness gains plausibility. This notion has influenced countless thinkers throughout history, including those who believe in God, offering an explanation for the divine existence based on the ethical need for a perfect being.

This is why the concept that goodness can engender existence has a rich history. While acknowledging the existence of ethical conflicts, proponents of this Platonic view recognize the necessity of a world governed by natural laws. They understand that the absence of miraculous occurrences and the possibility of human error are inherent to a world where free agents make choices. Plato's idea that a thing can exist due to its inherent goodness is not a logical necessity but a fundamental connection, often elusive to human understanding. We tend to associate value with physical mechanisms, but such mechanisms cannot explain the existence of the universe.

The omnipresence of this elusiveness, in fact, is "the most valid and surest starting-point for the dialogues of Plato, and, practically for the whole of philosophical consideration, is, in our opinion, the discerning of our own being. If this is correctly posited, we shall in every

way, I think, be able more accurately to understand both the good that is appropriate to us and the evil that fights against it", as Proclus states it in his *Commentary* (O'Neill, 1971).

It is evident from Plato's *Alcibiades-1* that souls do not acquire knowledge from sensory objects, nor do they derive an understanding of the whole and the unified from the partial and the divided. Rather, they actualize their innate knowledge and correct the imperfections of sensory phenomena. It is not to be supposed that non-existent and non-substantial entities are the primary causes of knowledge within souls. Nor should we esteem ambiguous, contradictory, and devoid-of-innate-notions things above the ever-consistent and self-sufficient knowledge, according to Proclus' *Commentary*. Likewise, we should not posit changeable and indeterminate things as the source of the unified and determinate intelligence.

Conclusions

Therefore, according to Plato's view, we must not derive the truth of eternal matters from the multitude, nor the discernment of universals from sensory objects, nor our judgment of the good from the irrational. Instead, the intuition, or the soul, by its own nature, must seek within itself the true, the good, and the eternal notions of morality. For its essence is imbued with these notions, though obscured by the forgetfulness inherent in generation. However, humans, in their quest for truth, often overlook their own intrinsic knowledge and seek the good in external things, neglecting their own knowledge inherent in their essence.

From this introspection, the beginning of self-knowledge emerges. If we were to focus solely on the multitude of individuals, we would never perceive their unified form, obscured as it is by multiplicity, division, separation, and manifold change. However, by turning inward, we can behold the singular notion and nature of humanity in its pure form. Researchers and technologists concerned about potential existential risks posed by artificial intelligence argue that it is imperative to ensure that superintelligent AI systems are aligned with human values and goals. They emphasize the importance of mitigating risks associated with emergent behavior and advocate for limiting the acquisition of excessive power by such systems. (Fisher, 2023). But can we teach something we have never been learning? In addition, in the aftermath of the digital world, people often struggle with the imperfect nature of human nature (Reed, 2016). According to Plato's words in his *Alcibiades-1*, even the most renowned Athenian statesmen, such as Pericles, were not immune to the challenges of raising their own children.

This is why the question of the origin of moral values still remains. It is still uncertain whether humans, who struggle to define good and just actions themselves, can instill such values in AI systems. Despite Plato's view that knowledge of good resides within us, programming AI with common values remains a rather vague task. This is why any conflict, even internal and emotional, is a complex ethical issue with no straightforward solutions. Probably because of the still present impossibility to clearly define the nature of the human *physical system* (Bazaluk, 2024) Plato never provides the answer to the questions settled in his dialogues. Neither does Steve Rosenberg in his articles (Rosenberg, 2024). Neither does Jim Holt in his book (Holt, 2012). Nor does it this article. It just summarizes ancient points of view and links them to those related to contemporary issues. It seems that Leibnitz overestimated the ability of humans to provide answers to any possible questions. Whether the problem, settled in *Alcibiades 1*, be a factor in our calculations as we formulate the response to the AI problem of *moral values*, still remains an open question. All that theory can do is to give us points of reference and standards of evaluation in specific areas of action, with the ultimate purpose not of telling how to act but of developing our judgment.

This results in the aforementioned problem of a *multiverse*. As it has been said, our universe sometimes is considered to be only one among a vast number of similar but alternative universes, all of them either interacting in a certain way or not. The problem of communication between *rabbit's holes*. Although Socrates did communicate his ideas to Alcibiades, it is still not clear whether they were perceived by the receiver in their ideal form. While many people still live in their rabbit's holes and *do not* communicate, it is still an open question whether we might share co-called *common moral values* between inhabitants of these rabbit holes, not to mention artificial intelligence. Therefore, it can be assumed, if there is a multiverse consisting of many universes, most of them are hostile to life due to the lack of common *moral values*, and our own world can be reduced to the so-to-say matrix, and there is no reason to expect that it is real.

🕮 References

Aquinas, Thomas (2017) *Summa Theologiae*, Transl. by Alfred Freddoso Available online: https://www3.nd.edu/~afreddos/summa-translation/toc.htm

Aquinas, Thomas (2019) *Summa Theologiae*, II-II, 64, 7 Available online: https://www.corpusthomisticum.org/iopera.html

Bazaluk, Oleg (2024) What Is Anthropos and What Is Equal to Him? *Philosophy and Cosmology*, Volume 33, 4-44. https://doi.org/10.29202/phil-cosm/33/1

Bos, Egbert (1992) *On Proclus and his Influence in Medieval Philosophy*. Leiden, New York. https://doi.org/10.1163/9789004320758

Clausewitz, Carl (1976) *On War*. Transl. by Robert Howard and Peter Paret.

Deely, John (2001) *Four Ages of Understanding*. University of Toronto Press.

Fisher, Richard (2023) *The A-Z of AI: 30 terms you need to understand* Available online: https://www.bbc.com/future/article/20230717-what-you-should-know-about-artificial-intelligence-from-a-z

Holt, Jim (2012) *Why Does the World Exist?* New York: W.W. Norton & Co

Lazar, Seth (2020) War. *The Stanford Encyclopedia of Philosophy*. Available online: https://plato.stanford.edu/cgi-bin/encyclopedia/archinfo.cgi?entry=war

Leslie, John (1996) *The End of the World.* Routledge.

Mc Intyre, Alison (2023) Doctrine of Double Effect. *The Stanford Encyclopedia of Philosophy*. Available online: https://plato.stanford.edu/archives/win2023/entries/double-effect/

O'Neill, William (1971) *Proclus: Alcibiades 1. A Translation and Commentary.* University of Southern California Press

Plato (1955) *In Twelve Volumes* Vol. 8 translated by W.R.M. Lamb. Cambridge, MA, Harvard University Press; London, William Heinemann Ltd.

Plato (2008) *Alcibiades-1*. Transl. by Benjamin Jowett. Available online: https://www.gutenberg.org/files/1676/1676-h/1676-h.htm

Rawashdesh, Samir (2024) *Mysterious Black Box Problem Explained* Available online: https://umdearborn.edu/news/ais-mysterious-black-box-problem-explained

Reed, Richard (2016) *If I Could Tell You Just One Thing.* London. Canongate.

Rosenberg, Steve (2024) *Fury in Russia at "Serious Escalation" of Missile Move* Available online: https://www.bbc.com/news/articles/c62j1g8g45vo

Sodomora, Pavlo and Lyubov Gutor (2022) Truth and Falsity: Whether they Overlap or Possess Distinct Borders. *Philosophy and Cosmology*, Volume 28, 159-167. https://doi.org/10.29202/phil-cosm/28/13

Stepanenko, Kateryna (2024) *Russian Offensive Campaign Assessment*. Available online: https://understandingwar.org/backgrounder/russian-offensive-campaign-assessmentmay-22-2024

Susskind, Leonard (2005) *The Cosmic Landscape* Little, Brown.

Tegmark, Max (2003) The elements of this multiverse: Parallel Universes *Scientific American*

The New Catholic Encyclopedia (1989-95) Washington, Catholic University of America. In 19 vol.

Tyler, Colin (2004). Hegel, war and the tragedy of imperialism. *History of European Ideas*, *30*(4), 403–431. https://doi.org/10.1016/j.histeuroideas.2003.11.017

Walzer, Michael (2006) *Just and Unjust Wars: A Moral Argument with Historical Illustrations*. New York: Basic Books

Westerink, Leendert (1956) *Olympiodorus Commentary on the First Alcibiades of Plato.* North Holland Publishing.

Wollard, Fiona, and Snyder, Frances (2023) Doing vs Allowing Harm. *The Stanford Encyclopedia of Philosophy*. Available online: https://plato.stanford.edu/archives/win2023/entries/doing-allowing/

Academic, University, and Alternative Philosophical-Cosmological Studies in Ukraine: Second Half of the 20th – Early 21st Century

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This article offers the first comprehensive analysis of theory and practice in Ukrainian philosophy of cosmology (second half of the 20th and early 21st centuries). The authors cover the main content of the three conditional stages of the discipline's formation, mainly: 1. Its origin and development in the conditions of humanization and Europeanization of academic and university science during the Khrushchev "Thaw" and the beginning of "stagnation" in the Ukrainian SSR (the mid-50s to the early 70s of the 20th century); 2. Its formation as a stable direction of official – academic and alternative – actually nonconformist and dissident – scientific studies, especially original authorial concepts (the early 70s to early 90s of the 20th century); 3. the institutionalization of philosophical and cosmological studies as an academic-university and state-patriotic direction of scientific research integrated into the global academic and university experience (1991 – the 20s of the 21st century). The development of cosmological studies at the Ukrainian SSR's Main Astronomical Observatory since the 1940s, together with productive collaborations of the academy's humanitarian and other institutes in a broad thematic palette of the analysis of the universe and society, resulted in their accomplishments being applied in a number of projects and programs of the Ukrainian Academy of Sciences during the 1960s and 1980s. During that time, the Ukrainian SSR saw two distinct trends in philosophical and cosmological research: alternative – nonconformist-dissident and academic-university. The first of them embodied a bright range of outstanding achievements of the classics of our native science, primarily V. Vernadskyi, V. Hlushkov, I. Klymyshyn, and P. Kopnin, and the second, in which the philosophical and cosmic

concepts of the ideologists of the Resistance Movement M. Rudenko and O. Berdnyk stand out. They became real sources of creative advancement in the philosophy of cosmology in modern Ukraine. Their notable accomplishments include the most recent philosophical and cosmological ideas of O. Bazaluk, Yu. Kanyhin, M. Chmykhov, and Yu. Shylov, as well as the scientific studies of the International Society of Philosophy and Cosmology (ICPC), which is led by the first of them.

Keywords: philosophy of cosmology, Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR, National Academy of Sciences of Ukraine, Kyiv Taras Shevchenko National University, International Society of Philosophy and Cosmology, O. Bazaluk, V. Vernadskyi, V. Hlushkov, P. Kopnin, S. Krymskyi, B. Paton

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1. Introduction

The philosophy of cosmology is one of the key trends of the development of global philosophical thought in the twenty-first century, the age of the planetary establishment of the information network society, under the circumstances of its embracement of global environmental, social, educational, and other challenges. The authors of the article jointly noted the transition of modern culturology and philosophy to the interdisciplinary stage, successfully synthesizing the main achievements of the humanities, natural sciences, and other sciences of philosophical and cosmological cognition. This was done while taking into account their many years of experience in understanding its phenomenon in the context of their own – philosophical and culturological studies, in particular, creative scientific and research cooperation in the publication (Kulturolohiia (Cultorology), 2013) on the consideration of the state of modern culturology in the face of universal problems. A comprehensive study of its place and role in postmodern science in the Ukrainian SSR and already independent Ukraine in the second half of the 20th and first quarter of the 21st century was made possible by the distinguished galaxy of scientists from the Academy of Sciences of the Ukrainian SSR and later the National Academy of Sciences of Ukraine, including the first president of the Ukrainian Academy of Sciences in Kyiv, V. Vernadskyi, and his more well-known successor, B. Paton, as well as a wide range of institutes representing this – the country's highest state scientific organization. The domestic philosophical community, which emerged in the 1950s as the "Kyiv philosophical circle" at the Faculty of Philosophy of the Taras Shevchenko Kyiv State University and the Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR, continues to make a significant contribution to the development of the philosophical dimension of cosmological studies in Ukraine and the world. Now, it is fairly adequately represented by several generations of his ideological successors, primarily in the format of the International Society of Philosophy and Cosmology (ISPC), which actively moves forward today in Ukrainian philosophical and cosmological scientific research.

Ukrainian scientists, such as the creators of the Kyiv Philosophical School of the second half of the 20th century, P. Kopnin, S. Krymskyi, and M. Popovych, as well as many of their colleagues from the institutes of the Academy of Sciences of the Ukrainian SSR, mentioned above, and since 1994, the National Academy of Sciences of Ukraine, focused their attention on the significant achievements of the entire interdisciplinary cooperation of world-famous researchers of cosmological topics. Notable and well-known developers of it include the honorary president of the Humanity and Biodiversity Association, the 1988 B. Pascal Prize winner, the 2001 A. Einstein Medal winner, H. Reeves, and cosmologist and theoretical

physicist S. Hawking, who won numerous prestigious scientific awards. In contemporary Ukraine, the successors of their work are currently examining a fairly broad range of diverse viewpoints, such as worldview-ideational perspectives, particularly religious views, as well as the models and methods of renowned foreign cosmologists in the study of personality, humanity, the Earth and cosmos, the universe, and being in general. The corresponding interpretations have their origins in both the traditions of the great monotheistic Abrahamic religions, such as Christianity (Wilkinson, 2024), and the general theory of relativity in the form of such a cosmological model of R. Penrose and V. Hurzadian, as, for example, conformal cyclic cosmology (Le Bihan, 2024). Over the past 20 years, renowned publications (Smeenk & Ellis, 2017; *The Philosophy of Cosmology,* 2017) have been published on the pages of respectable international publications, mostly encyclopedias of well-known universities like Stanford and their publishers like Cambridge University Press. These publications largely generalize the significant accomplishments of global cosmological thought. A considerable contribution to the popularization of academic and university studies on topical issues of philosophy of cosmology is made by a number of reputable publishers, including the global publishing company Springer, whose repertoire is represented in the global network by such works (De Bianchi et al., 2024; Perlov & Vilenkin, 2024) etc.

Publications of two Ukrainian scientists (Prits & Kuznietsov, 2020; Prits, 2020) provide an example of domestic research into the phenomenon of cosmology as a science, its theoretical and methodological foundations, and related philosophical aspects and issues. In the introduction and two parts of the first work, entitled "The Concept of the Physical World as a Whole at the Beginning of the Twenty-First Century" and "Philosophical Discussions around Cosmology," they revealed the palette of opinions of modern galactic science, as well as classical and modern worldviews, including the phenomena of dark matter and the expansion of the universe. Moreover, they also commented on the wide range of differences in the interpretation of the relationship between these two disciplines. In the second article, V. Prits expanded on the discussion of the relationship between philosophy and cosmology. In it he thoroughly covered the scientific discussions that began in the 1930s about the methodology of analysis and the probability of knowledge about cosmic objects and their very reality, including the observable spectrum and such dilemmas of the philosophy of cosmology as the question of "what the cause of the expansion of the universe is" and whether it is eternal or finite. At the same time, he paid special attention to such fundamental theses as the cosmological principle of "uniformity" and "isotropy" of the universe and the phenomenon of the "multiverse", theoretically arising from the "chaotic theory of inflation", the "many-world interpretation of quantum mechanics", and "superstring theory". Significantly, among the sources of these publications are the works of the well-known Ukrainian scientists-philosophers, P. Dyshlevyi and S. Krymskyi, who took an active part in the development (the 50s-80s of the 20th century) of academic and university studies on the achievements of the Copenhagen school of N. Bohr in theoretical physics and the place and role of cybernetics in the creative interaction of philosophical and natural science knowledge.

The topic of the philosophy of cosmology was raised by S. Krymskyi in many of his interviews and in the final autobiographical work (Krymskyi, 2012). He expressed in them his awe of the global scientific and sociocultural advancements of the 20th century. In addition to being the era of "struggles and loss", especially with respect to its "inhuman experience of totalitarianism", which he viewed in the framework of the fundamental defense of the ideal of humanism and spirituality, this was the era of the greatest number of "revolutions", mainly "nanotechnological" and "cosmic astrophysics and thermodynamics". We believe that this

trend in the growth of philosophical and cosmological studies in Ukraine is comprehensive and, in fact, pivotal to the thinking of local scientists regarding the origins of the solar system and the cosmos – the "early" universe in general – as well as the currently observed universe with all the potential hypotheses regarding the existence of parallel universes in the aforementioned "multiverse". For instance, the problem of interpreting the "anthropic principle" in science during the 20th and early 21st centuries – specifically, the probability of the paradigms of the "fine-tuned universe" and "intelligent design" – was actualized in the articles of these authors (Prits & Kuznietsov, 2020; Prits, 2020). This issue has been of great personal interest to domestic thinkers. One of the striking examples of this is the spiritual evolution professed by S. Krymskyi, who continued his movement of "rejection" of the philosophy of G. Hegel and logic in favor of "Christian values" a "call from above." It was confirmed by his recognition of a society as a "terrible thing" where religion and morality have been destroyed. The "inhuman world" of totalitarian governments and their criminal justice systems, as well as the "revolutions" in atomic, computer, biotechnological, and space technology that are unprecedented in human history, present a fundamental challenge for us as their witnesses and participants. Its essence is a systematic understanding of domestic academic and university, as well as alternative, scientific experience in developing philosophical and cosmological themes, problems, and teachings as an important part of the Ukrainian educational, scientific, cultural, artistic, and socio-political life of the Postmodern Era.

2. Main Stages in the History of Ukrainian Philosophy of Cosmology: From the Space Age to the Quantum Age

The origin, formation, and development of the latest postmodern, scientific academic, and university philosophical and cosmological studies in Ukraine can certainly be associated with the fruitful work of the famous founder of domestic biogeochemistry, geochemistry, and radiogeology, V. Vernadskyi. He was also the creator of the original concept of the geo-, bio-, and noosphere of the Earth, as well as the first president of the National Academy of Sciences of Ukraine. The influence of the latter on the progress of these studies, as well as the role of his figure and his scientific heritage in asserting the authority of the National Academy of Sciences of Ukraine for more than one hundred years of its complex and, at the same time, glorious history, has been repeatedly recognized in native and world science and is now indisputable. The appeal to them in the form of international scientific forums, as well as the reissuing of his works, in particular the diary, and their fruitful use in broad scientific research work, clearly marked three stages of philosophical and cosmological studies of the second half of the 20th and early 21st centuries in Ukraine. The first two of them occurred in the post-Stalin period of the history of the Ukrainian SSR, namely in the mid-50s to early 90s of the 20th century, and are referred to by them as: 1. its origin and progress in the conditions of humanization and Europeanization of academic and university science in the Ukrainian SSR during the Khrushchev "Thaw" and the beginning of "stagnation" (mid-50s–early 70s of the 20th century); 2. The formation as a stable direction of official-academic and alternative – actually nonconformist and dissident – scientific studies, in particular original authorial concepts (early 70s – early 90s of the 20th century). On the basis of these two stages in Ukraine, since 1991, the third stage (the current stage of the said studies) was started: 3. the full-fledged institutionalization of philosophical and cosmological studies as an academic-university, state-patriotic direction of scientific research integrated into the global academic and university experience: 1991 – the 20s of the 21st century.

The prehistory of the first of these stages is connected with the beginning of the revival in the mid-1940s of academic and university scientific life in the Ukrainian SSR after World War II. It was also conditioned by the foundation in Kyiv of the Main Astronomical Observatory of the Academy of Sciences of the Ukrainian SSR, which was planned by V. Vernadskyi and initiated by the academy's academician O. Orlov in 1944. In addition to publishing the annual "Astronomical Calendar" since 1948, this institution began publishing "Kinematics and Physics of Celestial Bodies" (since 1985) and "Space Science and Technology" (since 1995) journals. In addition, it developed very fruitful and active research and publishing activities throughout all three stages. In the year of Ukraine's independence, the Ukrainian Astronomical Association was established in Kyiv. It was based on the resources and personnel of that organization as well as two other comparable institutions: the Radio Astronomy Institute of the National Academy of Sciences in Kharkiv (since 1985) and the Astronomical Observatory of the Taras Shevchenko National University of Kyiv (since 1845), whose significant growth took place in the second half of the 20th century under the direction of the university's head of the astronomy department, S. Vsekhsviatskyi, and later K. Churiumov. This association is closely linked to the most recent postmodern astronomy and cosmology research and has served as the Ukrainian National Committee of the International Astronomical Union since 1993. It is interesting to note that the aforementioned Kharkiv Institute was founded in 1985 as the primary domestic scientific organization for radiophysical and radioastronomy research of outer space, based on the Department of Radio Astronomy of the Institute of Radiophysics and Electronics of the Academy of Sciences of the Ukrainian SSR. Today, the National Academy of Sciences of Ukraine's main astronomical observatory holds a prominent position in domestic research on the origin and evolution of stars and galaxies, as well as in the study of the sun and other solar system bodies, particularly the physics of their photosphere.

Two conditional periods may be identified in each of these three stages. They are primarily influenced by internal and external political circumstances related to the historical development of the Ukrainian SSR and, more recently, independent Ukraine, on the challenging path of democratization and state self-affirmation. It was precisely the second half of the 40s and the beginning of the 50s of the 20th century in the history of domestic academic science, according to the memoirs of the "Kyiv philosophical circle" participant from the Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR, S. Krymskyi, that was marked by "strong party pressure and control" on the part of the state authorities of the USSR on quantum mechanics and "following the persecution of biologists and geneticists." Meanwhile, at the same institute, research work on the "epistemic horizon" of the philosophy of scientific worldview was initiated by M. Omelianovskyi, academician of the Academy of Sciences of the Ukrainian SSR and the first director of the said institute (1946 to 1952). It was carried out along with his colleagues from the same institute and the Faculty of Philosophy of Taras Shevchenko Kyiv State University (Lukianets, 1998). M. Omelianovskyi, the famous author of "Philosophy & Modern Physics" (1954) and "Philosophical Questions of Quantum Mechanics" (1956), focused his attention on the multivector influence of cybernetics on the process of expanding the aforementioned "horizon" in addition to understanding the topic of the "Copenhagen interpretation of quantum physics", specifically the details of the fantastic interaction of micro-objects with measuring devices. The most well-known achievement of the research of V. Hlushkov, the first director of the Institute of Cybernetics of the Academy of Sciences of the Ukrainian SSR, and his team is Ukrainian language "Encyclopedia of Cybernetics: in 2 Vol." (1973). It offered a rethinking of the mathematical tools of theoretical

cybernetics and programming techniques, as well as theories of systems and information. Later the Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR began to examine the worldview and methodological role of philosophy in natural scientific cognition as a result of active familiarization with the initial findings of these studies. It was led in 1962-1968 by the academician of the Academy of Sciences of the Ukrainian SSR and founder of the Kyiv Philosophical School of the second half of the 20th century, P. Kopnin.

In fact, during the 60s and early 70s of the 20th century, already at the end of the Khrushchev "Thaw" and the "dawn" of the "stagnation" era, scientists from many institutes of the Academy of Sciences of the Ukrainian SSR, including socio-humanitarian ones, actively joined the process of the scientific and technological revolution in the USSR and the world. One more significant aspect of it was the participation of Ukrainian SSR academic and university scientists in various reputable international scientific forums since the latter part of the 1950s. One notable example of this is the participation of P. Kopnin and his colleagues, such as M. Popovych, S. Krymskyi, M. Honcharenko, and others, in world philosophical congresses and international Hegelian conferences, such as the XII in Venice (1958), XIII in Mexico City (1963), XIV in Vienna (1968), and others. The development of philosophical and cosmological research in Ukraine was actively prompted and based on this incredibly fruitful exchange of scientific experience with top scientists from the eastern and, at the same time, western military-political blocs. One example of this was the "Soyuz-Apollo" space program in 1975, which was a joint USSR-US project in the year of the adoption of the Helsinki agreements. These scientific-academic and university studies continued to be an important part of nonconformist and dissident-scientific and other studies during the development of the Ukrainian human rights movement or the Resistance Movement of the Sixties in the Ukrainian SSR in the 1960s and 1980s. This was especially true of the original authorial concepts of the movement's participants. Among these were the cosmological and philosophical teachings of the founders of the Ukrainian Helsinki Group (established in 1976), primarily its founder, M. Rudenko, a graduate of Taras Shevchenko Kyiv State University, a member of the Soviet branch of Amnesty International, and his colleague, O. Berdnyk.

Rich – both "self-published" and published in the "free world" – achievements of the creators of the alternative Ukrainian philosophy of cosmology gave a powerful reverse impulse to relevant academic research. These accomplishments were vividly represented by their surnames, numerous artistic and scientific works, such as "Gnosis and Modernity (Architecture of the Universe)" and "Energy of Progress (Essays on Physical Economy)" by the former, and by the latter's texts, published in the collection of works "Ukraine of the Fiery Sich" (1977), including "Alternative Evolution" and "Svitoniia of the Kingdom of Freedom". In the 1960s and 1980s, both during the "stagnation" and already Gorbachev's "perestroika", a broad process of popularizing important achievements of Ukrainian, all-Soviet, and global philosophical and cosmological studies of postmodernism among broad readership circles continued. It took place in the academic scientific thought of the Ukrainian SSR and, concurrently, in the domestic literary, cultural, and artistic life in general. This process was indicative in the breadth of topics, content, and forms of manifestation. In addition to scientific documentaries, thematic radio and television programs, and popular science lectures, scientific publishing houses like Naukova Dumka and, more importantly, Molod and Veselka also played a remarkable role in this process. Despite being censored, the latter two of them proved to be influential and beneficial to both adult and young audiences. They included many classic examples of these studies as well as numerous accomplishments of innovative scientific, technical, and humanitarian opinions of scientists from the Ukrainian

SSR's Academy of Sciences. These publishers' thematic series contributed to their widespread popularity. It is worth mentioning some of them: "Life of the Glorious" (1966-1977) and "Famous Names" (1977-1990) by the Molod publishing house, as well as, to a greater extent, the following series: "The Library of Adventures and Science Fiction" (1956-1959), "Adventures. Science Fiction" (1960-1964), and "Compass: Adventures. Science Fiction" (1965 – early 1990s). The following studies are among the publishing house's notable endeavors in the field of philosophical and cosmological research: "The Pyramid of the Sun" (1991) and "The Magic of the Celestial Spheres" (1993) by O. Yemchenko, a graduate of the Taras Shevchenko Kyiv State University Faculty of Journalism and the former head of the department of Science and Society journal, published by the Ukrainian Center for Spiritual Culture.

It is also worth mentioning the thematic series of the Veselka publishing house, such as "In the World of Adventures" (1957-1971), "Science Fiction" (1965-1971), and "Adventures. Fantasy" (1972-1991). Its other projects included, for instance, three issues of the "Discoveries. Searches. Finds" (1985-1989) almanac, in which several of the most well-known scientists of the Academy of Sciences of the Ukrainian SSR actively participated. The first of these was B. Paton, the head of the Academy from 1962 to 2020 and the president of the International Association of Academies of Sciences from 1993 to 2017.

We believe that they all play a significant part in promoting and popularizing the remarkable accomplishments of their research into the history of the Earth and its species, the solar system, the cosmos, and humanity in the Ukrainian SSR and now independent Ukraine. Thousands of pages of these publications have been published since the 1950s till now, and for many generations of Ukrainians, the theme of natural science and, at the same time, socio-humanitarian, not to mention philosophical, issues have been of interest. These include, in particular, studies on astronomy ("What Stars Tell Us" (1973)) and geochronology ("Life of the Earth" (1983)) by V. Utkin; cybernetics and artificial intelligence ("Artificial Intelligence" (1983)) by O. Chachko; biology and genetics ("The Clock of Life" (1987)) and "The Secret of Pentagira" (1989)) by N. Okolitenko, as well as geography ("Biographers of the Blue Planet: in 3 volumes" (1984-1991)) by O. Yemchenko and others. Such works as "Mysteries of History" (1966), "Ghost Hunters" (1968), and "Through the Dark Ages" (1969) by the famous Ukrainian historian and orientalist – researcher of the secrets of ancient, antique, and medieval civilizations, O. Horbovskyi – have attracted constant reader attention for many decades. By contrasting the well-known texts of the holy books of the great "Abrahamic" religions, many ancient cults, and contemporary accomplishments of Ukrainian and foreign academic and university science, he provided his philosophical and cosmological understanding of the history of the universe and its apocryphal-alternative history.

The second half of the 20th century and the first quarter of the 21st century, in our opinion, is the time when the largest number of philosophical and cosmological ideas, projects, and concepts representing both academic and university, as well as alternative dimensions of domestic socio-cultural existence, were published in Ukraine and the world. These dimensions, mainly the first one, were formed in the Soviet censored and politicized context in the Ukrainian SSR between 1918 and 1991. They were directly influenced by European philosophical and cosmological thought, particularly from the middle of the 20th century, primarily through Soviet translations and concepts into Russian. These are both the novels of O. Tolstoi and O. Beliaiev, as well as the pinnacle of Russian academic science fiction, primarily the novels of the famous science fiction writer and paleontologist I. Efremov, and, in particular, the works of professional philosophers, such as the novel "Cosmology

of the Spirit" (1956) by E. Ilyenkov. The cosmology of the Strugatskyi brothers, as well as H. Adamov, who are native to Ukraine, is also noteworthy because it is largely alternative to the works of the previous two. In our opinion, the last third of the last century became an extremely significant – fruitful, albeit now forgotten – stage of the wide public manifestation and influence, including in the diaspora and the world at large, of original postmodern philosophical and cosmological ideas and concepts. On the one hand, their authors were prominent employees of the Academy of Sciences of the Ukrainian SSR: astronomers, physicists, biologists, chemists, etc., such as doctors of physical and mathematical sciences M. Boholiubov, D. Hrekov, E. Hurtovenko, I. Klymyshyn, V. Pysarenko, and V. Shelest. They and many of their colleagues presented a fairly wide range of innovative, interdisciplinary (that generalize results of the development of exact and other sciences from archaic times to the present day) paradigms and concepts of their evolution and further progress. It spanned mainly from a comprehensive analysis of the phenomena of calendar and chronology in all known cultures of the world to systemic forecasts of the course of atomic and alternative energy and the prospects for human exploration of space.

These included, among others, prominent Ukrainian humanities scholars who worked at the Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR. For instance, S. Krymskyi, a co-founder of the mentioned Kyiv Philosophical School, rethought and creatively developed both domestic and foreign experiences, particularly the teachings of V. Vernadskyi, regarding the noosphere. On the other hand, under the influence of both these academic achievements and thanks to a much freer acquaintance with Ukrainian and world opinion of the 19th and 20th centuries (for example, the works of S. Podolynskyi and V. Vynnychenko, as well as the works of I. Azimov, R. Bradbury, A. Clarke, and, including, O. Huxley, O. Golding, and D. Orwell), a bright galaxy of thinkers and cultural figures of the Sixtiers and participants in the Ukrainian human rights movement of the 50s-80s of the 20th century, primarily O. Berdnyk and M. Rudenko, developed a number of extremely popular philosophical and cosmological teachings. It is noteworthy that a galaxy of so-called alternative academic and university developers with distinctively national-patriotic beliefs and worldviews emerged with regard to the foundations of Soviet science at the exact intersection of these two dimensions-vectors of the Ukrainian postmodern philosophy of cosmology. These individuals ranged from the well-known archaeologists Yu. Shylov, B. Mozolevskyi, M. Chmykhov to the famous cyberneticists L. Pliushch, Yu. Kanyhin, and H. Pocheptsov. Both they and many of their colleagues – employees of this academy and, mainly, graduates of the Taras Shevchenko Kyiv State University, such as researchers of domestic and foreign mineralogy and the secrets of the past of humanity, R. Furdui; artificial intelligence and its prospects, O. Chachko; the history of the solar system, O. Yemchenko; the universe of the Ukrainian language, V. Koptilov and A. Koval, etc. – for the first time summarized the experience of their predecessors and contemporaries in original – Ukrainian-language, scientific, and popular science publications.

The joint – fruitful and creative – cooperation of these scientists, as well as many of their colleagues from the Academy of Sciences of the Ukrainian SSR and the Taras Shevchenko Kyiv State University, national academies, and universities of numerous states of the Eastern and, partly, Western blocs in the 60s-80s of the 20th century, including coordinated at the level of many humanitarian and other scientific research projects of the UN and UNESCO since the 1950s, contributed to the formation in the Ukrainian SSR in the post-Stalin period of the foundations of the new domestic (postmodern) philosophy of cosmology. Its progress is unimaginable without the creative cooperation of all these scientists with several generations

of popularizers of the knowledge they gained. Their rather significant contribution to the twenty-year – quite fruitful – activity of the ISPC, established in October 2004, headed by its permanent leader, Doctor of Philosophy O. Bazaluk, is an important page in the brightly creative consideration and popularization of the scientific and philosophical model of the universe developed by the latter (Bazaluk, 2021; 2022). Together with their Ukrainian and international colleagues, these scientists regularly contribute to a number of the ISPC's prestigious periodicals, primarily international scientific journals Future Human Image and Ukrainian Policymaker, and most importantly, Philosophy and Cosmology. In a collaborative, creative, and enthusiastic manner, they explore, highlight, and popularize the most significant amount of knowledge about the structure and history of the universe, as well as the place and function of the individual, society, and their cultural creation on the scale of the Earth and space as a whole.

3. Modern Ukrainian Humanities and Philosophy of Cosmology: Finding the Folk Origins in the Perspective of Cosmic Search

The creative cooperation of the participants of this society and its supporters, both in Ukraine and in the world, first of all, in the friendly circle of scientific philosophical societies established in independent Ukraine and well-known in the international scientific arena within the Ukrainian Philosophical Foundation and outside it, is inseparable from the fruitful interaction with the H. Skovoroda Institute of Philosophy of the NASU and many other institutes of this academy. The following three of them have created highly esteemed scientific works: the M. S. Hrushevskyi Institute of Ukrainian Archeography and Source Studies (since 1990), the A. Yu. Krymskyi Institute of Oriental Studies (since 1991) and the Institute of Encyclopedic Research (since 2004). Despite being the newest in the academy, these three institutions have established the groundwork for a comprehensive, methodical, and extensive reconstruction of an objective scientific vision of the significant role and contribution of the Ukrainian people and Ukraine to the advancement of humanity from primitivism to postmodernity on a planetary scale based on the replication of their shared history. Since the 20th century, other institutes of the academy, including these six institutes of Archeology, Social Sciences, History of Ukraine, Philosophy, Art History, Folklore and Ethnology, as well as Literature, have contributed equally to the accomplishment of this scientific task. They prepared and published "History of Ukrainian Culture: in 5 Vol., nine books". It was the first domestic multi-volume publication of this type in Ukrainian. It became possible due to the support of the Naukova Dumka publishing house of the NAS of Ukraine (between 2001 and 2013), and with the help of scientists from Taras Shevchenko National University of Kyiv. For the first time, the six institutes mentioned above and over ten institutes of the National Academy of Sciences, which serve as the main institutions of this unique Ukrainian publication, provided readers in Ukraine and around the world with a highly qualified academic scientific project to ascertain the place and role of Ukraine and the Ukrainian people on the political and cultural map of the world, including in the philosophical and cosmological dimension.

On nearly ten thousand pages, its more than 100 authors laid the groundwork for this publication, which became, in our opinion, central – extremely scientifically indicative and historically significant. It was the outcome of the incredibly painful and intricate development of Ukrainian academic science, namely during the Soviet era. It was a palette of reflections on the historical progress and cultural development of the Ukrainian ethnos that had never before been seen in the domestic humanities. This is the largest humanitarian project of the

NAS of Ukraine to date, offering a conceptually new model of the development of native culture. This is in contrast to all previous research projects into the history of national culture, including the first Ukrainian-language multi-volume publications on the history of Ukrainian archaeology, literature, and art of the 1960s and 1970s, prepared at the Academy of Sciences of the Ukrainian SSR, and the most well-known publications of scholars of the Ukrainian diaspora, "History of Ukrainian Culture" edited by I. Krypiakevych & "Ukrainian Culture" (1940) edited by D. Antonovych. The said five-volume history of Ukrainian culture, in its systematic consideration, closely takes into account the achievements of all currently known encyclopedic Ukrainian research projects, such as, primarily, the "Encyclopedia of Ukrainian Studies" with its "General Part: in 3 volumes" (1949) and "Dictionary Part: in 10 volumes" (1955-1995), as well as the "Ukrainian Soviet Encyclopedia: in 17 volumes" (1959-1965). "A Sketch of the History of Ukrainian Culture" (1998) by M. Popovych, the late director of the H. S. Skovoroda Institute of Philosophy of the NAS of Ukraine from 2002 to 2018, is also worth mentioning separately because it is encyclopedic in terms of the amount of material and the depth of its analysis. The authors of "History of Ukrainian Culture in 5 volumes, 9 books" systematically used the main results of the interdisciplinary study of the history of the universe, the Earth with its flora and fauna, and humanity as a whole, both in the industrial and already information society. An important component of these studies was not only the detailed consideration but also the recognition of such significant achievements of scientists of the said Academy as the contribution of the M. Hlushkov Institute of Cybernetics and the M. Bogoliubov Institute for Theoretical Physics to solving fundamental scientific problems.

This publication, which appeared at a significant intersection of historical eras for the national history (the Soviet era at the end of Gorbachev's "perestroika" period and the formation of independent Ukraine) accumulated exceptional theoretical experience and practical results in the study of the Earth and cosmos in a number of state and international programs and projects implemented at that time with the participation of the Academy of Sciences of the Ukrainian SSR: "Informatics and Complex Automation," "Biotechnology," the Comprehensive Program of Scientific and Technological Progress of the CMEA Member States (until 2000), etc. Since the 1970s, the Academy initiated republican interdisciplinary scientific and technical complexes, such as "Powder Metallurgy," "Catalyst," "Biogen," "Membranes," "Anticorrosion," "Machinery Reliability," "Mekhanobr," "Thermosynthez," etc. As the President of the Academy of Sciences of the Ukrainian SSR, B. Paton noted in a review of the fundamental achievements of his academy colleagues at the end of the 1980s that their orientation to the world level brought remarkable results. He said, "Among those that have been obtained only recently, in particular, is the discovery of the phenomena of combined resonance and additional light waves in crystals, the redistribution of charge carrier energy in metal microcontacts at low temperatures, and the selective chemical sensitivity of ion channels of nicotinic cholinergic neurons" (Paton, 1988: 10). He highlighted the accomplishments of the Academy of Sciences of the Ukrainian SSR in the field of space exploration, pointing to their significant contributions to the study of high-temperature superconductivity and membrane technologies, as well as the advancement of computer science and complex automation, genetic therapy and molecular immunology. He also said, "The participation of our academy in the Vega project was impacted by the results of great scientific weight. For the first time in the USSR, highly dispersed spectra of Halley's comet were obtained, the circular polarization of its radiation was determined, and detailed digital photometry was performed" (Paton, 1988: 10). These studies were, at the same time, a continuation of S. Vsekhsviatskyi's research on the above-mentioned comet. This thesis

was developed in great detail by several of B. Paton's colleagues, who also added substantial support to it later on by praising his and his team's deposit to the research in cosmology in the second half of the 20th century.

During this second stage of the progress of philosophical and cosmological studies in the Ukrainian SSR, which can be divided into two conditional periods (before and after the accident at the Chornobyl NPP on April 26, 1986), four issues of the "Science and Culture. Ukraine" yearbook (from 21 to 24 (1987-1990)) of this academy and the Znannia society of the Ukrainian SSR, were published. They became, in our opinion, an authoritative source for identifying fundamental changes in the vision of the priorities of scientific research of the Academy of Sciences of the Ukrainian SSR, as well as its main achievements during the 70s-80s of the 20th century. In his article (Paton, 1987), the president of the Academy of Sciences of the Ukrainian SSR noted the need to restructure the organization's work by combining a critical evaluation of the major accomplishments of the implementation of the aforementioned academic programs and projects with an outline of such radically new scientific and other global challenges of the late 20th century, such as the above-mentioned Chornobyl accident and the spread of HIV-AIDS, in the context of mastering biotechnology and the peaceful exploration of space. The philosophical dimensions of cosmological topics in the work of the institutes of the academy were repeatedly raised in public speeches in the columns of this publication by both the former director of the Institute of Philosophy of the Academy of Sciences of the Ukrainian SSR, V. Shynkaruk, and his colleagues, in particular A. Horak, in a talk at a "round table" (Man and His Future, 1987) and in one of his articles (Krymskyi, 1987). The latter, along with his associates Yu. Pakhomov and Yu. Pavlenko, wrote the seminal work on this subject, "Paths and Crossroads of Modern Civilization" (1998). The two sections – "Man. Society. Epoch" and, especially, "Man. Science. Technology" of this yearbook combine reports by famous scientists on their achievements in all fields of scientific research. These are their accomplishments - in cosmology, as demonstrated by the projects "Raprog" and "Vega" (Ya. Yatskiv); space biology (Ye. Kordium & A. Popova); paleoclimatology (M. Veklych); elementary particle physics (D. Volkov); biosensors (H. Bielska & V. Strikha); neuroscience (P. Sierkov); ozonosphereology (M. Nuzhdina), etc. – while acknowledging the ecological crisis and the necessity of national programs to safeguard the environment and the health of the Ukrainian people. A red line on the way to the development of destructive production and industrial cycles in the Ukrainian SSR was this rather wide and professional range of warnings against the detrimental effects of the scientific and technological revolution, particularly the advancement of nuclear energy in its critical state as it was at the time.

The three said issues of the "Discoveries. Searches. Finds" almanac (1985–1989) were also influenced by the corresponding controversy in the assessment by scientists of the Academy of Sciences of the Ukrainian SSR of the accomplishments and challenges of the progress of scientific and technological advancements in the Ukrainian SSR, the USSR, and the world, taking into account, among other things, the aforementioned accident at the Chernobyl NPP and, generally, the economic crisis in the USSR in the 1980s. B. Paton made it clear in the introduction of the first of them, which was published a year prior to this accident, that there is a "special place" in the work of scientists since the start of the twenty-first century for "fundamental and applied research aimed at solving "global problems of humanity", such as energy, food, and health care. He also emphasized the necessity of actively developing nuclear power, so long as thermonuclear plants and fast neutron reactors can be built using new materials with specific properties. It is important to note that the authors of

this almanac's next two post-Chornobyl issues, as well as, to some extent, the first, gave special attention to alternative energy sources, specifically "radiant energy of the sun," "wind energy,," and hydrogen, as the fuel of the future. At the same time, they also highlighted the opportunities for the advancement of computer use in all areas of state life. The authors of the almanac enthusiastically discussed B. Paton's repeated idea of developing biotechnology, which is based on fundamental sciences and, first and foremost, microbiology, virology, cytology, biochemistry, molecular biology, and genetics, while paying much less attention to the task he proposed to "more confidently explore space and the world ocean". All three of this almanac's issues, however, also effectively addressed the theme of space, from the essays "In Space Under Sail" by V. Safronov and "A Particle of a Distant Planet" by P. Hutiunov to such works as "Stars, Respond!" by M. Slavynskyi, which already predict humanity's intergalactic future, and almost epic "Thoughts on a Spheroid" by M. Burliai.

A "garden of studies" on the history of local and global cosmology was planted simultaneously and is already thriving in the twenty-first century. It is showcased by creative collections made by researchers from the Ukrainian National Academy of Sciences (Ukrainian Sky, 2014; Ukrainian Sky 2, 2016). These two are the most famous projects released under the brand name of the Ya. S. Pidstryhach Institute for Applied Problems of Mechanics and Mathematics of the National Academy of Sciences of Ukraine. Notable among the more than forty authors of these publications are the following: astrophysicists B. Novosiedlyi and O. Petruk; professional astronomers T. A. Artemenko and I. Vavilova (The Main Astronomical Observatory of the National Academy of Sciences of Ukraine); historian Ya. Matviishyn (The Institute of Mathematics of the National Academy of Sciences of Ukraine), who specializes in mathematical natural science and cartography; and the astronomy classic, Klymyshyn himself, who wrote the classic exploration of the history of domestic and international astronomy (Klymyshyn, 2002). These and their colleagues gave to the publications a unique panorama of the flow of astronomical knowledge and cosmological phenomena in Ukraine and the world from their most recent – archaeoastronomical - stage to the present day. One notable achievement of these comprehensive volumes, titled "The Ukrainian Sky", was the inclusion of the accomplishments of such distinguished scientists as archaeologists M. Chmykhov and M. Videiko, historians I. Krypiakevych and Ya. Isaievych, philosophers M. Kashuba and P. Kraliuk, ethnologist and ceramist I. Poshivailo, philologist and literary critic L. Ushkalov, and others. In addition to their colleagues' coverage of astronomy and cosmology studies in Ukraine and around the world from antiquity to the Renaissance and beyond, the first two of them conducted extensive research on the role of astronomy in the life of primitive society, specifically the history of the zodiac's emergence and development. These studies provide a solid basis for the advancement of innovative studies in philosophy and cosmology in contemporary domestic academic and university science.

The authors of these publications V. Shelukhin, Ya. Isaievych, P. Kraliuk, and others provide evidence of the participation of many generations of Ukrainian scientists in this process. They examine the transition from the "esoteric-syncretic" to the "rational-empirical" model of thinking in Western European and Ukrainian astronomy and cosmology, using examples of their study and teaching traditions from the Middle Ages universities to the 17th and 18th-century Kyiv-Mohyla academic tradition, as well as the founding of the first national observatory at Lviv University and beyond in the 18th century. The authors explained the origins and principles of national folk astronomy along with the theogonic and cosmogonic ideas of the Ukrainian people, including in the fields of folklore and fine arts. They highlighted how the scientific heritage of Martyn of Zhuravytsia, Yu. Drohobych,

Ya. Liatos, T. Prokopovych, I. Falkivskyi, and several of their contemporaries and successors formed the tradition of professional astronomical studies in Ukraine. These profound studies, which are distinguished by a propensity to integrate the accomplishments of the natural sciences and the humanities, have, in our opinion, developed into a strong continuation of a number of unique, methodical attempts at the ethno-folklore-natural science replication of the universe of the original beliefs of the Ukrainian ethnos. We believe that the 1990-1991 edition of the never-published monograph "Dictionary of Ukrainian Mythology", written both by the candidate of historical sciences, M. Tkach, and his wife, M. Danylevska, and published in the Ukrainska Kultura journal, is among the most representative of them. It differs from similar studies in that its two authors made a fundamentally innovative attempt to identify the primary and secondary images of Slavic folklore, both in mythopoetic and sociocultural contexts, as well as against the backdrop of outdated ideas of the universe's structure, based on their analysis and scientific and philosophical reconstruction in terms of astronomy, cosmology, and contemporary natural sciences.

Conclusions

In parallel to the philosophical and cosmological research conducted by the authors of these publications and their colleagues from the National Academy of Sciences of Ukraine and domestic universities, the authors' reconstructions of multiple generations of domestic (academic and alternative) scientists played a crucial, state- and national-patriotic role in reproducing the historical past of Ukraine and its people and providing futurological insight into the prospects for their continued historical advancement. One of them is the dissident-human rights wing, which is represented by the artistic and scientific inventiveness of the previously mentioned O. Berdnyk and M. Rudenko. In the creative project known as "Ukrainian Spiritual Republic", the former had the chance to test the theoretical underpinnings of his Ukrainian-centric cosmism, which featured an image of the noosphere and the infinity of the universe. The second of them is a graduate of Taras Shevchenko Kyiv State University and an experienced researcher of the philosophical and socio-economic ideas of community movement figures. As a researcher of the teachings of S. Podolinskyi, who was the creator of the Ukrainian scientific school of physical economy and a critic of Maltusianism, M. Rudenko criticized in his books the theory and practice of Marxism-Leninism. He put forth his own "alternative cosmology" and the concept of the "architecture of the universe". The other, equally patriotic, nonconformist academic thinker-cosmologist wing consists, first and foremost, of a group of scientists from the Academy of Sciences of the Ukrainian SSR's Institute of Archaeology, mainly B. Mozolevskyi, M. Chmykhov, and Yu. Shylov, as well as a graduate of the Taras Shevchenko Kyiv State University's Faculty of Philosophy, Yu. Pavlenko. Following in the footsteps of V. Danylenko's work "Cosmogony of Primitive Society" (1965), which reconstructed seven cultural and chronological stages of the ethno-cultural history of the neolithic population of Southeast Europe, these scientists each presented their own theories regarding Ukraine's ancient past as well as its planetary and cosmic future.

The Yu. Pavlenko's vision of the ethno-cultural history of Ukraine in the context of world civilization, and M. Chmykhov's "cosmoarchaeological" concept of the existence of a 532-year "ethno-creative cycle" and "psycho-informational" and other civilizations (Chmykhov, 2001), immortalized the names and accomplishments of these scientists. Both of them were founders of the Department of Culturology and Archaeology of the NaUKMA. Philosophical and cosmological reconstructions by Yu. Kanyhin and O. Shylov – two

prominent scientists from the institutes of the Academy of Sciences of the Ukrainian SSR and the National Academy of Sciences of Ukraine, primarily in cybernetics and archeology – have been equally well-known and popular since the 1990s. They have also been the subject of numerous polemical and highly critical discussions in Ukraine's academic communities and universities (Kanyhin, 1997; Shylov, 1994). The first of them proposed a concept related to the oldest known, in particular the Tibetan one, cultural traditions of the significance of Ukraine in the "spiritual history of humanity" in the context of assessing the historical past and cosmic prospects of the latter. The history of the Dnipro region, the ancestral home of the Orians and "proto-Slavic Aratta", was restored by Yu. Shylov in his more than fifty books. He did this while taking into account ancient Indo-Ukrainian cultural ties and the "cosmic order" that the "mind of the universe" established. Both they and their already-mentioned colleagues pointed out that their ideas and teachings were, to a large extent, determined by the scientific views of V. Vernadskyi. Yu. Shylov emphasized that it was precisely V. Vernadskyi's natural science research that began to contribute to the "contours" of the "picture of mental-field interrelations" of man-humanity-universe" (Shylov, 1994: 377). Many of the aforementioned and other scientific and popular science studies on the history of the cosmos, solar system, geochronology, or "life of the Earth", as well as the mysteries surrounding the origin of its flora and fauna, were published during this fruitful period of transition from the second to the third stage of philosophical and cosmological studies in Ukraine.

Let us remember a bright collection of short stories called "The Integral of Pythagoras" (1965), written by N. Okolitenko, a graduate of the Faculty of Biology at Taras Shevchenko Kyiv State University. These works of her are devoted to the history of world biology and genetics and include "The Clock of Life" (1987), "The Secret of Pentagira" (1989), and "What is Written in the Book of Life" (1990). Since then, domestic scientists and the general public have been paying closer attention not only to the ripe fruits of academic science, such as astronomy, but also to disciplines that emerged in the second half of the 20th century and are revealing mysteries of the dark cosmos and universe, such as archaeoastronomy, with archaeoastrology, ethnoastronomy, and other sciences as part of it. At the end of the 20th century, renowned Ukrainian scientists H. Burhanskyi and R. Furdui focused their attention on the paleoastronomy that connects them all, including the issue of the existence of extraterrestrial civilizations, which was the subject of the international SETI program – "Search for Extraterrestrial Intelligence" – as well as numerous scientific institutions and well-known researchers like Z. Sichin, E. von Daniken, and E. Collins. In their seminal book "Mysteries of Antiquity: White Spots in the History of Civilization" (1988), they effectively summarized the important findings of official and alternative scientific studies on humanity's historical past and likely intergalactic future. In fact, they systematized the broadest range of concepts, ideas, themes, and plots of global philosophical and cosmological thought in the Ukrainian language for the first time. Within three years, the first Ukrainian-language anthology of the "ancient literature of Sumer, Babylon, and Palestine", called "On the Rivers of Babylon," edited by Taras Shevchenko Kyiv State University graduate, biologist, linguist, and translator, M. Moskalenko, was published by the Dnipro publishing house. It provided a solid foundation for the progress of domestic oriental studies in the A. Yu. Krymskyi Institute of Oriental Studies of the NAS of Ukraine, founded in the same year.

The impressive philosophical-cosmological legacy and rich but little-studied archaeoastronomy of the centuries-old interaction of the Ukrainian people with the Eastern civilizations – from the ancient, Near, Middle, and Far East to the modern one – have been the subject of extensive, in-depth, and fascinating works written by members of various domestic

oriental studies institutions and societies. It is worth mentioning such well-known ones as the Ukrainian Association of Jewish Studies, headed by V. Chernoivanenko; the Center for the Studies of History and Culture of East European Jewry of the Ukrainian Academy of Sciences under the leadership of L. Finberg; the Ukrainian Association of Sinologists with its president, acting director of the A. Krymskyi Institute of Oriental Studies of the National Academy of Sciences of the Ukraine, V. Kiktenko; the Ukraine-India Society, etc. Alongside the NAS of Ukraine's active scientific and research activities in the field of astronomical and cosmological studies – among which are the collections "Dark Energy and Dark Matter in the Universe: in 3 volumes" (2013-2015) and "Space Research in Ukraine: 2022-2024" (2024) published by the Akademperiodika publishing house – famous scientists like M. Videiko, S. Hubernachuk, S. Nalyvaiko, M. Tarasenko, Yu. Shylov, and others continue to find the origins of the archaeoastronomical past of Ukraine and the world. Their inspired collaboration on the challenging but important paths of academic and alternative study of the extremely significant place and role of Ukraine and its native people in European history and the history of world civilization in general is a reliable guarantee of the successful and innovative development of philosophical and cosmological thought in Ukraine and the world in the 21st century. The result of the age-old progress of these studies in Ukraine – from the colonial status in the Austro-Hungarian and Russian empires, through its national liberation competitions, two world wars, and neocolonial quasi-state existence in the USSR to its independence in 1991 – was the reaching by Ukrainian-academic and university science of a new level worthy of its history of establishing the place and prospects of the country and its people in the planetary and cosmic development of humanity.

🕮 References

Bazaluk, Oleg (2021) The Sophia Republic: The Special Theory of Education. *Philosophy and Cosmology,* Volume 26, 62-76. https://doi.org/10.29202/phil-cosm/26/5

Bazaluk, Oleg (2022) Philosophy of the Cosmos for a Discursive "Thinking Through" of the Chronology of the Universe. *Philosophy and Cosmology,* Volume 28, 5-21. https://doi.org/10.29202/phil-cosm/28/1

Chachko, Oleksii (1983) *Artificial Mind: A Scientific and Artistic Book.* Kyiv: Veselka.

Chmykhov, Mykola (2001) *From the Paradise Egg to the Idea of the Savior:* a Monograph. Kyiv: Lybid.

Culturology: A Handbook for Students of Higher Educational Institutions/coauthors; edited by A. Ye. Konverskyi (2013). Kharkiv: Folio.

De Bianchi, Silvia, Forgione, Marco and Marongiu, Laura (ed.) (2024) *Time and Timelessness in Fundamental Physics and Cosmology.* Springer Cham. https://doi.org/10.1007/978-3-031-61860-4

Discoveries. Searches. Finds: Almanac (1985). Kyiv: Veselka.

Kanyhin, Yurii (1997) *The Path of the Aryans: Ukraine in the Spiritual History of Humanity:* A Novel-Essay. Kyiv: Ukraine.

Klymyshyn, Ivan (2002) *Calendar and Chronology*. Ivano-Frankivsk: Hostynets.

Kordium, Yelyzaveta, Popova, Antonina (1987) *Microorganisms in Space Flight.* Science and Culture: Ukraine: Yearbook, 21: 184-191.

Korkh, O.M., and Khmil, V.V. (2024) Kant's Philosophy and the Idea of the Self-Made-Man. *Anthropological Measurements of Philosophical Research*, 25, 124-132. https://doi.org/10.15802/ampr.v0i25.307669

Krymskyi, Serhii (1987) *Science as a Cultural Phenomenon.* Science and Culture: Ukraine: Yearbook, 21: 132-136.

Krymsky Serhii (2012) *Sergey Krymsky: Our Lifelong Conversation (Interview Cycle with T. A. Chaika).* Kyiv: Dmitry Burago Publishing House.

Le Bihan, Baptiste (2024). The Great Loop: From Conformal Cyclic Cosmology to Aeon Monism. *Journal for General Philosophy of Science. Published online: 24 September 2024*. https://doi.org/10.1007/s10838-024-09678-5

Lukianets, Valentyn (1998) *Philosophy of Scientific Worldview: Transmutation of the Epistemic Horizon*. Filosofska Dumka, 4-6: 72-94.

Man and his Future. Round Table Conversation (1987) *Science and Culture:* Ukraine: Yearbook, 21: 17-28.

Paton, Borys (1987) *About the Security of Progress.* Science and Culture: Ukraine: Yearbook, 21: 8-16.

Paton, Borys (1988) *On the Reorganizing of the Activities of the Academy of Sciences of the Ukrainian SSR.* Science and Culture: Ukraine: Yearbook, 22: 8-18.

Perlov, Delia and Vilenkin, Alex (2024) *Cosmology for the Curious*. Springer Cham. https://doi.org/10.1007/978-3-031-58757-3

Prits, Vasyl and Kuznietsov, Volodymyr (2020) *Main Features of the Cosmological Picture of the World.* Filosofka Dumka, 2: 86-101.

Prits, Vasyl (2020) *Philosophical discussions around cosmology*. Filosofska Dumka, 3: 96-106.

Prykhodko, Volodymyr, and Rudenko, Serhii (2018) Body and Space Relationship in the Research Field of Phenomenological Anthropology: Blumenberg's Criticism of Edmund Husserl's "Anthropology Phobia". *Anthropological Measurements of Philosophical Research,* 13, 30-40.

Rudenko, Mykola (2015) *The Energy of Progress. Selected Works on Economics, Philosophy, and Cosmology.* Kyiv: KLIO.

Shylov, Yurii (1994) *The Gate of Immortality*. Kyiv: Ukrainskyi Svit Journal.

Smeenk, Chris and Ellis, George Francis Rayner (2017). *Philosophy of Cosmology*. In: Zalta, E. N. Ed., *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), The Metaphysics Research Lab, Stanford

The Philosophy of Cosmology (2017) / Ed. by Khalil Chamcham, Joseph Silk, John D. Barrow, Simon Saunders. Cambridge University Press.

Ukrainian Sky. Studies on the History of Astronomy in Ukraine: Collection of Scientific Works (2014). Lviv: Ye. S. Pidstryhach Institute of Applied Problems of Mechanics and Mathematics (Pidstryhach IAPMM), National Academy of Sciences of Ukraine (NASU).

Ukrainian Sky 2. Studies on the History of Astronomy in Ukraine: Collection of Scientific Works (2016). Lviv: Ye. S. Pidstryhach Institute for Applied Problems of Mechanics and Mathematics (Pidstryhach IAPMM), National Academy of Sciences of Ukraine (NASU).

Utkin, Volodymyr (1983) *Life on Earth: An Essay on the Structure of the Earth and the Development of Life on It.* Kyiv: Veselka.

Veklych, Maksym (1987) *Paleoclimatology. Current Status, Some Hypotheses, and Problems.* Science and Culture: Ukraine: Yearbook, 21: 192-197.

Wilkinson, David (2024). *Theology and Cosmology.* In: *St Andrews Encyclopedia of Theology.* Ed. by Brendan N. Wolfe. https: www.saet.ac.uk/Christianity/

Yemchenko, Oleksandr (1991) *Pyramid of the Sun*: Science Fiction Book. Kyiv: Molod.

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