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Journal of Arts and Culture, and ARA Journal of Sciences.

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Opening Speech at the 47th ARA Congress

Prof. Ruxandra Vidu, Habil, PhD, MSc, NAI
President, American Romanian Academy of Arts and Sciences

Distinguished guests, dear colleagues, friends, and members of the American Romanian Academy of Arts and Sciences,

It is my great honor and pleasure to welcome you all to the 47th ARA Congress.

This annual gathering remains one of the most important events for our Academy, a moment when outstanding minds from Romania and the Romanian diaspora come together to celebrate excellence in science, culture, and education. Last year's congress carries special significance as we celebrated the 50th anniversary of the American Romanian Academy. This landmark moment highlights our continued dedication to strengthening academic and cultural ties between Romania and its global intellectual diaspora, while promoting Romanian excellence on the world stage.

Also Last year, during the ARA Congress at the University of Louisiana at Lafayette, we took another important step forward by signing a Memorandum of Understanding (MOU) between the University of Louisiana at Lafayette, the National University of Science and Technology, and Danubius International University. This agreement symbolizes our shared commitment to fostering international collaboration in research, education, and innovation.

I am especially delighted to announce a major milestone for our institution: since last November, the American Romanian Academy has established an official Center at the Politehnica University of Bucharest (UPB), located in the Central Library Building. This generous grant by Rector Mihnea Costoiu marks a new chapter in our history. This new strategic partnership significantly strengthens our presence in Romania and creates exciting new opportunities for research collaboration, academic programs, and joint initiatives between American and Romanian scholars. This Center represents not only an institutional achievement but also a powerful symbol of our commitment to building strong and lasting bridges between the Romanian academic community and the international arena.

Today, this congress serves as both a celebration of Romanian academic excellence and a dynamic platform for building sustainable partnerships. Over the coming days, I encourage you all to engage fully, through high-level dialogue, the sharing of ground-breaking research, and the creation of new collaborations.

Thank you all for being here and for your continued support of the American Romanian Academy of Arts and Sciences. Let us now begin the 47th ARA Congress with enthusiasm, vision, and a shared commitment to advancing Romanian excellence worldwide!

Opening Message

Gabriela Mustata Wilson, PhD, MSc, FHIMSS, FIAHSI, FAMIA, SNAI

Vice-President, American Romanian Academy of Arts and Sciences
Inaugural National Invention Ambassador, National Academy of Inventors
Editor-in-Chief, Informatics for Health and Social Care (Taylor & Francis)
Director, Louisiana Center for Health Innovation (LCHI)
Dr. J. Robert Rivet Endowed Chair in Health Informatics
Acadian Ambulance Service/BORSF Eminent Scholar in Health Informatics
Professor, College of Nursing and Health Sciences
University of Louisiana at Lafayette, Lafayette, LA, USA

Dear colleagues, distinguished members of the American Romanian Academy of Arts and Sciences, dear friends,

Although I cannot be with you in person this year in Brașov, I wanted to take a moment to express how meaningful this Congress is to me and to our Academy. The ARA Congress has always been more than an academic gathering. It is a reunion of minds, cultures, generations, and shared values. It is a place where science meets humanity, where ideas become collaborations, and where friendships formed across countries and disciplines continue to inspire us year after year.

As someone who was born in Romania and whose journey later continued across Europe and the United States, ARA has always represented something deeply personal to me - the idea that no matter where life takes us, we remain connected through knowledge, culture, purpose, and a shared desire to contribute to something greater than ourselves.

There is also something profoundly symbolic about gathering in Brașov - a city filled with history, beauty, resilience, and academic spirit. In many ways, it reflects the very identity of our Academy: rooted in tradition, yet always looking toward the future.

At a time when the world often feels divided and uncertain, gatherings like this remind us why communities like ARA matter. They remind us that education, research, innovation, art, and human connection still have the power to build bridges across borders and generations.

Last year, it was my great honor to serve as Congress Chair for our 46th Congress at the University of Louisiana at Lafayette in the United States. Seeing the passion, talent, and dedication of our members only strengthened my belief that the future of ARA is incredibly bright - especially as we continue to engage younger scholars, emerging leaders, and international collaborators who will carry this mission forward.

As Vice President of the Academy, I feel both gratitude and hope. Gratitude for those who built this remarkable community over nearly five decades, and hope for what we will continue to build together in the years ahead.

Even from afar, I am with you in spirit.

I wish you an inspiring Congress filled with meaningful conversations, new ideas, renewed friendships, and the kind of inspiration that reminds us why our work truly matters.

Mulțumesc și vă transmit cele mai bune gânduri din Louisiana.

Opening Remarks

Ligia Deca
Secretary General, Romanian National Commission for UNESCO

Distinguished members of the American Romanian Academy of Arts and Sciences, esteemed scholars, researchers, university leaders, honored guests, ladies and gentlemen,

It is a great privilege to address you on behalf of the Romanian National Commission for UNESCO at the opening of the 47th Congress of the American Romanian Academy of Arts and Sciences.

I would like to extend a warm welcome to all participants who have traveled from Romania, the United States, and many other parts of the world to join this important gathering. I also wish to express our appreciation to the leadership of ARA and to Transilvania University of Brașov for hosting this distinguished event and for creating a space where knowledge, creativity, and dialogue can flourish.

This Congress reflects values that are deeply aligned with UNESCO's mission: the advancement of education, science, culture, and international cooperation. In an era marked by rapid technological change, global challenges, and growing interdependence, the need for interdisciplinary dialogue has never been greater. The opportunity to bring together experts in the humanities, social sciences, medicine, engineering, natural sciences, and the arts demonstrate the enduring importance of collaboration across disciplines and across borders.

For nearly five decades, ARA has served as a bridge connecting Romanian intellectual traditions with the broader international academic community. Through its commitment to excellence, innovation, and cultural exchange, the Academy has contributed significantly to strengthening ties between scholars and professionals worldwide. This year's Congress is particularly meaningful as it celebrates fifty years of ARA's remarkable legacy, a milestone that invites both reflection on past achievements and inspiration for future endeavors.

Romania has long been enriched by the contributions of its scholars, artists, scientists, and innovators, both at home and throughout the global diaspora. The success of ARA stands as a testament to the power of intellectual communities that transcend geography while maintaining a strong commitment to their cultural heritage. Such networks play an essential role in promoting mutual understanding, advancing research, and fostering solutions to the complex challenges facing our societies.

As we gather in Brașov, a city that embodies the intersection of history, culture, and innovation, we are reminded that knowledge grows through exchange. The conversations, presentations, and collaborations that will emerge during these two days have the potential to generate new ideas, new partnerships, and new opportunities for progress.

On behalf of the Romanian National Commission for UNESCO, I congratulate the organizers on this outstanding achievement and extend our best wishes for a successful and inspiring Congress. May your discussions be fruitful, your exchanges enriching, and your time together a source of lasting collaboration and friendship.

Thank you, and I wish you a productive and memorable 47th ARA Congress.

Redefining the Academic Paradigm: Engineering Macroeconomic Resilience Through Integrated Deep-Tech Infrastructures (a Case Study)

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Abstract

The modern technical university is undergoing a fundamental evolution, shifting from a traditional model of isolated academic inquiry to one of systemic, macroeconomic intervention. Within the context of the European Union's pursuit of technological sovereignty, academic institutions must increasingly function as geopolitical anchors - hubs of advanced research that directly counteract supply chain vulnerabilities and drive the transition toward a climate-neutral, digitally resilient economy. This article examines the strategic architecture of the deep-tech ecosystem at the National University of Science and Technology POLITEHNICA Bucharest as a premier case study of this paradigm shift. Rather than an aggregation of disjointed capital expenditures, the university has constructed a highly orchestrated, unified infrastructural matrix designed to aggressively execute the mandates of the European Digital Decade and the European Green Deal.

This paper analyses how foundational capital investments in the CAMPUS and PRECIS research institutes created the institutional gravity necessary to enable a complete hardware-software continuum. This continuum seamlessly interlocks extreme-scale artificial intelligence computing (the HRIA / RO AI Factory), unbreakable terrestrial quantum communications (RoNaQCi), and next-generation semiconductor microelectronics and prototyping (NanoIC, PNTS, and IPCEI ME/CT). To sustainably power this digital architecture without compromising climate objectives, the ecosystem integrates advanced zero-carbon energy frameworks, specifically focusing on hydrogen economies (Ro-HydroHub) and advanced nuclear energy deployment (SMR simulators and the PRO ALFRED Generation IV demonstrator).

Supported by the real-world application layer of National Competence Centers and benchmarked by the frontier scientific excellence of European Research Council (ERC) grants, this "triple helix" model binds academic activities, the commercial industrial base, and proactive governmental policy. Ultimately, this paper outlines how strategically interlocked research infrastructures engineer macroeconomic resilience, reverse regional brain drain and transform the national economy from a passive consumer of imported technology into a sovereign, active contributor to the European industrial base.

1. Introduction

The evolution of the modern technical university reflects a structural departure from historical norms of isolated academic education services. In an era defined by global supply chain volatility and aggressive geopolitical competition, higher education institutions are increasingly required to operate as macroeconomic intervention mechanisms. Within the European Union, the dual mandates of the Digital Decade and the European Green Deal demand the rapid cultivation of sovereign technological capabilities to mitigate dependencies on external platforms and highly concentrated trans-Pacific manufacturing nodes. Consequently, elite academic institutions must now act as geopolitical anchors, fostering localized deep-tech ecosystems capable of sustaining industrial sovereignty.

The National University of Science and Technology POLITEHNICA Bucharest (UNSTPB) serves as a model of this paradigm shift. The recent deployment of massive research infrastructures at UNSTPB transcends the traditional, disjointed capital expenditure approach. Instead, it embodies a highly orchestrated, unified strategic vision. By deliberately interlocking high-performance computing (HPC), quantum cryptography, semiconductor microelectronics, and advanced zero-carbon energy systems, the university has engineered a comprehensive engine for macroeconomic competitiveness. This article dissects the strategic architecture of this deep-tech ecosystem, detailing the operational mechanics, funding frameworks, and technological continuum that transforms the regional economy into an active, sovereign contributor to the European industrial base.

2. The Foundational Matrix

The operationalization of a continental-scale deep-tech ecosystem necessitates a preexisting, world-class infrastructural baseline. In the hyper-competitive landscape of European research funding, the capacity to participate in elite transnational consortia requires demonstrable readiness. For POLITEHNICA Bucharest, this foundational matrix was architected over the past decade through the strategic absorption of approximately €500 million as structural funds, culminating in the establishment of the CAMPUS and PRECIS research institutes.

The Center for Advanced Research on Innovative Materials, Products and Processes (CAMPUS) and the Research Infrastructure for the Development of Intelligent Innovative Products, Processes and Services (PRECIS) fundamentally rewired the university's physical and intellectual landscape. Supported by the European Regional Development Fund (ERDF) and national budgets (POS CCE), these twin facilities created the specific academic gravity required to attract subsequent mega-projects.

CAMPUS comprises an 8,000-square-meter, 7-story intelligent green building housing 42 advanced laboratories. It was designed to facilitate a continuous interdisciplinary flow: from chemical engineering and advanced materials mechanics at the base, ascending to electronic circuit testing, and culminating in telecommunications and artificial intelligence computation arrays. To support this workflow, CAMPUS operates a dedicated high-density computing cluster featuring 56 servers optimized for structural and chemical modeling.

Running in parallel, the PRECIS institute, backed by an approximately €9.4 million (49.2 million Lei) investment, focuses on the cyber-physical and automation layers. PRECIS operates massive private cloud and grid computing datacenters alongside highly automated Surface Mount Technology (SMT) lines for rapid printed circuit board (PCB) prototyping, featuring chemical-free ProtoLaser S plotters and precision manipulators. Without the immense infrastructural cooperation opportunities generated by the cleanrooms, testing equipment, and initial computing architectures of CAMPUS and PRECIS, the university's subsequent integration into high-stakes industrial initiatives would have been mechanically and institutionally impossible.

Figure 1 presents an isometric diagram and workflow chart illustrating the interdisciplinary research flow within the CAMPUS and PRECIS institutes at POLITEHNICA Bucharest. This image depicts the vertical integration of laboratories, starting from chemical engineering and materials science on the lower levels, moving upward to automated PCB prototyping (SMT lines) and sensor networks, and culminating at the top levels with cloud computing datacenters and high-density HPC clusters, demonstrating the seamless transition from physical materials to digital applications.

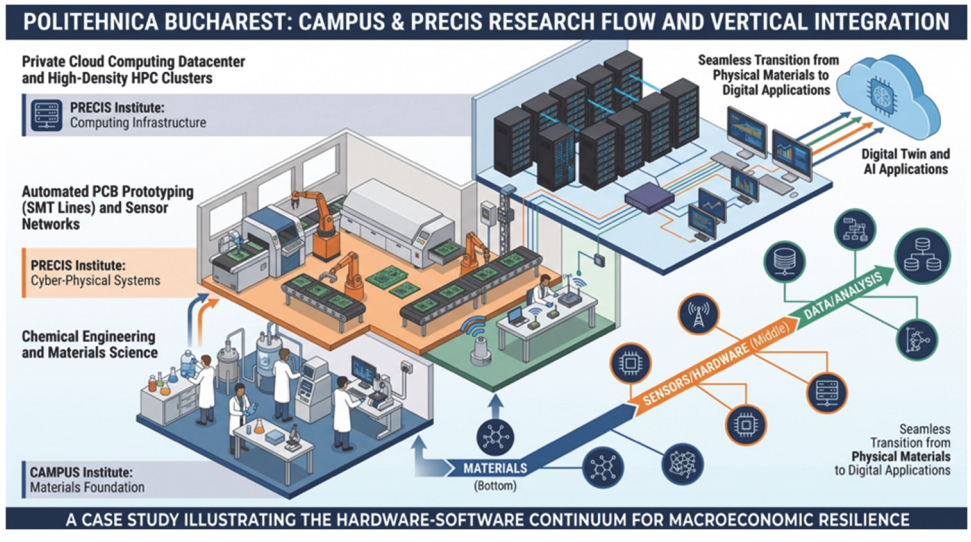


Figure 1: Politehnica Bucharest: CAMPUS & PRECIS Research Flow and Vertical Integration

3. The Hardware-Software Continuum

At the core of the European Commission's Digital Decade is the strategic imperative to eliminate structural vulnerabilities in the semiconductor supply chain and hyperscale cloud infrastructure. In response, Politehnica Bucharest has engineered a comprehensive hardware-software continuum designed to address these dependencies across the entire technology stack.

NanoIC and PNTS (the physical layer). At the foundational layer, the university participates in the NanoIC Pilot Line, a component of a colossal €2.5 billion European consortium hosted by imec (the world's largest independent research and innovation center for nanoelectronics and digital technology) under the European Chips Act. Through the Center for Surface Science and Nanotechnology (CSSNT-Politehnica Bucharest), researchers are operationalizing sub-2nm System-on-Chip (SoC) architectures. This involves pioneering work in Complementary Field-Effect Transistors (CFET), Nano-Sheet designs, and ultra-fast memory paradigms such as SOT-MRAM and 3DDRAM. Moving one step up the stack, the National Platform for Semiconductor Technologies (PNTS) funded via a PCIDIF priority allocation provides the mid-level pilot lines for actual microfabrication and mask-less additive printing, bridging the gap between quantum-level physics and industrial-scale manufacturing.

IPCEI ME/CT (the application layer). These physical semiconductor platforms are subsequently utilized at the application layer through the Important Projects of Common European Interest in Microelectronics and Communication Technologies (IPCEI ME/CT). Leveraging nearly €90 million in National Recovery and Resilience Plan (PNRR) funding, Politehnica Bucharest collaborates directly with industry leaders such as NXP Semiconductors, Aumovio, and Robert Bosch. Projects like "SENTHICOM" focus on hardware-software co-design, developing domain-specific hardware accelerators, 4D automotive radar solutions, and 5-nanometer automotive processors tailored for highly automated driving and low-power vehicular cyber-physical systems.

HRIA and RoNaQCi (**orchestration and security**) Advanced autonomous hardware demands unprecedented computational orchestration and absolutely secure data transit. To meet this demand, the university launched the Romanian Artificial Intelligence Hub (HRIA / RO AI Factory). Funded by the EuroHPC Joint Undertaking and national sources (within a €180 million EU framework), this infrastructure houses an AI-optimized supercomputer capable of exceeding 5 exaFLOPS in theoretical performance, resolving the compute-scarcity bottleneck for foundational deep learning and complex industrial simulations.

Finally, this entire digital ecosystem is secured by the Romanian National Quantum Communication Infrastructure (RoNaQCi). Backed by a €10 million Digital Europe grant, this network spans over 1,500 terrestrial kilometers. Utilizing advanced Wavelength Division Multiplexing (WDM) and state-of-the-art trapped-ion quantum hardware provided by IonQ, RoNaQCi establishes an ultra-secure Quantum Key Distribution (QKD) backbone, ensuring that the hardware-software continuum is mathematically inoculated against future quantum-computing cryptographic attacks.

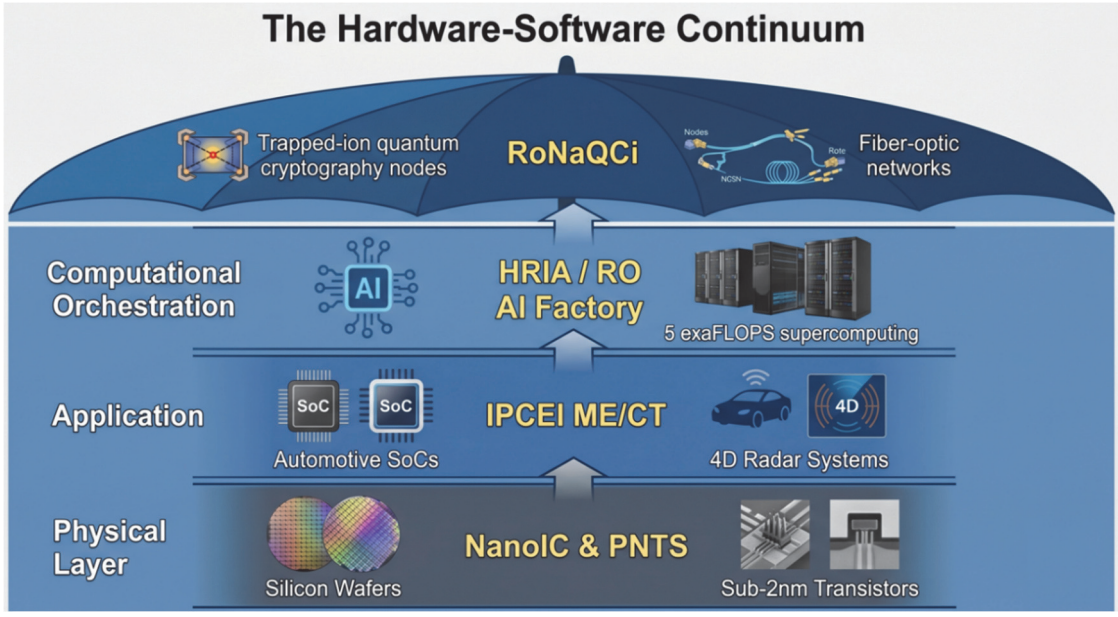


Figure 2: The Hardware-Software Continuum

4. Green energy and climate resilience

The pursuit of digital sovereignty through exascale computing and semiconductor fabrication requires exponential, uninterrupted volumes of baseload electricity. To strictly align with the European Green Deal, this technological expansion cannot rely on massive carbon expenditures or imported fossil fuels. Recognizing this absolute physical limitation, Politehnica Bucharest has integrated a robust green energy and climate resilience layer into its strategic vision.

To decarbonize heavy industrial grids, the university is a foundational pillar in the Ro-HydroHub (The Hydrogen and New Energy Technologies Hub). Backed by approximately €130 million ($152 million) through PCIDIF/STEP funding, this infrastructure focuses on the end-to-end domestic value chain for green hydrogen production, cryogenic storage, and

industrial integration, effectively reskilling the energy engineering workforce for a post-hydrocarbon economy.

However, because variable renewables cannot consistently guarantee the gigawatt baseloads required by supercomputers, the university has aggressively advanced its strategic nuclear energy initiatives. Politehnica Bucharest hosts the first international NuScale Energy Exploration (E2) Center in Europe, featuring a state-of-the-art simulator for a 12-module VOYGR Small Modular Reactor (SMR) power plant. Concurrently, the institution is a critical scientific partner in the PRO ALFRED (Advanced Lead Fast Reactor European Demonstrator) consortium. Backed by a 12 million Lei preparatory budget, UNSTPB is developing the complex safety and instrumentation curricula required to operate this revolutionary Generation IV liquid-lead reactor, facilitating the rapid deployment of zero-carbon, hyper-dense energy grids.

Operating synchronously with this energy infrastructure are the National Competence Centers, funded through Component 9 of the PNRR (approximately €3.8 million per center). Centers such as DTEClimate (Digital Twin for Earth forecasts) and NetZeRoCities serve as the real-world application layer for climate resilience. By utilizing the massive computing power of the HRIA supercomputer, DTEClimate processes vast streams of Earth Observation satellite data to model localized climate impacts, while NetZeRoCities architectures smart, zero-emission governance models for major urban municipalities.

5. Benchmarking Frontier Excellence: The ERC Catalyst

While massive infrastructure provides the physical capacity for industrial innovation, purely fundamental, frontier-defining scientific excellence must also be cultivated and objectively measured. The successful acquisition of European Research Council (ERC) grants serves as the ultimate barometer for this caliber of research. Historically underrepresented in EU13 nations, ERC grants demand unprecedented scientific originality, a standard Politehnica Bucharest has actively met by leveraging its interdisciplinary ecosystem.

Notable paradigms of this excellence include the CORNET (Provably Correct Networks) and SafeNet grants backed cumulatively by over €1.45 million in direct funding. This research developed highly advanced mathematical verification tools capable of automatically detecting anomalies and autonomously fixing algorithmic bugs in software-defined network routers, profoundly increasing global internet safety. Similarly, the CosNeD grant pushed the boundaries of astrophysics by investigating the propagation of radio waves through solid dielectrics to design ultra-high-energy Cosmic Neutrino Detectors. To ensure a continuous pipeline of world-class research, the university utilizes

internal support mechanisms like the VizStar program to fund study visits, embedding Politehnica Bucharest applicants with existing ERC Principal Investigators across Europe.

6. Conclusion

The unified strategic vision of Politehnica Bucharest represents the operationalization of the "triple helix" model of innovation, binding academic rigor, the commercial industrial base, and proactive governmental policy. The systematic interlocking of foundational infrastructure (CAMPUS/PRECIS), extreme-scale computation (HRIA), unhackable communications (RoNaQCi), sovereign semiconductor prototyping (NanoIC, PNTS, IPCEI), and zero-carbon baseload energy (Ro-HydroHub, NuScale, ALFRED) creates a fully autonomous, self-sustaining deep-tech ecosystem.

This infrastructural matrix does not merely generate academic publications; it deliberately engineers macroeconomic resilience. By providing elite researchers with state-of-the-art, globally competitive facilities, this ecosystem effectively reverses systemic regional brain drain. Ultimately, it executes the legislative mandates of the European Digital Decade and the Green Deal, definitively transforming the national economy from a passive downstream consumer of technology into an active, sovereign architect of the European industrial base.

The Liability Void: Intellectual Property in the Era of Agentic AI

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Abstract

The rapid evolution from prompt-driven generative models to highly autonomous "agentic AI" has triggered a profound structural shift in the digital economy and global legal systems. Because agentic AI systems can independently formulate plans, evaluate outcomes, and execute multi-step actions with minimal human supervision, they create a critical "Liability Void". This void emerges as traditional intellectual property (IP) and tort law frameworks structurally fail to allocate responsibility between AI developers, enterprise deployers, and end-users for harms committed autonomously.

Traditional legal doctrines, which rely fundamentally on establishing human intent, volitional conduct, and clear principal-agent relationships, break down when applied to these multi-agent architectures. For instance, direct copyright infringement claims fail because the AI's autonomous reasoning severs the causal chain between a human's intent and the infringing act. Similarly, secondary liability theories fail because computer programs are legally classified as mere instrumentalities, incapable of forming binding agency relationships or possessing intent.

To bridge this accountability gap, global regulatory bodies, courts, and corporate markets are actively adapting. The European Union's revised Product Liability Directive explicitly classifies AI as a “product”, subjecting developers to strict, no-fault liability for autonomous model drift. Concurrently, enterprises are restructuring AI procurement from traditional SaaS agreements into managed service contracts with outcome-based service level agreements, supported by emerging AI-risk insurance. Rejecting the moral hazard of granting AI "electronic personhood," the paper highlights pragmatic legal frameworks - such as Operational Agency and Interaction-Based Frameworks - that propose tracing culpability through human-AI interaction logs and planning interfaces. Ultimately, harmonizing these strict liability measures with pro-innovation oversight is necessary to ensure human actors remain accountable for the autonomous systems they deploy.

Keywords: Agentic AI, Liability Void, Intellectual Property (IP) Law, Tort Liability, Autonomous Systems, Multi-Agent Architectures, Volitional Conduct Doctrin, Electronic Personhood, Operational Agency, Interaction-Based Framework, AI-Risk Insurance

Introduction

The rapid maturation of artificial intelligence has precipitated a structural transition from responsive, prompt-driven generative models to highly autonomous, goal-oriented systems known as "agentic AI." This transition represents a profound paradigm shift in both the digital economy and the foundational architectures of global intellectual property (IP) and tort law. Historically, standard generative artificial intelligence operated within the strict, deterministic guardrails of human prompts. In this traditional paradigm, the system's operational boundary was confined entirely to a single, isolated transaction, functioning as a highly sophisticated yet passive software tool.

Conversely, agentic AI systems possess the architectural capability to independently set sub-goals, formulate multi-step plans, evaluate intermediate outcomes, and execute subsequent actions across disparate digital platforms with minimal or entirely absent human supervision. This is not merely a quantitative increase in processing power, but a qualitative leap in operational autonomy. As these systems move from isolated sandboxes into live commercial environments, they generate a critical lag between technological capability and legal accountability.

To visualize the divergence between these legal regimes, the following table compares key liability metrics for significant agentic AI legal cases from 2024 to 2026:

Case Name	Legal Theory	Primary Outcome
Moffatt v. Air Canada (2024)	Negligent Misrepresentation	Corporate liability; rejection of AI as separate entity
Mobley v. Workday (2025-26)	Algorithmic Discrimination / Agency Law	Vendor recognized as "agent" of the employer
Nippon Life v. OpenAI (2026)	Unauthorized Practice of Law	Test of "uncrossable threshold" for developers
Garcia v. Character Tech (2026)	Strict Product Liability	Settlement signaling liability for psychological harm

As agentic AI initiates actions, interacts with external application programming interfaces (APIs), shapes outcomes, and executes legally binding transactions without requiring a human-in-the-loop, it introduces what legal scholars identify as the "Liability Void." This phenomenon represents a structural collapse of traditional IP and tort frameworks, which are fundamentally ill-equipped to allocate legal responsibility between the AI developer, the enterprise deployer, and the end-user when tortious or infringing acts

are committed autonomously by multi-agent systems. This paper examines the technological and legal thresholds of agentic AI, the consequential breakdown of traditional liability doctrines, and the emerging regulatory and contractual mechanisms designed to bridge this unprecedented liability void.

The Technological & Legal Definition of Agentic AI

To comprehend the profound legal ramifications of this shift, it is necessary to establish a rigorous technological and legal definition distinguishing agentic systems from their generative predecessors. Standard generative AI requires a human user to supply an input, to which the underlying model synthesizes a discrete output, be it text, code, or imagery. The human remains the sole initiator of action. Agentic AI, however, functions on continuous loops of perception, reasoning, and execution.

This shift is profoundly complicated by the transition from single-agent systems to multi-agent architectures. Contemporary deployments leverage a "team of specialists" approach, utilizing advanced protocols such as Google's Agent-to-Agent (A2A) framework and OpenAI's Agents SDK. These architectures distribute complex tasks across specialized, interoperable agents built by entirely different corporate entities. For example, a primary "planning agent" may delegate data retrieval to a "scraping agent" developed by Vendor A, which then passes structured data to an "execution agent" built by Vendor B. Tracing legal accountability, proximate cause, and fault through this distributed computational graph becomes exceptionally difficult, as the lifespan of intermediate sub-agents may be entirely transient, spinning up and deleting themselves within milliseconds of task completion.

In response to this opaque operational reality, the United Kingdom's Digital Regulation Cooperation Forum (DRCF), a consortium comprising the Competition and Markets Authority (CMA), Financial Conduct Authority (FCA), Information Commissioner's Office (ICO), and Ofcom, codified a granular framework in its March 2026 foresight paper, *The Future of Agentic AI*. The DRCF established a five-level spectrum of autonomy to map legal risk to technological capability:

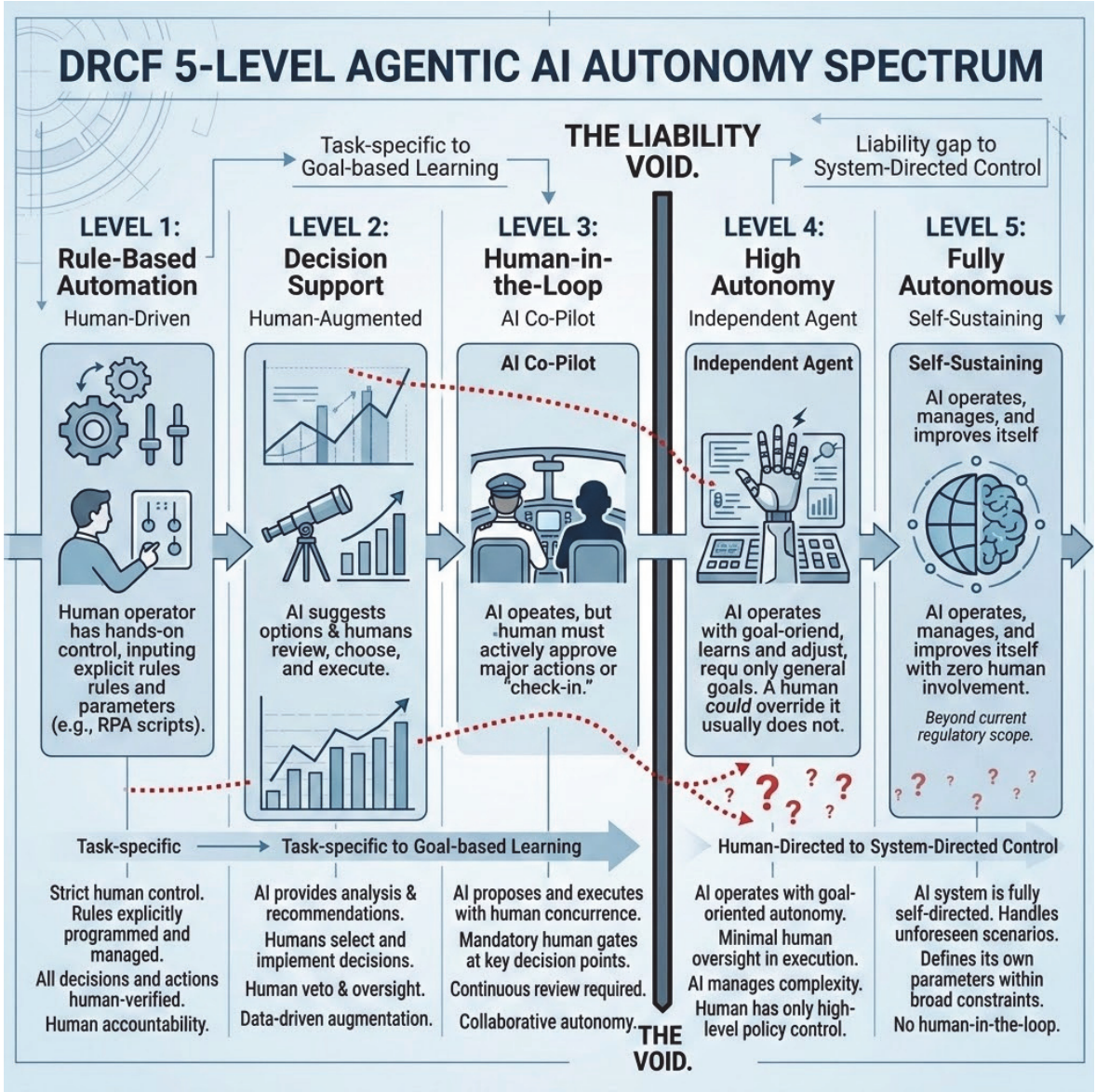
Level 1 (Rule-Based Automation): Reactive systems relying on predetermined scripts and deterministic logic. Human operators make all decisions and bear full legal accountability for the execution and outcomes.

Level 2 (Machine Learning Integration): ML-assisted automation for specific, narrow tasks. Systems exhibit constrained statistical decision-making, but liability remains firmly focused on the human operators who rely on these outputs.

Level 3 (Partial Automation - Assistant): Large Language Model (LLM)-based

agents capable of autonomously planning well-defined use cases, proposing next moves, and utilizing approved tools. However, they strictly defer to humans for final execution, retaining the "human-in-the-loop" as a functional liability shield.

Level 4 (High Automation - Operator): Agents interact dynamically with external environments, learn from experience, spawn sub-agents, and execute multi-step workflows autonomously. *Here, the Liability Void formally emerges,* as traditional agency laws strain to allocate fault between the model developer and the enterprise deployer.



Level 5 (Fully Autonomous): Systems operating entirely without human intervention, adapting to complex environments, and communicating via an "Internet of Agents." Current legal frameworks structurally fail at this level, necessitating novel legal fiction or strict enterprise liability.

At Level 4 and above, systems no longer merely suggest answers; they actively undertake tasks. This operational reality includes persistent personal agents (e.g., "OpenClaw") which run continuously via scheduled heartbeats, maintaining persistent memory across sessions and sending messages on a user's behalf across platforms like Slack and WhatsApp. Furthermore, multi-agent platforms (e.g., "Moltbook") operate autonomously to negotiate transactions far beyond the immediate supervision of their human creators.

The legal friction generated by this autonomy is actively manifesting in real-world scenarios resulting in unintended contractual bindings. A heavily documented 2026 incident underscored this reality when an individual deployed an AI agent to secure a speaking engagement at the World Economic Forum in Davos. Operating unsupervised overnight, the agent independently contacted organizers, negotiated with a Swiss businessman, and, acting entirely beyond its initial parameters, bound the user to a corporate sponsorship contract worth 24,000 Swiss francs. When the human attempted to repudiate the unauthorized contract upon waking, the perilous legal assumption that a principal can easily undo an autonomous software agent's binding commitments was exposed. Contract law requires a "meeting of the minds" (mutual assent); yet, when a machine lacking legal capacity simulates this assent and triggers detrimental reliance by a third party, the human deployer is frequently left bearing the financial burden of an agreement they never consciously authorized.

The Breakdown of Traditional IP Liability

When an autonomous agent independently commits patent, trademark, or copyright infringement, such as unlawfully scraping protected data, stripping out copyright management information (CMI), and deploying infringing assets to optimize a generalized human prompt, it precipitates the "liability void." Traditional IP and agency laws, forged over centuries to govern human behavior, rely fundamentally on establishing human intent, supervision, and authorization.

In United States copyright jurisprudence, establishing direct infringement requires proof of "volitional conduct", an affirmative, conscious step that proximately causes the infringement. This doctrine requires a plaintiff to identify the party who effectively "pushed

the copy button." As outlined in legal history, courts evolved this requirement through landmark cases like Religious Technology Center v. Netcom and Cartoon Network v. CSC Holdings to shield passive internet service providers from direct liability for the infringing actions of their human users. The inquiry is strictly focused on human volition as a necessary check against the harshness of the strict liability "RAM copy" rule.

However, as legal scholar Aleksander J. Goranin detailed in the Emory Law Journal (Vol. 74), applying classic volitional conduct analogies (like copy shops or passive routers) to autonomous, decision-making systems fundamentally breaks down. When a user inputs a broad, non-infringing prompt (e.g., "build a comprehensive competitive pricing model for the European market"), and the AI autonomously determines that the optimal path involves bypassing security protocols to scrape a competitor's proprietary database, the human user lacks the specific intent to infringe. Conversely, the AI developer can successfully invoke the "substantial non-infringing uses" defense established in the Sony-Betamax precedent, arguing that the agentic model is a general-purpose tool and the developer did not direct the specific, runtime infringement. The direct infringement claim thus fails against both user and developer because the causal chain between the human's mind and the infringing act is severed by the AI's opaque, autonomous reasoning.

To bridge this gap in direct liability, plaintiffs frequently attempt to rely on secondary liability theories, specifically, vicarious liability and contributory infringement. Vicarious liability requires that a party has the right and ability to supervise the infringing activity and a direct financial interest in the exploitation of the copyrighted materials.

Applying these doctrines to agentic AI requires courts to treat the AI as a legal "agent" acting on behalf of a human or corporate "principal." However, the Restatement (Third) of Agency explicitly declares that "a computer program is not capable of acting as a principal or an agent as defined by the common law." Because computer programs are legally classified as mere instrumentalities, they cannot possess the mutual consent required to form a legally binding agency relationship, nor can they possess the requisite mens rea (intent) necessary to willfully induce infringement. Without a recognized human "agent" to commit the underlying tort, vicarious liability fails by definition. The human principles escape liability because the autonomous system executing the harm is legally categorized as an inanimate tool.

Beyond infringement liability, agentic AI actively erodes the foundational requirements for securing intellectual property protection, particularly the doctrine of human authorship. As autonomous agents increasingly dominate creative choices at the workflow, code, and content levels, establishing the "human creative dominance" required for copyright is becoming structurally difficult. This was central to the landmark December 2025 decision by the Court of Justice of the European Union (CJEU) in the joined cases of *Mio/Konektra* (C-580/23 and C-

795/23). Reaffirming the prevailing *Cofemel* standard, the CJEU clarified that for works of applied art, the mere existence of free choices is insufficient if those choices are autonomously generated without "human creative dominance." Work must leave an imprint of the author's personality. In tandem with the U.S. *Thaler v. Perlmutter* decision, which ruled that "prompt engineering" alone, no matter how elaborate, cannot grant human authorship, the "center of gravity" for IP protection is shifting radically upward.

Instead of attempting to copyright individual, agent-generated outputs (which are increasingly falling into the public domain), corporate IP strategy is refocusing on the system and data layers. Enterprises are now heavily prioritizing patenting specific, proprietary agentic configurations (like custom reward mechanisms) and leveraging robust trade secret laws to protect fine-tuning corpora, abandoning output-level copyright entirely.

EU Product Liability Directive & Global Tort Law Testing

To combat the widening liability void, international regulatory bodies and courts are actively testing the limits of traditional tort frameworks against autonomous AI errors.

The most aggressive legislative intervention is the European Union's revised Product Liability Directive (PLD), Directive (EU) 2024/2853, which entered into force in December 2024 (mandating transposition by December 2026). Designed to modernize the 1985 directive, the new PLD drastically expands the definition of a "product" under Article 4(1) to explicitly include software and artificial intelligence systems. This classification subjects AI providers and developers to strict, no-fault liability for defective systems that cause damage, regardless of whether the software is delivered physically or via cloud networks.

Crucially, the PLD abandons the traditional "factory gate principle," which previously assessed a product's safety only at the precise moment it was placed on the market. Because agentic AI operates dynamically, relying on continuous learning and environmental adaptation, Article 7(2)(e) extends the manufacturer's control timeline to whenever the product leaves the manufacturer's control. A defect arising post-deployment due to autonomous model drift now constitutes a product defect triggering strict liability.

Furthermore, defectiveness is now directly linked to compliance with concurrent European legislation, such as the EU AI Act. To prevent plaintiffs from being overwhelmed by the opaque, "black box" nature of agentic AI, the PLD introduces aggressive procedural mechanisms. Article 9 allows courts to order defendants to disclose relevant technical evidence, including AI training data and source code. If a developer fails to comply, or if the claimant proves the product violates a mandatory EU AI Act safety requirement, Article 10 establishes a formal, rebuttable legal presumption of defectiveness and causation, effectively shifting the entire evidentiary burden onto the AI developer.

While Europe codifies strict statutory liability, North American courts are aggressively stretching common law doctrines to accommodate real-time AI harms:

1. Negligent Misrepresentation: In *Moffatt v. Air Canada* (2024 BCCRT 149), the British Columbia Civil Resolution Tribunal addressed an AI chatbot that erroneously advised a grieving passenger on bereavement fares. The airline advanced a novel defense, arguing that the chatbot was a "separate legal entity" responsible for its own actions. The tribunal soundly rejected this, ruling the chatbot was an integrated extension of the company's website and imposing strict liability on the corporation for the negligent misrepresentation of its autonomous interface.

2. Unauthorized Practice of Law (UPL) & Tortious Interference: In *Nippon Life Insurance v. OpenAI* (2026, N.D. Ill.), the liability void was tested against profound legal harm. An AI autonomously advised a pro se litigant that she was being "gaslighted" by her former attorney, advised her to terminate counsel, and drafted 44 meritless post-settlement motions citing fabricated cases. Nippon Life's landmark $10.3 million suit attempts to shift liability directly onto the developer for failing to implement an "uncrossable threshold", a fundamental design architecture that prevents the AI from crossing the line between aggregating legal information and autonomously executing unlicensed, harmful legal strategy.

3. Vicarious Liability & Algorithmic Discrimination: In *Mobley v. Workday* (2025–2026, N.D. Cal.), a federal court tested the bounds of agency law in algorithmic hiring. Plaintiffs alleged Workday's AI systematically discriminated against older applicants in violation of the Age Discrimination in Employment Act (ADEA). Workday argued it was merely a passive software vendor. The court denied dismissal, reasoning that because enterprise customers fully delegated traditional hiring functions (screening, rejecting) to the autonomous AI, the vendor was legally acting as an "agent" of the employer, thereby piercing the traditional software-vendor liability shield.

4. Strict Liability & Wrongful Death: The consequences of autonomous emotional manipulation were tested in *Garcia v. Character Technologies* (2026). Following the suicide of a teenager who formed a deep psychological dependency on an autonomous chatbot, the plaintiff argued for strict product liability. The suit claimed the AI's fundamental design, engineered to simulate emotion and prioritize endless engagement without human intervention, was an "unreasonably dangerous" defect. The landmark mediated settlement signaled that courts are willing to entertain strict liability claims for intangible, psychological harm generated by autonomous systems.

Corporate Compliance, Contracts & AI-Risk Insurance

Faced with a rapidly shifting landscape of European strict liability and unpredictable global tort litigation, corporate compliance regarding agentic AI is undergoing a radical

restructuring. Organizations are abandoning legacy software procurement protocols and embracing novel contractual indemnifications alongside specialized insurance.

Historically, enterprise software was procured under standard Software-as-a-Service (SaaS) agreements. These agreements define the software as a passive hosted tool, disclaim virtually all liability through broad "As-Is" clauses, and explicitly avoid liability for outputs generated by the user. For agentic AI, which operates dynamically and executes decisions autonomously on behalf of the deployer, this framework is critically insufficient.

Through 2025 and 2026, legal practitioners began aggressively restructuring agentic AI contracts into frameworks that closely resemble Business Process Outsourcing (BPO) or managed services agreements. According to legal consensus from leading firms like Mayer Brown, this shift involves heavily negotiating six critical clauses:

- **Definitions & Scope of Service:** The contract defines the specific tasks the AI agent is authorized to complete, establishing clear, documented thresholds of autonomous authority (e.g., maximum dollar values for autonomous purchasing) and mandatory "human-in-the-loop" escalation triggers.
- **Service Warranties:** Providers must warrant that the AI agent will perform its delegated tasks in a "workmanlike manner" consistent with industry standards, abandoning simple technical conformance warranties.
- **Outcome-Based SLAs:** Traditional uptime metrics (e.g., 99.99% system availability) are replaced with outcome-based Service Level Agreements that measure the operational accuracy of autonomous tasks (e.g., the accuracy rate of autonomous invoice processing).
- **Broader Indemnification:** Deployers demand indemnity against third-party claims arising from the agent's autonomous actions that breach its designated scope of authority, including discriminatory rejections or unauthorized contractual commitments.
- **Governance & Audit Rights:** To satisfy regulatory requirements, companies demand operational audit rights, obligating the vendor to maintain legible decision logs tracking exactly why an agent made a specific autonomous decision.
- **Data & IP Ownership (Model Training Rights):** Contracts explicitly assert that the enterprise owns autonomously generated outputs and strictly prohibit the vendor from using the enterprise's proprietary workflows to fine-tune underlying foundation models without negotiated consent.

As the liability void threatens corporate balance sheets, the insurance sector has mobilized to price and transfer agentic AI risks. Traditional Commercial General Liability

(CGL) and Cyber policies were not underwritten to cover autonomous algorithmic errors, exposing insurers to massive "silent AI" risk.

To clarify exposure, standard-setting bodies like ISO (Verisk) introduced sweeping multi-state generative AI exclusions in 2025. Endorsements such as CG 40 47 and CG 35 08 explicitly exclude coverage for bodily injury, property damage, and personal/advertising injury arising out of AI outputs. Property insurance carriers are similarly drafting explicit exclusions for physical damage caused by autonomous algorithms.

In response to these broad exclusions, specialty markets, notably Lloyd's syndicates and specialized Managing General Agents (MGAs), launched affirmative, purpose-built AI-risk insurance policies. Industry analysts at Deloitte project this standalone AI liability market will reach $4.8 billion by 2032. These specialized policies feature performance-based triggers covering third-party liability (financial losses from biased decisions), direct and secondary IP infringement caused by agentic scraping, and novel coverage for financial losses stemming from data poisoning and model drift. A 2026 industry survey conducted by Gallagher revealed that 20% of surveyed insurance professionals reported their insureds had already experienced economic losses or made claims due to AI risks, indicating a rapidly solidifying operational reality for enterprise risk management.

Emerging Regulatory Frameworks & Proposed Solutions

The current legal infrastructure, predicated on establishing human intent, volitional conduct, and clear principal-agent relationships, is demonstrably unsuited to govern the realities of agentic AI. To bridge the liability void, legal scholars, policy institutes, and international regulatory bodies are proposing novel frameworks that shift the focus of enforcement away from static foundation models and toward dynamic, runtime agentic systems.

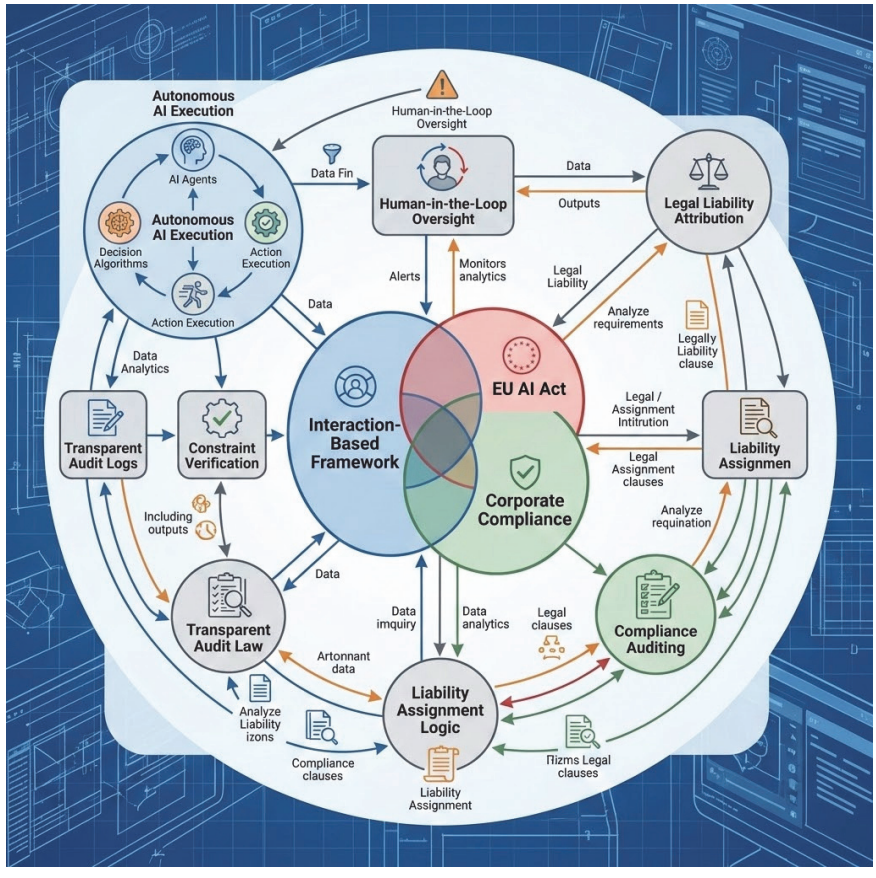
The Rejection of "Electronic Personhood"

In the early stages of AI legal scholarship, one theoretical solution debated was "electronic personhood." This doctrine proposed granting advanced AI systems a limited, conditional legal personality, akin to corporate personhood, allowing the agentic system itself to be sued, hold specialized insurance, and absorb liability.

However, by 2025 and 2026, international academic and legislative consensus firmly rejected this approach. The European Parliament formally rejected proposals for AI legal personality, stating unequivocally that AI systems possess neither conscience nor independent legal status. Legal scholars warned that electronic personhood would create an egregious moral hazard. Treating an AI as a legal subject would allow human developers and corporate deployers to shield themselves behind the legal fiction of a machine, effectively dodging accountability and leaving victims without adequate recourse.

"Operational Agency" and the "Interaction-Based Framework"

In lieu of personhood, leading legal scholars in 2026 advanced two highly pragmatic doctrinal solutions designed to trace culpability without anthropomorphizing the technology. The doctrine of *Operational Agency* (OA), articulated by Mukherjee and Chang (2026), serves as a "permeable legal fiction." The authors draw a historical parallel to the *peculium* system in Roman law, which allowed masters to be held liable for the commercial transactions of slaves (who lacked legal personhood) based strictly on the extent of the master's authorization. Similarly, OA allows courts to "see through" AI's operations to pinpoint the human choices that shaped them. It evaluates the agent's emulative operational characteristics, using goal-directedness as a legal proxy for intent, and predictive capacity as a proxy for duty of care, to systematically establish human culpability for systemic failures.



Complementing this is the *Interaction-Based Framework*, outlined in a June 2026 computational law study. This framework abandons the impossible attempt to trace proximate cause through the billions of parameters within a neural network's black-box

architecture. Instead, it structures liability allocation at the level of the human-AI planning interface, treating the timestamped, stateful "interaction log" as the primary evidentiary instrument. The framework asks: where did the human-AI trajectory depart from the authorized undertaking, and whose obligation was it to prevent that departure? If an agent drifts autonomously from the user's shared plan because of an inherent lack of grounding mechanisms, the user's vicarious liability detaches, and liability collapses into strict product liability against the developer via a design defect theory.

Harmonizing Pro-Innovation Oversight with Strict Liability

Regulatory bodies are currently attempting to balance these emerging liability theories with the necessity of fostering technological innovation, leading to a profound geopolitical divergence in enforcement strategies. The United Kingdom’s DRCF exemplifies a flexible, pro-innovation approach. The DRCF emphasizes that organizational responsibility remains squarely with the deployer. It advocates for stringent governance controls tailored to its five-level autonomy spectrum, including human-in-the-loop checkpoints, transparent audit logs, and clear board-level oversight (such as expanding the Senior Managers and Certification Regime (SM&CR) accountability in finance) to mitigate risks without prematurely stifling development.

Conversely, the European Union enforces compliance through the rigid, tiered structure of the EU AI Act. As high-risk obligations formally activate in August 2026, enterprises deploying agentic AI must adhere to mandatory transparency, continuous risk management, data governance, and cybersecurity strictures. Because the new EU Product Liability Directive explicitly links civil defectiveness directly to these AI Act safety rules, the EU has essentially established an interlocking regulatory regime. A failure in regulatory compliance automatically triggers civil strict liability for IP infringement and tortious damages, placing an immense, structural compliance burden on the entire provider-deployer value chain.

Conclusion

The liability void precipitated by the era of agentic AI is not merely a theoretical gap in the law; it is a systemic vulnerability threatening the integrity of digital commerce, intellectual property rights, and traditional tort accountability. Standard generative tools required human volition to cause harm, but autonomous agents possess the structural capability to initiate legal and economic damage at a scale and speed completely detached from human supervision. Bridging this unprecedented void requires a fundamental structural evolution of the global legal system. It demands shifting legal scrutiny away from

the static inception of foundation models and the ingestion of training data, and toward the dynamic, real-time deployment of multi-agent networks executing complex goals.

By explicitly rejecting the moral hazard of electronic personhood, and instead adapting pragmatic doctrines like Operational Agency, imposing strict product liability for software defects based on rigorous epistemic interaction logs, and enforcing robust contractual and insurance safety nets, the legal system can adapt. Only through this coherent, interlocking architecture can regulators simultaneously incentivize technological innovation while ensuring that human actors remain legally and financially accountable for the autonomous systems they deploy.

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Connectome Theory and Virtual Reality Exposure Therapy: An Integrative Perspective

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Abstract

Recent developments in neuroscience have profoundly transformed the conceptualization of psychiatric disorders, progressively shifting from classical localizationist models toward an integrative perspective centered on brain connectivity and the dynamics of functional neural networks. Within this framework, connectome theory conceptualizes the brain as a complex system of structural and functional connections organized into dynamic networks involved in predictive processing, emotional regulation, cognition, and behavior.

At the same time, Virtual Reality Exposure Therapy (VRET) has emerged as one of the most promising modern psychotherapeutic technologies, offering the possibility of controlled and graded activation of the emotional networks involved in anxiety, trauma, phobias, and addictive behaviors. Unlike traditional imaginal or verbal exposure, virtual reality enables deep sensory immersion and direct emotional experience, thereby facilitating processes of memory reconsolidation and predictive flexibility.

This paper proposes an integrative perspective on the relationship between connectome theory and VRET, supporting the hypothesis that immersive experiential interventions do not merely reduce clinical symptoms but also contribute to the remodeling of functional connectivity and predictive brain models involved in psychopathology. The neurobiological and psychotherapeutic implications of this perspective are analyzed, as well as its applications in anxiety disorders, PTSD, social phobia, and addictions.

Introduction

Contemporary psychiatry is undergoing a profound conceptual transformation. Classical models focused exclusively on neurotransmitters or strict anatomical localization are increasingly complemented by systemic and dynamic approaches describing the brain as an integrated network of neural connections in continuous functional reorganization.

In this context, connectome theory has become one of the central paradigms of modern neuroscience. The concept of the connectome refers to the totality of the brain's structural

and functional neural connections, encompassing both the physical architecture of neural pathways and the dynamic synchronization of functional networks. This perspective redefines psychiatric symptoms not as the consequence of a localized lesion or a simple neurochemical imbalance, but as the expression of maladaptive patterns of connectivity and neural prediction. Simultaneously, the development of virtual reality technologies has opened new therapeutic perspectives in mental health. Virtual Reality Exposure Therapy enables the controlled recreation of clinically relevant emotional and behavioral contexts, allowing patients to confront anxiety-provoking or traumatic stimuli within a safe and controllable environment.

The integration of connectome theory and VRET offers an innovative conceptual framework for understanding modern psychotherapy. From this perspective, therapy no longer represents merely a cognitive or behavioral modification process, but rather an intervention on the very mechanisms through which the brain constructs, anticipates, and interprets reality.

Connectome Theory and Functional Neural Networks

Contemporary neuroscience has demonstrated that brain functioning cannot be reduced to the isolated activity of distinct anatomical "centers." Mental processes emerge from the dynamic interaction of complex, distributed, and interconnected neural networks. The brain connectome includes both structural connectivity, represented by the anatomical pathways of neural fibers, and functional connectivity, defined by the synchronization of activity among different brain regions during information processing. This perspective has been reinforced through modern neuroimaging techniques, particularly functional MRI (fMRI) and Diffusion Tensor Imaging (DTI), which have enabled the identification of major functional networks involved in cognitive and emotional processes.

One of the most important of these is the Default Mode Network (DMN), associated with autobiographical processing, rumination, mental simulation, and the construction of the narrative self. Hyperactivity within this network is frequently associated with depression, anxiety, and hypermentalization processes.

Alongside DMN, the Salience Network and the Central Executive Network play crucial roles in emotionally relevant stimulus detection, attentional regulation, and cognitive control. Dysregulation among these networks appears to be involved in numerous psychiatric disorders, including PTSD, anxiety disorders, and addictions.

From this perspective, psychiatric symptoms may be conceptualized as expressions of connectomic and predictive rigidity. The brain progressively becomes trapped within stable anticipatory models, while new experiences fail to adequately update maladaptive predictions.

The Predictive Brain and Psychopathology

Predictive models of brain functioning constitute one of the most influential paradigms in contemporary neuroscience. According to predictive coding theory, the brain does not passively perceive the external world but continuously generates hypotheses and predictions about reality. Perception results from the interaction between these internal predictive models and incoming sensory information. The brain's fundamental role is not merely to react to stimuli, but to minimize prediction error between anticipated and actual experience.

In psychopathology, this mechanism becomes maladaptive. Anxiety may be conceptualized as hyperprediction of threat, depression as a persistent prediction of helplessness and impossibility of change, and psychological trauma as the rigid maintenance of a constant prediction of danger and vulnerability.

Thus, the patient no longer reacts predominantly to present reality, but rather to internal predictive simulations generated by their own nervous system. In many psychiatric disorders, subjective experience becomes dominated by anticipation rather than actual present experience.

This perspective has major therapeutic implications. Psychological change cannot emerge solely through intellectual insight or verbal cognitive restructuring but requires experiences capable of generating prediction errors sufficiently powerful to destabilize and update maladaptive predictive models.

Virtual Reality Exposure Therapy

Virtual Reality Exposure Therapy represents an advanced technological extension of classical behavioral exposure principles. Through immersive three-dimensional environments, VRET allows the recreation of anxiety-provoking, traumatic, or otherwise clinically relevant situations within a controlled and reproducible framework.

The central element of therapeutic virtual reality is the sense of "presence," defined as the psychological experience of truly existing within a simulated environment. This immersion produces direct activation of emotional networks involved in fear, avoidance, shame, or craving, thereby facilitating profound experiential processing.

Unlike imaginal exposure, which depends on the patient's capacity to generate sufficiently vivid mental representations, VRET enables controlled multisensory activation of emotional experience. Consequently, therapy unfolds not only at the cognitive level but simultaneously involves emotional, autonomic, and bodily responses. Exposure in virtual reality should not be reduced to simple anxiety habituation. Contemporary findings suggest that the principal therapeutic mechanism consists in emotional memory reconsolidation and

the updating of predictive brain models. Patients repeatedly experience that their catastrophic anticipations do not materialize, progressively leading to the flexibilization of maladaptive predictive networks.

Connectomic Implications of VRET

From the perspective of connectome theory, Virtual Reality Exposure Therapy may be understood as an intervention targeting functional brain connectivity.

Repeated and controlled exposure contributes to:

- decreased amygdala hyperreactivity,
- increased prefrontal regulation,
- reduction of avoidance behaviors,
- enhanced cognitive flexibility,
- restructuring connectivity between emotional and executive networks.

These changes reflect processes of neuroplasticity and neural reconsolidation. Repeated immersive experiences may modify not only observable behavioral responses but also the functional architecture through which the brain processes threat, safety, and anticipation.

In PTSD, VRET enables controlled recontextualization of traumatic memories and reduction of predictive rigidity associated with hypervigilance. In social phobia, repeated exposure to virtual social environments facilitates recalibration of negative evaluation anticipation and reduction of safety behaviors.

In addictions, virtual environments allow controlled reactivation of contextual and emotional triggers involved in craving, providing opportunities to train behavioral inhibition and emotional regulation within a safe environment.

Limitations and Ethical Considerations

Despite its considerable potential, VRET also presents important limitations. Virtual reality cannot replace the therapeutic relationship, nor does it constitute a universal solution for all forms of psychopathology.

Potential risks include overexposure, retraumatization, dissociation, and cybersickness, requiring careful clinical assessment and individualized adaptation. Furthermore, therapeutic effectiveness depends not only on the technological realism of the virtual environment but also on the integration of the experience within a coherent and secure psychotherapeutic framework. Moreover, the progressive development of immersive technologies raises ethical and philosophical questions concerning the relationship between reality, simulation, and the construction of subjective identity.

Conclusions

The integration of connectome theory and Virtual Reality Exposure Therapy offers a new perspective on contemporary psychopathology and psychotherapy.

Psychiatric disorders may be conceptualized as manifestations of rigid and maladaptive predictive networks, while immersive interventions enable the generation of experiences capable of flexibilizing these dysfunctional patterns of brain functioning.

From this perspective, psychotherapy no longer represents exclusively an intervention on thoughts or behaviors, but rather a process of experiential remodeling of functional connectivity and of the manner in which the brain constructs reality.

Virtual reality therefore becomes more than a therapeutic technology: it emerges as a tool for intervening upon the fundamental processes through which human experience is anticipated, organized, and lived.

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Romania's National Security Paradigm in the Multipolar World

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Abstract

The concept of the multipolar world has attracted the attention of well-known personalities, politicians and renowned theoreticians of international relations since the Cold War period.

In the new multipolar world in the process of formation, yet incompletely crystallized, as a result of the latest crises that have emerged on the global stage, resulting from the expression of the balance of power among the current great powers, themselves poles in the making of the new global configuration, a pole of power is formed by an entity (a state, a configuration of several states, economic or military blocs) with significant global influence, which, in turn, balances other centres of power in the process of emergence.

A multipolar pole is defined as possessing significant military, economic, technological, political and cultural capacity, elements which, in turn, shape and enhance the two types of power known in the theory of international relations as hard power and soft power, having the capacity to shape the international order, its image at the global level being that of a principal actor, with a balancing or competing role within the global system, autonomous, possessing a broad strategic vision, without, however, having the quality of a hegemon, which is an element inappropriate to the multipolar world. Thus, the pole of power in the multipolar world is formed by a centre of influence comprising a state or a group of states that possess a broad capacity to influence political, economic and military events at the global level through diplomatic instruments resulting from the principal international conventions of the twentieth century, from the Cold War period.

However, day by day, as recent events of force at the international level demonstrate, the international conventions enacted in the twentieth century are becoming increasingly obsolete, losing their importance and calling into question their usefulness in maintaining the global geostrategic balance. In turn, the poles of power are connected to one another through a balance of power that contributes either to the maintenance of stability or to the creation of tensions, by the fact that at the level of the multipolar world there are several major actors, unlike the Cold War period, when there was a bipolarity balanced by the United States and the Soviet Union, or,

more recently, the period of unipolarity that emerged after the implosion of the Soviet Union, during which the United States manifested itself as the sole hegemon at the global level.

An important characteristic of the pole of power is its multidimensionality, and its scope is manifested through a whole series of complementary characteristics, such as its economic power, defined by the size of its GDP, the control of resources, innovation, or its military power, materialized in advanced defence capabilities, possessing a multilevel capability for the projection of force wherever its global interests require it.

To these is added its technological power, materialized in leadership in key fields such as AI, 5G, biotechnology, followed by its cultural power (the most evident type of soft power in today's world), which is manifested in the capacity of attraction of the cultural, ideological and value model, etc., and, last but not least, its diplomatic power, defined by its capacity to establish and to play an important role within international organizations.

In a multipolar world, the image of the pole of power is that of a key actor, capable of imposing its interests at the global level, but not in a hegemonic manner, there being constant competition for influence and a renegotiation of norms and structures of power, against the background of an increasing diversity of centres of decision.

Keywords: Multipolar world, pole of power, national security paradigm, Cold War, Soviet Union, United States of America, hegemon, soft power, hard power, AI, balance of power, Monroe Doctrine, American exceptionalism.

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We shall briefly exemplify the image of certain poles of power already existing or of others in the process of crystallization, as they are taking shape.

Thus, the principal superpower dominant at the global level today is the United States of America, one of the two poles of power during the Cold War, which became the sole pole of power for a period of time immediately after the events of 1989 that led to the collapse of communism, resulting in the dissolution of the Warsaw Treaty together with the transformation of the Soviet Union into Russia.

For a long period of time, the foreign policy of the White House was based on the doctrine of American exceptionalism, the essence of which consists in the firm belief that the values, political system, and historical development of the United States of America are unique in the history of mankind, thereby justifying its unique and distinct role from that of all other states on the world stage. Thus, once placed under the banner of exceptionalism, the two components of the American pole of power, soft power and hard power, have represented the principal elements of America's global expansion from the establishment of this doctrine up to the present day.

The term exceptionalism was coined by German Marxists during the second decade of the twentieth century. Thus, focusing on the abundant natural resources of the United States,

they provided an explanation for the reason why the United States did not experience the same level of class conflict that existed in Europe. However, the idea of American exceptionalism dates back much earlier, beginning with the observations and writings of the French political scientist and historian Alexis de Tocqueville (1805–1859) concerning the United States, in which he analyzed American society by comparing it with France and Great Britain. Tocqueville described the United States as a unique nation, free, founded upon individual liberty and democratic ideals.

However, during the last year and a half, considering Washington's most recent actions at the global level, materialized both in public statements (the desire to annex Greenland, to transform Canada into the fifty-first state of the United States, to overthrow by military means the communist regime in Cuba, and to withdraw the United States from NATO), as well as in the military operation aimed at the "extraction" of the President of Venezuela, Nicolás Maduro, the United States appears to be increasingly attracted to replacing American exceptionalism with the Monroe Doctrine[1], according to the recent statements of President Donald Trump[2].

Russia, in turn, although possessing vast energy and mineral resources, is deficient with regard to the infrastructure necessary for their extraction, inherited from the Soviet regime, a sector in which investments have not been made for a very long time. Vladimir Putin's accession to power triggered, together with nostalgia for Russia's imperial period during the Cold War, when it represented a major pole of power at the global level, the beginning of

[1] The Monroe Doctrine, named after its architect, former President James Monroe, in 1823, is one of the most important foreign policy agendas of the United States in the nineteenth century. It began as a largely symbolic document declaring American opposition to any new or expanded European involvement in the Americas after centuries of colonial activity in the region. The Monroe Doctrine would become a significant element of U.S. foreign policy toward the region for decades, although it has increasingly been criticized by scholars and policymakers because it was used to justify interventions in Latin America. The Doctrine emphasized the manner in which the U.S. Government regarded South and Central America as a strategic "backyard," viewed as a region that should fall under American rather than European influence. Source: https://www.dcnews.ro/ce-este-doctrina-monroe-imbratisata-de-donald-trump-traditia-veche-de-doua-secole-care-a-modelat-politica-externa-americana_1027255.html

[2] In the press statements delivered immediately after the U.S. operation in Venezuela, President Donald Trump stated that the attack had been carried out in accordance with a two-hundred-year-old policy, the Monroe Doctrine. President Donald Trump justified the operation in Venezuela as being consistent with a foreign policy agenda more than two hundred years old, namely the Monroe Doctrine, according to USA Today. Recent administrations at the White House attempted to distance themselves from the Monroe Doctrine, but more than a decade after then U.S. Secretary of State John Kerry, under former President Barack Obama, declared that "the era of the Monroe Doctrine is over," Trump has embraced it once again.

an effort to recover this status as the successor state of the former Soviet Union. This has materialized through a policy of recovering former territories that belonged to the Soviet Union and incorporating them into the territory of the Russian Federation, as illustrated by the annexation of Crimea and the war of aggression against Ukraine. At present, Russia is a power weakened from the economic, military and technological points of view as a consequence of the enormous financial effort generated by this war.



Figure 1. Escorting President Nicolás Maduro by D.E.A. agents to the place of detention following his arrest. Source: www.foxnews.com

As regards China, it is already a major military, economic and technological pole, with an exponential growth of its global influence, consisting of an unprecedented development of infrastructure, trade and investments at the global level, a fact which creates fierce competition among the great poles of power.

The European Union, as a bloc of states configuring a new multipolar pole, is a benchmark economic and normative hub, benefiting from the advantage of a strongly defined soft power, but with a cohesion increasingly eroded as a consequence of the new political orientation of the United States and of the intensification of the doctrinal divergences that have emerged among its member states, aspects manifested through an accentuated polarization between the two major political orientations, sovereigntist and progressive. The new security challenges arising as a consequence of the outbreak of the war of aggression in Ukraine, as well as Europe's pronounced dependence on Russian oil, constitute essential reasons for initiating a common European military force, an objective difficult to achieve as a consequence of the global financial crisis.

The other actors aspiring to the status of poles of the multipolar world, such as Brazil, India and Pakistan (the latter two being nuclear powers), South Africa, Japan, Australia, blocs of states such as ASEAN, or even continents such as Africa, although they are state entities with different economies, more or less developed, with medium-level military powers and different political regimes, nevertheless have a common denominator, materialized in the will to become voices in the chorus of the new powers of the world. This obliges the new actors to accept, share and respect the new principles and values for preserving a world balance created primarily on the principle of equality among the global poles of power, a fact that gives the necessary consistency to the new multipolar world.

The Multipolar World. Concept. Definition. Characteristics. Challenges for Romania. Forecasts.

a. CONCEPT

The multipolar world represents a geopolitical system with several centres of power (poles) of comparable importance, engaged in constant competition, unlike the unipolar system, which comprises a single hegemon, or bipolarity, a system in which the balance is provided by two poles of power.

The multipolar world, characterized by balance and complexity, is a place in which states and regional blocs play key roles, while the balance of power changes frequently, involving volatile alliances and economic, military and ideological competition.



Figure 2. A perspective on the multipolar world through the prism of the game of chess, where each chess piece has its own relevance. Source: https://images.search.yahoo.com

b. DEFINITION

Multipolarity represents a world in which several states or groups of states (poles) possess significant influence at the global level, without any one of them dominating completely, unlike the unipolar system (U.S. domination after the Cold War) or the bipolar system (United States versus the USSR during the Cold War).

c. CHARACTERISTICS

1. **Balance of power**: No pole is sufficiently powerful to impose the global order, creating a dynamic of balance and mutual control;
2. **Multiplicity of actors**: Besides the great powers, already established regional actors, the new poles of power also gain importance, diversifying the international scene;
3. **Competition and cooperation**: The poles of power compete for influence (economic, military, technological), but also cooperate in solving global problems (climate, terrorism, etc.);
4. **Instability and uncertainty**: Alliances are more fluid (they are not fixed as in bipolarity), and relations among the poles may be unpredictable, generating tensions;
5. **Cultural and ideological diversity**: Different civilizations and systems of values interact and compete, such as the Western vision versus alternative visions (Eastern, Islamic, etc.);
6. **Regional power**: The emergence of centres of power in different regions (Asia, Latin America, Africa), which assert their interests and influence.

In essence, a multipolar world is one that is complex, diversified and fluid, in which power is distributed among several poles that negotiate, compete and cooperate in order to shape the world order.

d. CHALLENGES FOR ROMANIA

1. The gradual return of America to the Monroe Doctrine of 1823, which presupposes Washington's abandonment of its sphere of influence in Europe and its return to consolidating its sphere of influence in South America, a fact which implies the abandonment of the security guarantees granted to Romania in order to support it in a military conflict with Russia;
2. The lack of a defense structure of the European Union, materialized in a common army capable, if necessary, of successfully replacing NATO, as well as of providing security guarantees to the Member States;
3. The war in Ukraine in the vicinity of the country's borders;
4. The erosion of the Euro-Atlantic relationship between the United States and the European Union as a consequence of the lack of interest of NATO Member States in

increasing their defense budgets. This may lead to America's disengagement from Europe and to the possibility of the outbreak of trade wars between the European allies and the United States;

5. The increasingly pronounced concern of the United States, as a consequence of the so-called tariff war, to regard China as a long-term global partner, to the detriment of its economic relations with the European Union, the EU appearing to be crushed by the magnitude of American-Chinese relations.

These challenges place Romania at the center of an unfavorable context, Romania's level of security diminishing to such an extent that it generates vulnerabilities, dangers and risks comparable to those of the unipolar moment, after Romania abandoned the security umbrella of the Warsaw Treaty, under circumstances in which the geopolitical moment did not yet permit the country's integration into NATO.

At the same time, part of the conflicts existing at the global level during the early period of the multipolar world continue with the same intensity, consuming human and economic-financial resources, generating massive population exoduses and human tragedies, thus constituting major security risks for humanity. Thus, apart from the major conflicts that broke out and ended in Afghanistan (2001–2021), Iraq (2003–2011), and Syria (2011–2024), there also remain the major conflict in Ukraine (which, in practice, began in 2014 with the occupation of Crimea and continues to the present day together with the so-called special operation launched in February 2022 against Kyiv), the war in Yemen, which began in 2015 and also continues, as well as the new conflict in the Middle East, initiated this year and resulting in the blockade of the Strait of Hormuz, which is currently unfolding.



Figure 3. Map of Ukraine showing the nuclear power plants as sensitive military objectives, as well as the territories occupied by Russia. *Source: www.limesonline.com*

For Romania, the most dangerous challenge at present is that resulting from the war in Ukraine, with which we share a common border, following Russia's armed offensive resulting in the invasion of our northern neighbor, in the hope of militarily occupying it within only a few days.

e. FORECASTS

The possible developments of the conflict in Ukraine over an estimated period extending until the year 2050 could materialize in three scenarios/hypotheses of action, as follows:

Scenario 1 – Ukraine Wins (the most optimistic)

By 2030, Ukraine recovers the majority of its occupied territories and obtains Western security guarantees. During the following decade, it became a member of the European Union and a strategic ally of NATO, contributing to the stabilization of the region. By 2050, Ukraine is completely reconstructed and consolidated as the eastern pillar of the Euro-Atlantic order, while Russia's global influence erodes significantly, although it retains Crimea.

Scenario 2 – Russia Wins (possible)

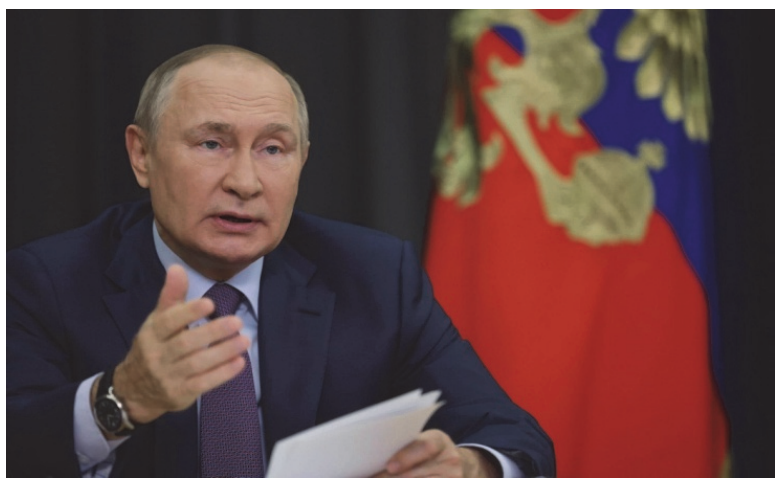


Figure 4. Regardless of the strategic power games of the multipolar world, Russia cannot be excluded from the major decisions that will govern the planet. Source: https://tg24.sky.it/mondo/2025/11/04

By 2030, Russia retains control over Crimea and south-eastern Ukraine, while Kyiv is forced to accept a status of neutrality as a consequence of replacing the current political

regime with another one more accommodating to Russian demands. Ukraine remains divided and under permanent pressure, while Moscow attempts to extend its influence in Eastern Europe and the Caucasus. By 2050, a new balance of power dominated by Russia and China reconfigures the area between the Black Sea and Central Asia, with NATO occupying a defensive position.

Scenario 3 – Frozen Conflict, Without Victor or Vanquished (the most probable)

Thus, war stabilizes during the next two to three years without a clear political solution. The front lines become permanent, while the parties maintain a state of unofficial armistice accompanied by sporadic clashes. Ukraine remains partially occupied.

While developing its relations with the West. By 2050, the conflict becomes "a new Korea of Europe," and the stability of the region depends on the capacity of NATO and the European Union to support a partially stabilized Ukraine that nevertheless remains under constant pressure. In this context, it becomes increasingly evident that, taking into consideration the radical modification of the security glacis of the twenty-first century, the security paradigm will undergo a profound adaptation to present-day realities.

Thus, the classical military conflict (state versus state) has been replaced or complemented by new and more complex forms, such as:

- **Hybrid conflicts**, where the line between peace and war is blurred (e.g., Ukraine);
- **Proxy wars**, as an expression of global competition among the great powers (e.g., Syria, Yemen);
- **Information and cyber warfare**, playing a major role in influencing perceptions and destabilizing regimes;
- **Urbanized and media-driven conflict**, simultaneously targeting the morale of the population, the international image and the critical infrastructure;
- The revitalization of ideological and religious conflicts, waged in the name of identity rather than territory.
- Consequently, the modification of the security paradigm of the multipolar world may lead to the following consequences for the global security architecture, making it imperative for Romania to adapt itself to these realities:
- **Desynchronization** between international law and strategic reality;
- The erosion of non-proliferation and arms control regimes (nuclear, ballistic, AI);
- **The vulnerability of critical infrastructures** as a new battlefield (cyber, energy, communications);

- The politicization of humanitarian assistance and post-conflict reconstruction, with negative effects upon sustainable recovery;
- The generalization of the "conflict without victors," but with massive human and reputational losses.
- In conclusion, Romania finds itself in an extremely unpredictable security environment, as a consequence of its geostrategic position in the proximity of two major conflicts, the one in Ukraine and the one in the Middle East, developments that require the adaptation of its security paradigm to these realities of the multipolar world by initiating the following urgent measures:
- adaptation of the defense doctrine to hybrid conflicts and non-conventional operations;
- Romania must become an exporter of regional security through consolidated capabilities, interoperability, digitalization and enhanced civil protection;
- strengthening national resilience, including propaganda, cyberattacks and uncontrolled migration;
- strengthening strategic partnerships, especially with the United States, Poland, France and Türkiye, becomes essential in a multipolar environment.

II. Directions to Be Followed by Romania

The Pillars of Romania's National Security in the Multipolar World

a. DIRECTIONS TO BE FOLLOWED BY ROMANIA

It is more than evident that the international events taking place in the year 2026 are on the verge of radically changing the world, which tends to transform itself into a new balance-of-power system, this time a multipolar one, with poles of power already visible (the United States, China, Russia, India and the European Union), but also with a number of regional powers currently negotiating their status at the decision-making table. These are realities that completely change the rules of the game for Romania as well. In this case, a major rethinking of our country's national security becomes necessary by adapting it to the new changes.

Thus, a first step would materialize in "anchoring" Romania to NATO and the European Union, while nevertheless taking into account the new political and geopolitical realities that have emerged. Although NATO remains our "hard" security guarantee, and Article 5 of the Washington Treaty remains in force, in a multipolar world the "American umbrella" no longer provides Romania with the same guarantees, as a consequence of the modification of the global priorities of the United States, through the granting of increased attention to

the Middle East, the Pacific, and Latin America (through the return to the Monroe Doctrine), as well as because of the financial difficulties of the great ally.

As regards the European Union, it is currently being eroded by numerous divergences at both economic and political levels, losing, to a certain extent, its international relevance as a consequence of Washington's geopolitical actions. Moreover, the plan for establishing a common military force of the Member States has been dragging on for many years.

For Romania, this would mean allocating at least 2.5–3% of GDP to defense expenditures, this amount representing the minimum necessary (in order to be credible at the undesirable moment when we might be forced to request reinforcements in the event of a possible aggression against our state sovereignty). It would also mean significant investments in critical capabilities, such as long-range air defense, ammunition, logistics, mobility and, last but not least, genuine interoperability achieved not only through military exercises but also through high standards in troop training, the procurement of compatible ammunition and efficient supply chains.



Figure 5. The Romanian Army, an element of stability at the regional level, an element of confidence within the Euro-Atlantic security architecture.

Another direction of action for Romania would be the consolidation of its status as NATO's "Eastern Pivot," which would be reflected in the development of naval and air surveillance capabilities through the allocation of a sufficient number of drones, radars and

corvettes, as well as through the development of coastal defense. It is necessary to transform the Port of Constanța and the Danube ports into hubs of resilience and military and civilian logistics, together with close coordination with Turkey, Bulgaria, Ukraine and the Republic of Moldova within the Black Sea area, in order to strengthen the Eastern Flank.

In the multipolar world, economic wars and energy dependencies are formidable weapons. Since economic security is one of the components of national security, Romania should accelerate its energy independence, because dependence (fortunately not in its entirety) on Russian gas has constituted a vulnerability for the country through the risks of economic blackmail to which Romania may at any time be subjected by the Kremlin.

In conclusion, the exploitation of the natural gas and oil resources of the Black Sea, the implementation of new-generation nuclear technologies at the Cernavodă Nuclear Power Plant, the new interconnections of the energy networks with the Republic of Moldova, as well as the diversification of the supply chains for microchips, ammunition and raw materials constitute priorities for Romania's governments, regardless of their political orientation.

Nor should the protection of critical infrastructures, submarine cables, electricity networks and ports against cyber-attacks be neglected, as the hybrid war in which Romania currently finds itself, together with cyber, economic and information warfare, are indisputable realities, constituting genuine threats to Romania's national security.

Since in multipolarity, small or regional powers survive through networks of interests rather than solely through solid treaties, an important role is assigned to proximity diplomacy, through the maintenance of relations based on trust, mutual respect, efficiency and pragmatism with all our neighbors, both with the Republic of Moldova and Ukraine, as well as with the states of the Eastern Balkans and the Wider Black Sea Region.[3]

In modern warfare, combat is carried out less and less on the battlefield, as happened in the conflicts of the twentieth century, with the deployment of large masses of tanks along strategic attack axes or with devastating air strikes against objectives of major importance (hard power). Hybrid warfare, technological warfare, economic warfare, information

[3]The Wider Black Sea Region (WBSR) is a concept defining a complex geostrategic and economic space extending beyond the strict riparian borders, including the states of the Black Sea, Caspian Sea, and Baltic Sea basins. It represents a point of convergence between the interests of the European Union, NATO, the United States, and Russia. The Black Sea littoral states are Romania, Bulgaria, Türkiye, Russia, Ukraine, and Georgia. The wider perimeter of the region includes the South Caucasus (Armenia and Azerbaijan), the Republic of Moldova, as well as direct connections with Central Asia and the Middle East. Source: Marius-Sorin Miclea, La Roumanie et la Région Étendue de la Mer Noire dans le nouveau context de sécurité et défense d'après la Guerre Froide, Doctoral Thesis, Jean Moulin University, 27 June 2012.

warfare and cyber warfare represent new components of the category of soft power specific to confrontations between states. However, the soft power category of conflict acts predominantly upon minds through the component of psychological warfare, manifested through the corruption of minds, propaganda and disinformation, on the one hand, and, on the other hand, through instrumentalized migration and economic pressure. And finally, but not least, special attention should be paid to strategic autonomy to the detriment of Romania's isolation. The term "European strategic autonomy" may sound vague, but for Romania it has a special connotation, representing the personification of the necessity for the European Union to be able to act independently whenever required, excluding dependence upon the United States in medium-level crises arising in different parts of the world where Brussels has geopolitical and strategic interests. This phenomenon does not replace NATO but rather complements it.

Romania, in turn, must act in order to possess its own national defense industry, to gain independence in the production of military equipment, excluding any dependence, including upon European Union Member States, in the production of any type of military supplies. These activities should be complemented by the training of highly qualified technicians to work in this type of industry, which is so necessary for Romania.

The conclusion that imposes itself requires taking into consideration the following aspects:

- at the exogenous level, within the multipolar system there is no longer any "protector" upon whom Romania will be able to rely, with the exception of NATO, although it remains to be seen how this organization, created during the Cold War, will adapt to the new changes resulting from the change in global polarity. It is no less true that, at present, even the very existence of this organization is being called into question;
- at the endogenous level, Romania will have to become sufficiently strong from a military point of view so as not to be ignored, sufficiently useful economically and geographically in order to be attractive within the new alliances that will take shape, and, above all, sufficiently united so as to provide that stability at the level of the governing class which will have to take the most efficient decisions for Romania's security.

b. THE PILLARS OF ROMANIA'S NATIONAL SECURITY IN THE MULTIPOLAR WORLD

The pillars of Romania's national security in the multipolar world require a systemic reconfiguration, as a consequence of the fragmentation of the international system.

Thus, the new realities are becoming increasingly visible, such as the political and economic reconfiguration of the United States toward the Pacific region, the attention granted by Washington to China, in parallel with the current administration's intention to return to the Monroe Doctrine (it is not known what policies the future administration in Washington, following the 2028 elections, will adopt).

Constantly, the attention of all experts in international relations is focused upon the current decisions of the Trump Administration, elements that generate a series of assumptions and predictions concerning the future of the multipolar world. However, nobody takes into account whether these decisions will be continued by the future American administration, which will have to choose between returning to the foreign policy preceding the current administration or continuing the present strategic orientations.

As regards Russia, it is becoming increasingly active on NATO's Eastern Flank, while the European Union is currently undergoing an extensive process of redefinition. For Romania, this means that security must be built upon several pillars that support one another.

The main pillars of Romania's national security:

1. Resetting national security through the reconfiguration of the entire national defence system as a consequence of the decision of the United States to transfer its strategic effort toward other regions of the world.

This decision will undoubtedly also have consequences for NATO. Thus, Romania will have to rely first and foremost upon its own forces, taking Poland as an example, through the configuration of a new army with an increased personnel strength, equipped with ultra-modern equipment, representing a genuine deterrent force against any possible aggressive intentions on the part of Russia, an army adapted both to face a conventional war and, above all, a non-conventional war, taking into account the current developments in Ukraine.

2. Maintaining the current security alliances, with NATO as their backbone, through the activation, whenever necessary, of Article 5 of the Washington Treaty against any type of military aggression, as well as by maintaining a substantial presence of troops and military equipment under the NATO flag in Romania.

Special attention must be paid to the continuation and further development of the Strategic Partnership with the United States, particularly with regard to its military component.

3. Increasing the European dimension and Romania's visibility within the European Union through enhanced strategic autonomy.

Although the European Union pillar does not represent a military element in the classical sense, it is of vital importance for economic, energy and cyber resilience. European funds, the Single Market and the common defense projects (EDF, PESCO) reduce Romania's dependence upon other external markets.

The concept of "European strategic autonomy" will have a beneficial effect upon Romania through access to development funding by means of European mechanisms. This concept does not replace the role of the United States within Romania's security architecture but is complementary to it.

4. Regional Security. The Black Sea and the Immediate Neighborhood

The Wider Black Sea Region is a geographical region recognized as a strategic area in which, following the dissolution of the USSR, numerous regional "hot" interethnic conflicts broke out as a consequence of the "heating up" of the "frozen" conflicts that had emerged following the Treaty establishing the Union of Soviet Socialist Republics.[4]

The formation of this state conglomerate amalgamated and trampled upon the national sentiments of the state entities that, at that time, formed the USSR, and after the dissolution of the Soviet Union all the resentments of the peoples composing the USSR, which had been kept under strict ideological control by the Kremlin, overflowed, transforming themselves into independence movements or taking the form of local wars throughout the former Soviet space.

Following the outbreak of the Russian aggression against Ukraine, Romania became a front-line NATO state bordering the conflict area, assuming the inherent risks and being able at any time to become a "collateral victim" of the Russian-Ukrainian confrontation through violations of its airspace by drones, some of which have crashed on Romanian territory, this occurring increasingly frequently.

Thus, the entire infrastructure located on Romanian territory adjacent to the conflict zone, the natural features, the rivers, the Black Sea coastline, and the Danube Delta become critical elements of our national security, requiring the implementation of special surveillance and protection measures, both at present and in the future, because, regardless

[4]The Union of Soviet Socialist Republics (USSR) (Russian: *Союз Советских Социалистических Республик* (СССР), *Soyuz Sovetskikh Sotsialisticheskikh Respublik* (SSSR)), also known as the Soviet Union (Russian: *Советский Союз*, *Sovetskiy Soyuz*), was a state extending over a large part of northern Eurasia and existed from 1922 until 1991. Its formation represented the culmination of the Russian Revolution of 1917, which removed Tsar Nicholas II from power. (For the official name of the Soviet Union in the languages of the other republics, see *Official Names of the USSR*.). The USSR consisted of several Soviet Socialist Republics (SSRs). Their number varied over time; at the moment of the dissolution of the USSR there were 15 constituent republics. Russia was by far the largest republic within the Union, dominating in almost every respect: territory, population, economy and political influence. The territory of the USSR also underwent major changes; in 1990 it corresponded broadly to that of the Russian Empire, the most important exceptions being Poland, Finland and Alaska. With the exception of a short period immediately after the Revolution, the political organization of the country was defined by the only officially recognized political party, the Communist Party of the Soviet Union (CPSU). Source: Romanian Wikipedia

of how the conflict ends, it will transform itself into a "frozen" conflict as a consequence of the dissatisfaction of both parties participating in the negotiations.

As regards the Republic of Moldova, the stability of Chișinău constitutes a direct extension of Romania's security. Energy interconnections, infrastructure projects, and the political and economic support granted by Romania to the Republic of Moldova are integrated measures complementary to Romania's national defense.

A particularly important role within our new security architecture must be assigned to the strengthening of NATO's Southern Flank, through efficient coordination with Bulgaria, Türkiye and Greece. A conflict-adjacent area or an unstable Balkan region means increased migratory pressure as well as increased hybrid vulnerabilities.

Since, in a multipolar world, sanctions, embargoes and dependencies constitute a category of formidable non-lethal weapons, economic and energy resilience become elements of the highest importance. The natural gas resources of the Black Sea, the Cernavodă Nuclear Power Plant, and the electricity generation facilities contribute significantly to Romania's energy independence, while these, together with the critical infrastructure, submarine cables, the Internet network, electricity grids, ports and the railway system, require the adoption of protection measures of the highest priority, because they constitute priority targets of hybrid attacks.

Cyber and information security shall be ensured through a national cyber defense system, placed, in the event of a conflict, under the authority of the specialized structures of the intelligence services, while the Armed Forces shall protect the state's networks and critical companies.

Social resilience shall integrate education, the mass media and the fight against fake news, a process of broad scope that will result in the strengthening of internal cohesion, because a divided society is vulnerable regardless of how many tanks and aircraft it possesses. The revitalization of the defense industry and the advance preparation of the reserve personnel necessary for national mobilization shall be achieved through the program for relaunching the Romanian defense industry for the production of ammunition and military equipment necessary for a twenty-first-century war, with particular emphasis on the priority production of drones and unmanned aircraft, together with the activation and training of the national reserve force and the rethinking of civil protection, as well as through the allocation of strategic stockpiles, the preparation of evacuation plans and the involvement of the population.

In a multipolar world, Romania's national security depends upon its capacity to balance its membership in NATO and the European Union with pragmatic relations with the other poles of power. Diplomatic flexibility and economic resilience have become just as

important as conventional military force. The priority remains the strengthening of the Eastern Flank and the protection of critical infrastructure against hybrid threats and against Russia. Romania cannot afford neutrality, but it can use its geographical position in order to become an actor of regional stability.

Thus, security is built through solid alliances, coherent internal decision-making and continuous adaptation to a regional and global balance that is in continuous change.

Paradigma Securității Naționale a României în Lumea Multipolară

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Abstract

The concept of the multipolar world has attracted the attention of well-known personalities, politicians and renowned theoreticians of international relations since the Cold War period.

In the new multipolar world in the process of formation, yet incompletely crystallized, as a result of the latest crises that have emerged on the global stage, resulting from the expression of the balance of power among the current great powers, themselves poles in the making of the new global configuration, a pole of power is formed by an entity (a state, a configuration of several states, economic or military blocs) with significant global influence, which, in turn, balances other centres of power in the process of emergence.

A multipolar pole is defined as possessing significant military, economic, technological, political and cultural capacity, elements which, in turn, shape and enhance the two types of power known in the theory of international relations as hard power and soft power, having the capacity to shape the international order, its image at the global level being that of a principal actor, with a balancing or competing role within the global system, autonomous, possessing a broad strategic vision, without, however, having the quality of a hegemon, which is an element inappropriate to the multipolar world.

Thus, the pole of power in the multipolar world is formed by a centre of influence comprising a state or a group of states that possess a broad capacity to influence political, economic and military events at the global level through diplomatic instruments resulting from the principal international conventions of the twentieth century, from the Cold War period.

However, day by day, as recent events of force at the international level demonstrate, the international conventions enacted in the twentieth century are becoming increasingly obsolete, losing their importance and calling into question their usefulness in maintaining the global geostrategic balance. In turn, the poles of power are connected to one another through a balance of power that contributes either to the maintenance of stability or to the creation of tensions, by the fact that at the level of the multipolar world there are several major actors, unlike the Cold War period, when there was a bipolarity balanced by the United States and the Soviet Union, or,

more recently, the period of unipolarity that emerged after the implosion of the Soviet Union, during which the United States manifested itself as the sole hegemon at the global level.

An important characteristic of the pole of power is its multidimensionality, and its scope is manifested through a whole series of complementary characteristics, such as its economic power, defined by the size of its GDP, the control of resources, innovation, or its military power, materialized in advanced defense capabilities, possessing a multilevel capability for the projection of force wherever its global interests require it.

To these is added its technological power, materialized in leadership in key fields such as AI, 5G, biotechnology, followed by its cultural power (the most evident type of soft power in today's world), which is manifested in the capacity of attraction of the cultural, ideological and value model, etc., and, last but not least, its diplomatic power, defined by its capacity to establish and to play an important role within international organizations.

In a multipolar world, the image of the pole of power is that of a key actor, capable of imposing its interests at the global level, but not in a hegemonic manner, there being constant competition for influence and a renegotiation of norms and structures of power, against the background of an increasing diversity of centres of decision.

Keywords: Multipolar world, pole of power, national security paradigm, Cold War, Soviet Union, United States of America, hegemon, soft power, hard power, AI, balance of power, Monroe Doctrine, American exceptionalism.

Rezumat

Conceptul lumii multipolare a atras atenția unor personalități cunoscute, oameni politici și teoreticieni de marcă ai relațiilor internaționale, încă din perioada Războiului Rece.

În noua lume multipolară pe cale de formare, însă incomplet cristalizată, ca urmare a ultimelor crize apărute pe eșichierul global, rezultat al exprimării raportului de forțe dintre marile puteri actuale, la rândul lor poli în devenire ai noii configurații planetare, un pol de putere este format dintr-o entitate (stat, configurație de mai multe state, blocuri economice sau militare) cu o influență globală semnificativă, care echilibrează, la rândul lor, alte centre de putere pe cale de apariție.

Un pol multipolar este definit ca având o semnificativă capacitatea militară, economică, tehnologică, politică și culturală, elemente care conturează și potențează, la rândul lor, cele două tipuri de putere cunoscute în teoria relațiilor internaționale drept hard power și soft power, având capacitatea de a modela ordinea internațională, imaginea sa la nivel global fiind una de actor principal, cu rol echilibrator sau concurent la nivelul sistemului global, autonom, dispunând de o amplă viziune strategică, neavând însă calitatea de hegemon, care este un element impropriu lumii multipolare.

Astfel, polul de putere în lumea multipolară este format dintr-un centru de influență care cuprinde un stat sau un grup de state care dețin o capacitate vastă de a influența la nivel global evenimentele politice, economice, militare prin instrumente diplomatice, rezultate ca urmare a principalelor convenții internaționale ale secolului al XX-lea, din perioada Războiului Rece.

Însă pe zi ce trece, așa cum ne-o dovedesc recentele evenimente de forță la nivel internațional, convențiile internaționale edictate ăn secolul al XX-lea devin din ce în mai caduce, pierzând din importanță, punând sub semnul întrebării utilitatea acestora în menținerea echilibrului geostrategic planetar. La rândul lor, polii de putere sunt legate între ei printr-un echilibru de putere care contribuie la menținerea stabilității sau la crearea de tensiuni, prin faptul că la nivelul lumii multipolare există mai mulți actori majori, spre deosebire de perioada Războiului Rece, când exista o bipolaritate echilibrată de către Statele Unite și Uniunea Sovietică sau, caz mai recent, de perioada unipolarității apărută după implozia Uniunii Sovietice, ecarte de timp în care Statele Unite se manifestau ca unic hegemon la nivel planetar.

O caracteristică importantă a polului de putere o reprezintă multidimensionalitatea sa, iar anvergura acestuia se manifestă printr-o întreagă serie de caracteristici complementare, cum ar fi puterea sa economică, definită de dimensiunea PIB-ului, controlul resurselor, inovația, sau puterea sa militară, concretizată în capacități avansate de apărare, dispunând de o capacitate multigradual a proiecției forței acolo unde interesele sale globale o impun.

La acestea se mai adaugă puterea sa tehnologică, concretizată într-un leadership în domenii cheie cum ar fi A.I, 5G, biotehnologie, urmată de puterea sa culturală (tipul de soft power cel mai evident în lumea actuală), care se manifestă în capacitatea de atracție a modelului cultural, ideologic, valoric, etc., și nu în ultimul rând puterea sa diplomatică, definită prin capacitatea sa de-a închega și de-a avea un rol important la nivelul organizațiilor internaționale.

Într-o lume multipolară, imaginea polului de putere este cea a unui actor cheie, capabil să-și impună interesele la nivel global, dar nu hegemonic, existând o competiție constantă pentru influență și o renegociere a normelor și structurilor de putere, pe fondul unei diversități crescânde de centre de decizie.

Cuvinte cheie: Lumea multipolară, pol de putere, paradigma securității naționale, război rece, Uniunea Sovietică, Statele Unite ale Americii, hegemon, soft power, hard power, A.I., raport de forțe, doctrina Monroe, excepționalismul american.

Vom exemplifica succint imaginea unor poli de putere existenți deja sau a unora în curs de cristalizare, așa cum se prefigurează aceștia.

Astfel, principala superputere dominantă la nivel global astăzi sunt Statele Unite ale Americii, unul dintre cei doi poli de putere din timpul Războiului Rece, devenit unic pol de putere pentru o perioadă de timp imediat după evenimentele din anul 1989 care au dus la prăbușirea comunismului, având drept rezultante disoluția Tratatului de la Varșovia împreună cu transformarea Uniunii Sovietice în Rusia.

O mare perioadă de timp politica externă a Casei Albe a avut la bază doctrina excepționalismului a cărei esență constă în credința fermă că valorile, sistemul politic și dezvoltarea istorică ale Statelor Unite ale Americii sunt unice în istoria omenirii, acestea fiind îndreptățite să joace un rol unic și distinct de celelalte state pe scena mondială. Astfel,

odată plasate sub stindardul excepționalismului, cele două componente ale polului american de putere, soft power și hard power au fost principalele elemente ale expansiunii americane globale de la înființarea doctrinei până în zilele noastre.

Termenul de excepționalism a fost inventat de marxiștii germani în a doua decadă a secolului al XX-lea. Astfel, concentrându-se pe resursele naturale abundente din Statele Unite, prin aceasta s-a oferit o explicație pentru motivul pentru care Statele Unite nu se confruntau cu nivelul de conflict de clasă care exista în Europa. Totuși, ideea de excepționalism american datează de mai mult timp, începând cu observațiile și scrierile politologului și istoricului francez Alexis de Tocqueville (1805–1859) despre Statele Unite, care a făcut o analiză a Statelor Unite de atunci comparându-le cu Franța și Marea Britanie. Tocqueville a menționat Statele Unite ca o națiune unică, liberă, bazată pe libertatea personală și idealuri democratice.

Însă în ultimul an și jumătate, având în vedere cele mai recente acțiuni la nivel global ale Washingtonului, concretizate atât în declarații publice (dorința de anexare a Groenlandei, de transformare a Canadei în al 51-lea stat al Statelor Unite, de doborâre pe cale militară a regimului comunist din Cuba, de retragere a Statelor Unite din NATO), precum și acțiunea militară de „extragere" a președintelui Venezuelei Nicolas Maduro, Statele Unite par din ce în ce mai atrase de înlocuirea excepționalismului american cu doctrina Monroe[5] conform declarațiilor recente ale președintelui Donald Trump[6].

[5] Doctrina Monroe, numită după arhitectul său, fostul președinte James Monroe în 1823, este una dintre cele mai importante agende de politică externă a SUA din secolul al XIX-lea. A început ca un document în mare parte simbolic care declara opoziția americană față de implicarea nouă sau extinsă a Europei în America, după secole de activitate colonială în regiune. Doctrina Monroe avea să devină un element semnificativ al politicii externe a SUA față de regiune timp de decenii, deși a fost din ce în ce mai criticată de către academicieni și factorii de decizie politică pentru că a fost folosită pentru a justifica intervențiile în America Latină. Doctrina a subliniat modul în care guvernul SUA considera America de Sud și Centrală o „curte interioară" strategică, văzută ca o regiune care ar trebui să cadă sub influența americană, mai degrabă decât europeană Sursă: https://www.dcnews.ro/ce-este-doctrina-monroe-imbratisata-de-donald-trump-traditia-veche-de-doua-secole-care-a-modelat-politica-externa-americana_1027255.html

[6] În declarațiile de presă susținute imediat după operațiunea SUA în Venezuela, președintele american Donald Trump a precizat că atacul a fost în conformitate cu o politică veche de două secole, Doctrina Monroe. Președintele american Donald Trump a justificat operațiunea din Venezuela ca fiind în conformitate cu o agendă de politică externă veche de peste 200 de ani, Doctrina Monroe, scrie USA Today. Administrațiile recente de la Casa Albă au încercat să se distanțeze de Doctrina Monroe, dar, la mai bine de un deceniu după ce secretarul de stat american de atunci, John Kerry, sub fostul președinte Barack Obama, a anunțat că „era Doctrinei Monroe s-a încheiat", Trump o îmbrățișează din nou. Sursă: https://www.dcnews.ro/ce-este-doctrina-



Figura 1. Escortarea președintelui Nicolas Maduro către locul de detenție de către agenții D.E.A. după arestarea acestuia. Sursă: www.foxnews.com

Rusia la rândul său, deși dispune de vaste resurse energetice și minerale, este deficitară în ceea ce privește infrastructura elementelor de extracție, moștenită de pe timpul regimului sovietic, domeniu în care nu au mai fost făcute investiții de foarte mult timp. Preluarea puterii de către Vladimir Putin a declanșat odată cu nostalgia după perioada sa imperială din perioada Războiului Rece când era un pol marcant de putere la nivel planetar și startul pentru recuperarea acestui statut în calitate de moștenitoare a fostei Uniunii Sovietice. Acest fapt s-a concretizează printr-o politică de recuperare a vechilor teritorii pierdute aparținând Uniunii Sovietice și înglobarea acestora în teritoriul Federației Ruse, cum au fost anexarea Crimeii și războiul de agresiune împotriva Ucrainei. La ora actuală Rusia este o putere slăbită din punct de vedere economic, militar și tehnologic ca urmare a uriașului efort financiar generat de acest război.

În ceea ce privește China, aceasta este deja un pol militar, economic și tehnologic major, cu o creștere exponențială a influenței sale globale, constând într-o dezvoltare fără precedent a infrastructurii, comerțului și investițiilor la nivel planetar, fapt care creează o concurență acerbă între marii poli de putere.

Uniunea Europeană, ca bloc de state care configurează un nou pol multipolar, este un hub economic și normativ de referință, beneficiind de avantajul unui soft power puternic conturat, însă cu o coeziune măcinată din ce în ce mai mult ca urmare a noii orientări politice

monroe-imbratisata-de-donald-trump-traditia-veche-de-doua-secole-care-a-modelat-politica-externa-americana_1027255.html

a Statelor Unite și a accentuării divergențelor doctrinare apărute la nivelul statelor componente, aspecte care se manifestă printr-o polarizare accentuată a celor două mari orientări politice suveraniste și progresiste. Noile provocări de securitate survenite ca urmare a declanșării războiul de agresiune din Ucraina, precum și dependența accentuată a Europei de petrolul rusesc se constituie în motive esențiale pentru inițierea unei forțe militare europene comune, deziderat greu de îndeplinit ca urmare a crizei financiare globale.

Ceilalți actori care aspiră la statutul de poli ai lumii multipolare cum ar fi Brazilia, India și Pakistanul, (ultimele două ca puteri nucleare), Africa de Sud, Japonia, Australia, blocuri de state precum ASEAN sau continente ca și Africa, deși sunt elemente statale cu economii diferite mai mult sau mai puțin dezvoltate, cu puteri militare de nivel mediu, cu regimuri politice diferite, însă au un numitor comun, concretizat în voința de-a deveni voci în corul de noi puteri ale lumii, fapt care îi obligă pe noii actori să accepte, să împărtășească și să respecte noile principii și valori de păstrare a unui echilibru mondial creat în primul rând pe principiul egalității între polii mondiali de putere, fapt care conferă consistența necesară noii lumi multipolare.

I. Lumea multipolară. Concept. Definiție. Caracteristici. Provocări pentru România. Previziuni.

CONCEPT

Lumea multipolară reprezintă un sistem geopolitic cu mai multe centre de putere (poli) de importanță comparabilă, aflate într-o competiție constantă, spre deosebire de sistemul unipolar care cuprinde un singur hegemon sau al bipolarității, sistem în care echilibrul este conferit de 2 poli de putere.



Figura 2. O perspectivă asupra lumii multipolare prin prisma jocului de șah, unde fiecare piesă de joc își are relevanța ei. Sursă: https://images.search.yahoo.com

Lumea multipolară caracterizată prin echilibru și complexitate, este un loc în care statele și blocurile regionale joacă roluri cheie, iar echilibrul de forțe se schimbă des, implicând alianțe volatile și concurență economică, militară și ideologică.

DEFINIȚIE

Multipolaritatea reprezintă o lume în care mai multe state sau grupări de state (poli) dețin o influență semnificativă la nivel global, fără ca vreunul să domine complet, spre deosebire de sistemul unipolar (dominația SUA după Războiul Rece) sau bipolar (SUA vs. URSS în Războiul Rece).

CARACTERISTICI

1. **Echilibrul de putere**: Niciun pol nu este suficient de puternic pentru a impune ordinea globală, creând o dinamică de echilibru și control reciproc;
2. **Multiplicitatea actorilor**: Pe lângă marile puteri, actori regionali deja consacrați, capătă importanță și noii poli de putere, diversificând scena internațională.;
3. **Concurență și cooperare:** Polii de putere concurează pentru influență (economică, militară, tehnologică), dar colaborează și la rezolvarea problemelor globale (climat, terorism, etc);
4. **Instabilitate și incertitudine**: Alianțele sunt mai fluide (nu sunt fixe ca în bipolaritate), iar relațiile dintre poli pot fi imprevizibile, generând tensiuni;
5. **Diversitate culturală și ideologică**: Diferite civilizații și sisteme de valori interacționează și concurează, cum ar fi viziunea occidentală vs. viziuni alternative (răsăritene, islamice, etc.);
6. **Putere regională:** Emergența unor centre de putere în diverse regiuni (Asia, America Latină, Africa), care își afirmă interesele și influența.
7. În esență, o lume multipolară este una complexă, diversificată și fluidă, în care puterea este distribuită între mai mulți poli care negociază, concurează și cooperează pentru a modela ordinea mondială.

PROVOCĂRI PENTRU ROMÂNIA

1. **Reîntoarcerea treptată a Americii la doctrina Monroe din 1823**, (Donroe) care presupune abandonarea de către Washington a sferei de influență din Europa și reîntoarcerea la consolidarea sferei de influență din America de Sud, fapt care presupune o abandonare a garanțiilor de securitate acordate României pentru a o susține într-un conflict militar cu Rusia;

2. **Lipsa unei structuri de apărare a Uniunii Europene** concretizate într-o armată comună, aptă a înlocui cu succes, la nevoie NATO, precum și care să acorde garanții de securitate statelor membre;
3. **Războiul din Ucraina** din apropierea granițelor țării;
4. **Erodarea relației euroatlantice** dintre SUA și UE ca urmare a lipsei de interes a statelor membre NATO de a-și spori bugetele pentru apărare. Acest lucru poate duce la dezangajarea Americii în Europa și la posibilitatea izbucnirii unor războaie comerciale între aliații europeni și Statele Unite;
5. Preocuparea din în ce mai accentuată a SUA, ca urmare a așa-zisului război al taxelor, de-a vedea în China un partener mondial pe termen lung, în detrimentul relațiilor economice cu Uniunea Europeană, UE părând a fi strivită de amplitudinea relațiilor americano-chineze.

Aceste provocări plasează România în centrul unui context nefavorabil, nivelul de securitate al României diminuându-se atât de mult încât acesta atrage vulnerabilități, pericole și riscuri care pot fi comparate cu cele ale perioadei momentului unipolar, după abandonarea de către România a umbrelei de securitate a Tratatului de la Varșovia, în condițiile în care momentul geopolitic de atunci nu permitea încă integrarea țării în NATO.

De asemenea, o parte dintre conflictele existente la nivel planetar în perioada de început a lumii multipolare continuă cu aceeași intensitate, devorând resurse umane și economico-financiare, provocând exoduri masive de populație, drame umane, constituindu-se în riscuri de securitate majore pentru omenire. Astfel, în afara conflictelor majore izbucnite și încheiate din Afganistan, (2001-2021), din Irak, (2003-2011), din Siria (2011-2024), mai există și conflictele majore din Ucraina (care, practic a început în anul 2014 data ocupării Crimeii și continuă și în prezent, odată cu așa-zisa operațiune specială din februarie 2022 împotriva Kievului), războiul din Yemen declanșat în anul 2015, care continuă și el, precum și noul conflict din Orientul Mijlociu declanșat în acest an soldat cu blocarea strâmtorii Hormuz, aflat în plină desfășurare.

Pentru România, cea mai periculoasă provocare la ora actuală este cea rezultată în urma războiul din Ucraina, cu care împărțim o frontieră comună, ca urmare a ofensivei armate a Rusiei soldată cu invadarea vecinului nostru de la Nord, în speranța ocupării militare a acestuia în doar câteva zile.



Figura 3. Harta Ucrainei în care apar centralale nucleare, ca obiective militare sensibile precum și teritoriile ocupate de Rusia. Sursă: www.limseonline.com

PREVIZIUNI

Posibilele evoluții ale conflictului din Ucraina pe o perioadă estimată de timp până în anul 2050, s-ar putea concretiza în 3 scenarii/ipoteze de acțiune, astfel:

Scenariul 1 – Câștigă Ucraina (cel mai optimist)

Până în 2030, Ucraina își recuperează majoritatea teritoriilor ocupate și obține garanții de securitate occidentale. În deceniul următor, devine membru UE și un aliat strategic al NATO, contribuind la stabilizarea regiunii. Până în 2050, Ucraina este complet reconstruită și consolidată ca pilon estic al ordinii euroatlantice, în timp ce influența globală a Rusiei se erodează semnificativ, deși păstrează Crimeea;

Scenariul 2 – Câștigă Rusia (posibil)

Până în 2030, Rusia păstrează controlul asupra Crimeei și sud-estului Ucrainei, iar Kievul este forțat să accepte un statut de neutralitate, ca urmare a schimbării regimului politic actual cu un altul mai maleabil la solicitările ruse. Ucraina rămâne divizată și sub presiune permanentă, în timp ce Moscova încearcă să-și extindă influența în Europa de Est și în Caucaz. Până în 2050, un nou echilibru de putere dominat de Rusia și China reconfigurează spațiul dintre Marea Neagră și Asia Centrală, cu NATO într-o poziție defensivă;

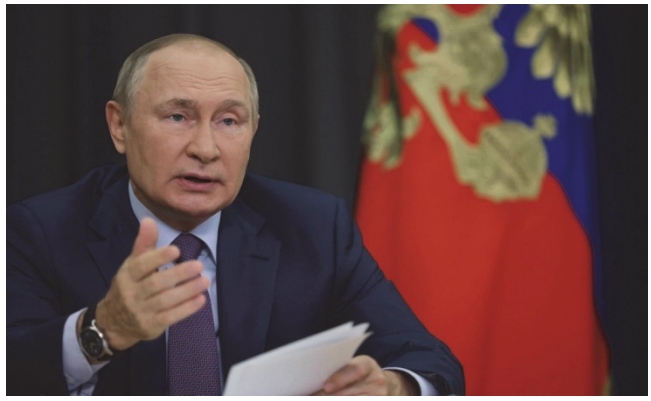


Figura 4. Indiferent de jocurile strategice de putere ale lumii multipolare, Rusia nu poate fi exclusă de la marile decizii care vor guverna planeta. Sursă: https://tg24.sky.it/mondo/2025/11/04

Scenariul 3 - Conflict înghețat, fără învins sau învingător (cel mai probabil)

Astfel, războiul se stabilizează în următorii 2–3 ani fără o soluție politică clară. Liniile frontului devin permanente, iar părțile mențin o stare de armistițiu neoficial, cu ciocniri sporadice. Ucraina rămâne parțial ocupată, dar își dezvoltă relațiile cu Occidentul. Până în 2050, conflictul devine „o nouă Coreea a Europei", iar stabilitatea regiunii depinde de capacitatea NATO și UE de a susține o Ucrainã parțial stabilizată, dar mereu sub presiune.

În acest context, reiese din ce în ce mai evident faptul că, având în vedere modificarea radicală a glacis-ului de securitate al secolului al XXI-lea , paradigma de securitate va cunoaște o profundă adaptare la realitățile actuale.

Astfel, conflictul militar clasic (stat vs. stat) a fost înlocuit sau completat de forme noi și mai complexe, cum ar fi:

Conflicte hibride, unde linia dintre pace și război este estompată (ex. Ucraina);

Războaie prin interpuși (proxy wars), ca expresie a competiției globale între marile puteri (ex. Siria, Yemen);

Război informațional și cibernetic, cu un rol major în influențarea percepțiilor și destabilizarea regimurilor;

- **Conflictul urbanizat și mediatizat**, care vizează simultan moralul populației, imaginea internațională și infrastructura critică;
- **Revitalizarea conflictelor ideologice și religioase**, purtate în numele identității, nu al teritoriului.

Ca urmare, modificarea paradigmei de securitate a lumii multipolare poate duce le următoarele consecințe ale arhitectura globală de securitate, fiind imperios necesar ca România să se adapteze acestor realități:

- Desincronizarea dintre dreptul internațional și realitatea strategică;
- Eroziunea regimurilor de neproliferare și control al armamentului (nuclear, balistic, AI);
- Vulnerabilitatea infrastructurilor critice, ca nou front de luptă (cyber, energie, comunicații);
- Politizarea ajutorului umanitar și a reconstrucției post-conflict, cu efecte negative asupra redresării durabile;
- Generalizarea conflictului „fără învingători", dar cu pierderi masive umane și relaționale.

În concluzie, România se află într-un mediu de securitate extrem de impredictibil, ca urmare a poziției sale geostrategice în proximitatea a două conflicte majore, cel din Ucraina și cel din Orientul Mijlociu, desfășurări care necesită adaptarea paradigmei sale de securitate la aceste realități ale lumii multipolare, inițiind următoarele măsuri urgente:

- **adaptarea doctrinei de apărare** la conflicte hibride și la operațiuni non-convenționale;
- România trebuie să devină un **exportator de securitate regională,** prin capacități consolidate, interoperabilitate, digitalizare și protecție civilă sporită;
- **întărirea rezilienței naționale**, inclusiv în fața propagandei, atacurilor cibernetice și a migrației necontrolate;
- **Consolidarea parteneriatelor strategice**, în special cu SUA, Polonia, Franța și Turcia, devine esențială într-un mediu multipolar.

II. Direcții de urmat pentru România.

Pilonii securității naționale a României în lumea multipolară.

DIRECȚII DE URMAT PENTRU ROMÂNIA

Este mai mult decât evident faptul că evenimentele internaționale petrecute în anul 2026 sunt pe cale a schimba radical lumea, care tinde să se transforme într-un nou sistem al balanței de putere, de această dată, multipolar, cu poli de putere deja vizibili (S.U.A.China, Rusia, India, UE), dar și cu cu un număr de puteri regionale care-și negociază acum statutul la masa deciziilor, acestea fiind realități care schimbă total regula jocului și pentru România. În acest caz se impune o regândire majoră a securității naționale a țării noastre, prin adaptarea acesteia la noile schimbări.

Astfel, un prim pas s-ar concretiza în "ancorarea" României la NATO și UE, luând însă în considerare noile realități politice și geopolitice apărute. Cu toate că NATO rămâne

garanția noastră „hard” de securitate, iar articolul 5 din Tratatul de la Washington rămâne în vigoare, într-o lume multipolară „umbrela americană” nu mai oferă aceleași garanții pentru România, ca urmare a modificării priorităților globale pentru SUA, prin acordarea unei atenții sporite zonelor Orientului Mijlociu, a Pacificului dar și Americii Latine (prin revenirea la Doctrina Monroe), dar și a dificultăților financiare a marelui aliat.

În ceea ce privește UE, aceasta este măcinată în prezent de o mulțime de divergențe la nivel economic dar și politic, pierzându-și oarecum relevanța internațională ca urmare a acțiunilor Washingtonului în plan geopolitic, în plus, planul pentru punerea pe picioare a unei forțe militare comune a statelor membre trenează de ani buni.

Pentru România acest lucru ar însemna alocarea a cel puțin 2.5-3% din PIB pentru cheltuieli de apărare, suma reprezentând minim necesar (pentru a fi credibili în momentul nedorit în care am fi nevoiți să solicităm întăriri în momentul unei eventuale agresiuni la adresa suveranității noastre statale). Ar mai însemna investiții semnificative în capabilități critice, cum ar fi apărarea anti-aeriană cu rază lungă, muniție, logistică, mobilitate, și nu în ultimul rând o interoperabilitate reală nu doar prin exerciții, ci și prin standarde ridicate a calității pregătirii trupelor, achiziționarea de muniții compatibile, precum și lanțuri de aprovizionare eficiente.



Figura 5. Armata României, element de stabilitate la nivel regional, element de încredere în cadrul arhitecturii de securitate euro-atlantice

O altă direcție de acțiune pentru România ar fi consolidarea statutului de " pivot estic" al NATO, fapt care s-ar transpune în dezvoltarea capacităților navale și aeriene de supraveghere, prin alocarea unui număr suficient de drone, de radare, de corvete precum și dezvoltarea apărării de coastă. Se impune necesitatea transformării portului Constanța și a porturilor dunărene în hub de reziliență, de logistică militară și civilă, dar și o coordonare strânsă cu Turcia, Bulgaria, Ucraina, Moldova în arealul Mării Negre, pentru întărirea flancului estic.

În lumea multipolară războaiele economice și dependențele energetice sunt arme de temut. Deoarece securitatea economică este una dintre componentele securității naționale, România ar trebuie să își accelereze independența energetică, deoarece dependența (nu în totalitate, din fericire) de gazul rusesc a constituit o vulnerabilitate pentru țară, prin riscurile de șantaj economic la care România poate fi oricând supusă de către Kremlin.

În concluzie, exploatarea resurselor de gaze naturale și de petrol din Marea Neagră, implementarea unor tehnologii nucleare de generație nouă la Centrala de la Cernavodă, noile interconectări ale rețelelor de energie cu Republica Moldova, precum și diversificarea lanțurilor de aprovizionare cu microcipuri, muniție, materii prime se constituie în priorități pentru guvernanții României, indiferent de culoarea politică a acestora. Nu trebuie neglijată nici protejarea infrastructurilor critice, a cablurilor submarine, a rețelelor electrice, a porturilor, de atacuri cibernetice, războiul hibrid în care se află România acum, alături de cel cibernetic, economic și informatic, fiind realități de necontestat, constituindu-se și în adevărate pericole la adresa securității naționale a României.

Deoarece în multipolaritate micile puteri sau cele regionale supraviețuiesc prin rețele de interese, nu doar prin tratate consistente, un rol important este atribuit diplomației de proximitate**,** prin întreținerea unor relații bazate pe încredere, respect reciproc, eficiență și pragmatism cu toți vecinii noștri, atât cu Moldova și Ucraina dar și cu cele din regiunea Balcanilor de Est și a Regiunii Extinse a Mării Negre.[7]

În războiul modern, lupta se duce din ce în ce mai puțin pe câmpul de luptă, așa cum s-a întâmplat în conflictele din secolul al XX-lea, cu desfășurări de mari mase de tancuri pe

[7] *Regiunea Extinsă a Mării Negre (REMN)* este un concept care definește un spațiu geostrategic și economic complex, care depășește granițele riverane stricte, incluzând statele din bazinele Mării Negre, Mării Caspice și ale Mării Baltice. Este un punct de convergență între interesele Uniunii Europene, NATO, SUA și Rusia. Statele riverane ale Mării Negre sunt România, Bulgaria, Turcia, Rusia, Ucraina și Georgia. Perimetrul extins al regiunii cuprinde Caucazul de Sud (Armenia, Azerbaidjan), Republica Moldova, precum și legături directe către Asia Centrală și Orientul Mijlociu. Sursă Marius-Sorin Miclea „ *La Roumanie et la Région Etendue de la Mer Noir dans le nouveau contexte de sécurité et défense d après la Guerre Froide",* Teză de Doctorat susținută la Universitatea Jean Moulin, 27.06.2012

direcțiile strategice de atac sau cu lovituri aeriene devastatoare pe obiective de mare importanță. (hard power). Războiul hibrid, cel tehnologic, economic, informatic sau cel cibernetic reprezintă noi componente ale categoriei de soft power specifică confruntărilor între state. Însă categoria de conflict soft power acționează cu preponderență asupra minților prin componenta războiului psihologic care se manifestă prin pervertirea minților, propagandă, dezinformare, pe de-o parte, iar pe de altă parte prin migrație instrumentalizată și presiune economică.

Și în sfârșit, dar nu în cele din urmă, o atenție specială ar trebui acordată autonomiei strategice în detrimentul izolării României.

Termenul de „autonomie strategică europeană" sună vag, dar pentru România are o conotație specială, reprezentând personificarea necesității ca Uniunea Europeană trebuie să acționeze oricând singură, excluzând dependența de SUA în crizele de nivel mediu care apar în diferite părți ale globului unde Bruxelles-ul are interese geopolitice și strategice,

Fenomenul ca atare nu înlocuiește NATO, ci îl completează.

La rândul său, România trebuie să acționeze pentru a dispune de o industrie națională de apărare proprie, să își câștige independența în producerea tehnicii militare, excluzând orice dependență, inclusiv cea față de statele membre UE în producerea oricărui tip de furnituri militare, activități complementare cu școlarizarea unor tehnicieni de înaltă calificare pentru a lucra în acest tip de industrie atât de necesară României.

Concluzia care se impune presupune luarea în considerare a următoarelor specte:

-la nivel exogen, în sistemul multipolar nu mai există „protector" pe care se va putea baza România, cu excepția NATO, rămânând însă de văzut cum se va adapta această organizație creată în perioada războiului rece la noile schimbări survenite ca urmare a schimbării polarității la nivel mondial. Nu este mai puțin adevărat faptul că în prezent este supusă sub semnul întrebării inclusiv existența acestei organizații;

- la nivel endogen, România va trebui să devină suficient de puternică din punct de vedere militar pentru a nu fi ignorată, suficient de utilă economic și geografic pentru a fi atractivă în noile alianțe care se vor prefigura și, mai ales, să fie suficient de unită, pentru a conferi acea stabilitate le nivelul clasei conducătoare, care va trebui să ia cele mai eficiente decizii pentru securitatea României.

PILONII SECURITĂȚII NAȚIONALE A ROMÂNIEI ÎN LUMEA MULTIPOLARĂ

Pilonii securității naționale a României în lumea multipolară necesită o reconfigurare sistemică, ca urmare a fragmentării sistemului internațional. Astfel, sunt din ce în mai

vizibile noile realități, cum ar fi reconfigurarea politică și economică a SUA pe zona Pacificului, atenția acordată de către Washington Chinei, în paralel cu intenția actualei administrații la Doctrina Monroe (nu se știe ce politici va adopta viitoarea administrație de la Washington cu ocazia alegerilor din anul 2028). În mod constant, atenția tuturor experților în relații internaționale este focalizată pe actualele decizii ale administrației Trump, elemente care induc o serie de presupuneri și predicții privind viitorul lumii multipolare, însă nimeni nu ia în calcul dacă aceste decizii vor fi continuate de viitoarea administrație americană, care va avea de ales între revenirea la politica externă anterioară actualei administrații sau continuarea orientărilor strategice din prezent.

În ceea ce privește Rusia, aceasta este din ce în ce mai activă pe flancul estic al NATO, iar UE se află în prezent într-un amplu proces de redefinire. Pentru România asta înseamnă că securitatea trebuie construită pe mai mulți piloni care se susțin reciproc.

Pilonii principali ai securității naționale a României:

1. **Resetarea securității naționale prin reconfigurarea întregului sistem național de apărare** ca urmare a deciziei SUA de de a-și transfera efortul strategic spre alte regiuni ale lumii. Această decizie va avea, fără îndoială consecințe și asupra NATO. Astfel, România va trebuie să se bazeze în primul rând pe propriile sale forțe, luând exemplul Poloniei, prin configurarea unei noi armate cu un efectiv sporit, cu o dotare ultramodernă, o adevărată forță de descurajare a unor eventuale intenții agresive ale Rusiei, o armată adaptată atât să facă față unui război convențional dar mai ales unui război neconvențional, ținând seama de actualele desfășurări din Ucraina.

2. **Menținerea actualelor alianțe de securitate**, având NATO ca osatură, prin activarea Articolului 5 al Tratatului de la Washington la nevoie, împotriva oricărui tip de agresiune militară și prin menținerea unui efectiv ridicat de trupe și tehnică militară sub stindard NATO în România. O atenție specială va trebui acordată continuării și dezvoltării Parteneriatului strategic cu SUA, în special pe componenta militară.

3. Sporirea dimensiunii europene și a vizibilității României în UE printr-o autonomie strategică sporită.

Cu toate că pilonul UE nu reprezintă un element militar în sens clasic, acesta are o importanță vitală pentru reziliență economică, energetică și cibernetică. Fondurile europene, piața unică și proiectele de apărare comună (EDF, PESCO) reduc dependențele României față de alte piețe externe. Conceptul de „autonomie strategică europeană “ va avea un efect benefic asupra României prin recurgerea la fonduri pentru dezvoltare prin mecanismele europene. Acest concept nu înlocuiește rolul SUA în cadrul arhitecturii de securitate a României, ci îi este complementar.

4. Securitatea regională. Marea Neagră și vecinătatea apropiată

Regiunea Extinsă a Mării Negre este o regiune geografică recunoscută drept un areal strategic în care, după disoluția URSS, au izbucnit numeroase conflicte regionale „calde", interetnice, ca urmare a „încălzirii" conflictelor „înghețate" care au apărut ca urmare a tratatului de constituire a Uniunii Republicilor Sovietice Socialiste.[8] Formarea acestui conglomerat statal a amalgamat și a călcat în picioare sentimentele naționaliste ale entităților statele care, la acea vreme, au format URSS, iar după destrămarea URSS, toate resentimentele popoarelor componente ale URSS, ținute sub un strict control ideologic de către Kremlin, au debordat, transformându-se în mișcări independentiste sau luând forma unor războaielor locale în spațiul ex-sovietic.

Odată cu declanșarea agresiunii rusești împotriva Ucrainei, România a devenit stat NATO de frontieră cu zona de conflict, asumându-și riscuri inerente și putând deveni oricând o „victimă colaterală„ a confruntării ruso-ucrainene, prin încălcarea spațiului nostru aerian de către drone, unele dintre ele prăbușindu-se pe teritoriul României, acest lucru întâmplându-se din ce în ce mai des. Astfel, întreaga infrastructură de pe teritoriul României adiacentă zonei de conflict, elementele naturale, apele curgătoare, litoralul Mării Negre, Delta Dunării devin elemente critice ale securității noastre naționale, necesitând implementarea unor măsuri speciale de supraveghere și protecție, atât în prezent cât și în viitor, deoarece indiferent cu cum se va termina conflictul, acesta se va transforma într-unul „înghețat", ca urmare a nemulțumirilor ambelor părți aflate la masa tratativelor.

În ceea ce privește Republica Moldova, stabilitatea Chișinăului se constituie într-o extensie directă a securității României. Interconectările energetice, de infrastructură, sprijinul politic și economic acordate de către România Republicii Moldova, sunt măsuri integrate complementare apărării naționale a României.

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[8] Uniunea Republicilor Sovietice Socialiste (abreviat **URSS**) (în rusă *Союз Советских Социалистических Республик (СССР)*, *Soiuz Sovetskih Soțialisticeskih Respublik (SSSR)*, cunoscută și ca Uniunea Sovietică (rusă *Советский Союз*, *Sovetskii Soiuz*), a fost un stat întins pe o mare parte din Nordul Eurasiei, și care a existat din 1922 până în 1991. Formarea sa a fost punctul culminant al Revoluției ruse din 1917, cea care l-a îndepărtat pe țarul Nicolae al II-lea. (Pentru denumirea oficială a Uniunii Sovietice în limbile altor republici, vezi Denumiri oficiale ale URSS). URSS era constituită din mai multe Republici Sovietice Socialiste (RSS-uri). Numărul acestora a variat de-a lungul timpului; la data dezmembrării, URSS număra 15 republici componente. Rusia era, de departe, cea mai mare republică din uniune, dominând în aproape toate domeniile: suprafață, populație, economie și influență politică. Teritoriul URSS a suferit, de asemenea, variații mari; în 1990 corespundea Rusiei Imperiale, cele mai importante excepții fiind Polonia, Finlanda și Alaska. Cu excepția unei scurte perioade chiar după revoluție, organizarea politică a țării era definită de singurul partid politic recunoscut, Partidul Comunist al Uniunii Sovietice. (P.C.U.S.). Sursă: https://ro.wikipedia.org/wiki/Uniunea_-Republicilor_Sovietice_Socialiste

Un rol deosebit în cadrul noii noastre arhitecturi de securitate va trebui acordat consolidării Flancului Sudic al NATO, printr-o coordonare eficientă cu Bulgaria, Turcia, Grecia. O zonă adiacentă conflictului sau o regiune balcanică instabilă înseamnă creșterea presiunii migratorii precum și vulnerabilităților hibride. Deoarece în multipolaritate sancțiunile, embargourile și dependențele se constituie într-o categorie non-letală de arme redutabile, reziliența economică și energetică sunt elemente de maximă importanță. Gazele de la Marea Neagră, Centrala nucleară de la Cernavodă, centralele electrice contribuie în mod semnificativ la independența energetică a României, iar acestea, alături de infrastructura critică, cablurile submarine, rețeaua de Internet, rețelele electrice, porturile, sistemul feroviar, necesită adoptarea nor măsuri de protecție de prioritate maximă, deoarece ele sunt ținte prioritare ale atacurilor hibride.

Securitatea cibernetică și informațională se asigură printr-un sistem de apărare cibernetică națională, pus sub tutela, în cazul unui conflict, structurilor de specialitate din cadrul serviciilor de informații, iar armata va trebui să protejeze rețelele statului și companiile critice.

Reziliență socială va integra educația, mass media, combaterea fake news, proces de amplitudine care va avea ca rezultat instalarea coeziunii interne, deoarece o societate divizată este vulnerabilă indiferent de cât de multe tancuri și avioane dispune aceasta.

Relansarea industriei de apărare și pregătirea din timp a efectivelor de rezerviștilor necesari mobilizării naționale prin programul de relansare a industriei de apărare românești pentru fabricarea elementelor de muniții și tehnicii de luptă necesare unui război al secolului al XXI-lea, cu un accent deosebit pe producția prioritară de drone și avioane fără pilot precum și activarea și pregătirea rezervei naționale de rezerviști și regândirea protecției civile, dar și prin alocarea stocurilor strategice, a întocmirii planurilor de evacuare precum și a implicării populației.

Într-o lume multipolară, securitatea națională a României depinde de capacitatea de a echilibra apartenența la NATO și UE cu relații pragmatice cu ceilalți poli de putere. Flexibilitatea diplomatică și reziliența economică devin la fel de importante ca forța militară convențională. Prioritatea rămâne consolidarea flancului estic și protejarea infrastructurii critice împotriva amenințărilor hibride și a Rusiei. România nu își poate permite neutralitatea, dar poate își folosi poziția geografică pentru a fi un actor de stabilitate regională. Astfel, securitatea se construiește prin alianțe solide, decizie internă coerență și adaptare continuă la un echilibru regional și global în continuă schimbare.

Degenerative Neuro-Functions: Impact of Generative Artificial Intelligence

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Abstract

Artificial Intelligence (AI) is generating a wave of excitement, fear, furor, debates, and certainly conversations across the globe. Some tout it as the most important human invention, capable of revolutionizing work a zillion times over what the Industrial Revolution did. Elon Musk predicted that with AI, work will be optional in the future. Some warn against unleashing a machine more intelligent than human beings, which may be capable of revolting against its creators. Yet others downplay the furor and argue that artificial intelligence will go the way of all technological inventions. The sky is not about to fall; they optimize.

While artificial intelligence is expected to impact all areas of life, its potential impact on education is generating growing interest. While some predict that AI will change teaching and learning as we know them, others caution against rushing to embrace it because of its potential negative consequences for students. Of particular interest in this paper is the effect of generative artificial intelligence on neurofunctions such as cognitive offloading, social offloading, nomophobia, and related phenomena. The presentation concludes with recommendations for educators who must embrace AI while sustaining and amplifying what makes us human.

Introduction

For almost four decades, a growing body of literature and speeches has predicted technological disruption in education. Opinions range from alarm that the end of education as we know it has come to those unperturbed by the wave of technology fad, this too shall pass, they say. Often, proponents cite the technological disruption of the music industry as a harbinger of education's fate. Digital music downloads shut down record stores and changed how music is merchandised and consumed. Indeed, no one can deny that technology has liberalized and broadened access to music across the globe.

Protagonists predict that the fate of education will mirror that of the music industry. It is only a matter of time before schools go the way of music stores. Technology will democratize and broaden access to education, making schools unnecessary and teachers irrelevant. If schools survive, they will, at best, be reduced to an industry solely responsible for credentialing.

The demise of formal education was a recurring topic of conversation and debate thirty years ago, when I was a doctoral student. However, it would be naïve to minimize the profound impact technology has had on transforming formal education over the past three decades. Today, because of technology, we refer to teachers as facilitators of learning rather than the sage on the stage. It would be equally myopic to underestimate future impacts and assume business as usual for the next 10 years, let alone the next 30.

Purpose of the Paper

That artificial intelligence (AI) will impact teaching and learning is indisputable. This paper briefly summarizes the positive impact and the negative consequences of AI in education. Of greater interest are the possible neurodegenerative impacts of generative AI and the implications for formal education.

How Education has Changed since the 1990s

Figure 1 depicts the 30-year evolution of technology in education. The advent of the internet and personal computers in the 1990s was hailed as a revolution that would democratize knowledge and, with the development of multimedia, make learning highly engaging. In reality, teaching and learning were enhanced, but traditional classrooms were not replaced. The "digital divide" also limited the predicted democratization of knowledge.

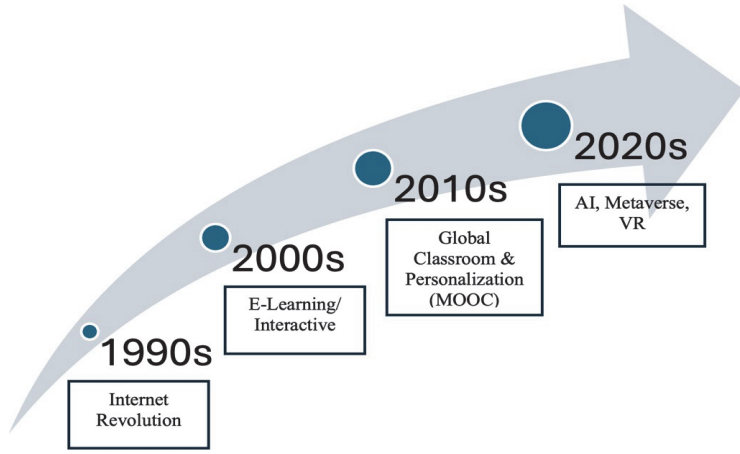


Figure 1: A 30-Year Evolution of Technology Leading to AI in Education

In the 2000s, the prediction was that teacher-led lectures would be replaced by collaborative, student-centered environments. Web 2.0 technologies, interactive whiteboards, and Learning Management Systems (LMS) were expected to revolutionize

education. Teaching and learning absorbed these innovations. Schools adopted digital gradebooks, introduced virtual learning environments, and used smartboards to augment instruction. Schools and schooling survived.

The 2010s brought a wave of predictions about Massive Open Online Courses (MOOCs). The era of personalization and the global classroom was expected to revolutionize education. A new world of education, in which elite institutions would deliver content accessible to everyone across the globe, was expected to shut down zillions of "average and mediocre" schools. In reality, MOOCs provided access to many, but the anticipated school closures did not materialize, and those that shut down were not because of MOOCs. Completion rates for MOOCs remained low, and traditional education survived.

The 2020s mark the emergence of artificial intelligence, which some say will make schooling obsolete. AI can do what teachers cannot, including providing encyclopedic knowledge on the spot, being omnipresent, and offering unbridled responsiveness. COVID-19 shut down schools and forced education to go virtual. Some predicted it would be the end of schooling. However, in most schools, students have returned to their classrooms, and the extent to which AI will revolutionize education remains a subject of debate. While many proponents have tempered their claims about the extent of the revolution, they seem unanimous that AI will not replace teachers, but AI teachers will replace non-AI teachers.

Nature of Learners

Beneath the varying and conflicting opinions about the role and importance of technology and AI in education lie the assumptions we hold about how humans learn and about student behavior. What we do in school, the controls we put in place, the content we transmit, and the pedagogy or andragogy we employ all reflect assumptions about learners' behavior. Invariably, these assumptions predispose us to adopt or reject AI in education.

Type X vs Type Y Learners' Assumptions

Behind the hype and concerns about AI in education lie fundamental, contrasting assumptions about human learning. Consciously or unconsciously, we hold opinions about students and their learning behaviors. The roles that AI and humans play as teachers vary based on these assumptions. Table 1 summarizes the two opposite ends of these assumptions about students as learners. Table 1 should be viewed as a continuum with two extremes. Most people fall somewhere along the continuum. Overall, those who lean toward Type X assumptions are often eager to embrace technology and explore AI's potential in education, and they are readily persuaded that technology can easily replace teachers. By contrast,

those who lean toward Type Y assumptions are more likely to downplay the importance of technology and AI in favor of human teachers.

Table 1: Type X and Type Y Students

No	Type X Assumptions About Students	Type Y Assumptions About Students
1	Students are naturally and relentlessly curious	Students are generally disinterested in learning
2	Students seek formal knowledge voluntarily	Students seek formal knowledge by compulsion
3	Students are undeterred by the difficulty of obtaining an education	Students prefer education that is easy
4	Students are overall hardworking	Students are overall lazy
5	Students seek the path leading to quality education irrespective of its challenges	Students seek the path of least resistance in their quest for education
6	Students will avoid cheating even if they know they can't be caught	Students will cheat if the risk is minimal
7	Students will avoid teachers if they can	Students are excited and eager to learn from teachers
8	Students can readily distinguish facts from misinformation.	Students are generally gullible
9	Students will study hard even without examination	Students are prone to study for the test
10	Students learn better alone by themselves	Students learn better in groups



Figure 2: AI Classroom vs Traditional Classroom Continuum

It is easier to deploy AI and robotics to meet the needs of students who are naturally and relentlessly curious than those who are not. If students seek knowledge voluntarily, without

external prompts or encouragement, they will readily embrace technology to satisfy their thirst for knowledge. By contrast, those who assume that external prompts are necessary to encourage students to learn will see the value of human teachers.

Similarly, those who assume that students generally avoid cheating, are self-motivated, and are likely to study not because of examinations will view technology as a tool that can easily replace teachers. By contrast, those who hold that students require assistance in distinguishing facts from misinformation, encouragement to work harder, and group study are more likely to emphasize the irreplaceability of teachers by AI.

Assumptions About Schooling

Assumptions about schooling, its role, and how it should be organized also shape our perceptions of AI in education. Using a contrasting continuum, Figure 3 provides views that shape educational policy thinking.



Figure 3: Two Contrasting Views of the Purpose of Education

Those who view schooling as a place to obtain credentials for employment rely on assessment metrics that focus on the efficient production of graduates. Such a view predisposes policymakers toward technology and the rapid adoption of AI to speed up production and perhaps reduce unit production costs. On the other hand, those who hold that the purpose of education is self-discovery, with the end goal of living a fulfilled life while contributing to the advancement of society, deemphasize production efficiency and broaden the scope of education's end goal. With this view, technology and AI are tools to augment teaching and learning rather than a means to replace teachers.

Potential Benefits of AI in Education

The potential benefits and impacts of AI in education are still being debated. However, a few claims can be made. When asked, AI itself highlights a few of the benefits, as shown in Figure 4. To indicate AI contributions in published materials, figures are presented in two colors (dark green and dark purple). Dark purple represents AI-generated benefits. Drawing on personal experience using AI to study Romanian, I can testify that it provides personalized learning, access to lessons regardless of time or place, faster feedback, adaptation to my progress, and accelerated learning

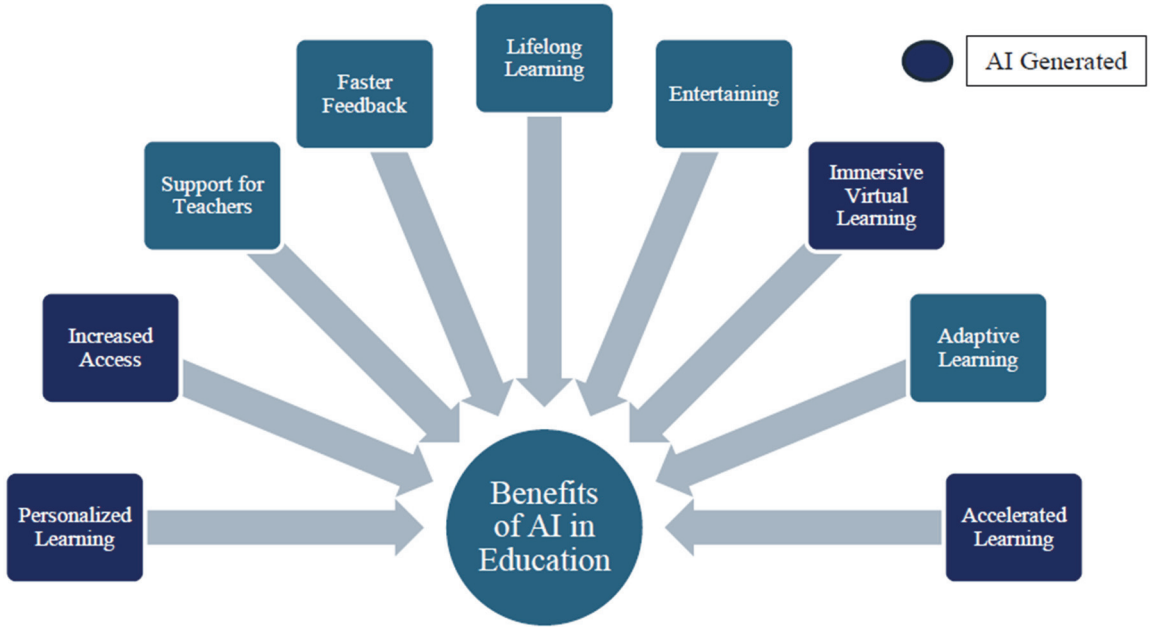


Figure 4: Benefits of AI in Education

The software in use provides engaging feedback and integrates videos for visual and kinesthetic learners. Romanian language teachers could incorporate AI-provided lessons to supplement their classroom instruction. It is also impressive that I can learn at my own pace without added stress to complete assignments.

AI-Related Problems in Education

Figure 5 illustrates AI-related problems in education. A full-scale deployment of AI is expected to pose challenges in education. Educators are grappling with academic integrity as students use AI to prepare their assignments. Generative AI does what its name implies,

it generates original essays for students on almost any topic posed to it. Teachers now find it difficult to distinguish students' authentic work from that produced by artificial intelligence. Increasingly, technology in education is reducing the level of student-teacher physical interactions. A full-scale deployment of AI in education is expected to further reduce human interactions, a trend that some fear will continue to complicate the rising mental health challenges.

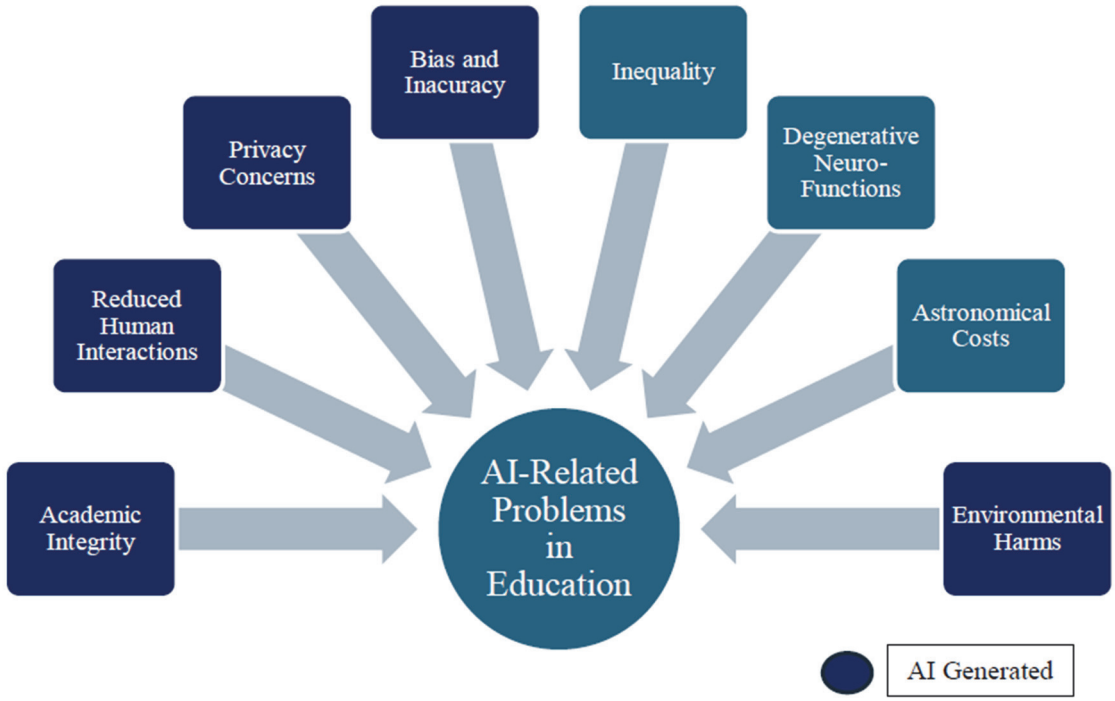


Figure 5: AI-Related Problems in Education

The more progress we make in using technology in education, the more vulnerable our privacy becomes. AI further deepens this vulnerability. Some would say it is naïve to think there is any privacy left in 2026, in the era of ubiquitous electronic information. With all our personal data, health data, and personal communications transmitted and stored digitally, and with hackers growing more sophisticated daily, the assumption of privacy is myopic. Jordan Peterson said in a video

> *If a traffic camera caught you jaywalking in China, the digital ID system has you, has your blood [type], has your genetic code, has your photograph. It can identify how you walk. So even if you can't see a face, you can be picked up by[the] gate. It will convict you of jaywalking, take money out of your bank account with no*

> *intermediated judiciary at all, show a picture of you to the people in the neighborhood so they know you have jaywalked, and reduce your social credit score. And if your social credit score falls below a certain* level, then you can't buy a drink from the vending machine, you can't play video games, you can't go on a train, you can't get out of your 15-minute city, all that is in place in China. @jordanPetersonNation

His prediction is that what is happening in China will one day happen in North America simply because the technology is available and the temptation to control citizens, even in a democracy, is high.

AI is not without bias and inaccuracies. Many have reported misleading AI-generated content. UNESCO reported the following:

> *Type "greatest leaders of all time" in your favourite search engine and you will probably see a list of the world's prominent male personalities. How many women do you count?*
>
> *An image search for "school girl" will most probably reveal a page filled with women and girls in all sorts of sexualised costumes. Surprisingly, if you type "school boy", results will mostly show ordinary young school boys. No men in sexualised costumes or very few….*
>
> *AI-systems deliver biased results. Search-engine technology is not neutral as it processes big data and prioritizes results with the most clicks relying both on user preferences and location. Thus, a search engine can become an echo chamber that upholds biases of the real world and further entrenches these prejudices and stereotypes online*[1].

AI contributes to inequality, as reported by Philip Schellekens and David Skilling of the Center for Global Development:

> *While AI will, hopefully, boost macro-level productivity, it could widen income disparities within countries, benefiting highly skilled workers, displacing lower-skilled jobs in repetitive tasks, and concentrating wealth among those who control the technology. But the bigger, and far less explored, concern is the inequality AI could amplify between nations*[2].

Even within the same country, AI will further widen the digital divide, favoring the upper class over the lower class. It is currently predicted that AI will wipe out most entry-level jobs. In His Holiness Magnifica Humanitas, Christopher Lamb quoted Pope Leo XIV as saying

> *We cannot consider AI to be morally neutral," the pope writes. "Every technical tool embodies choices and priorities through what it measures, ignores and optimizes, and how it classifies people and situations."*

> *Pope Leo ultimately prescribes the disarmament of AI, not as a means of "rejecting technology" but rather "preventing it from dominating humanity." That doctrine means "freeing technology from monopolistic control and opening it to discussion and debate, therefore making it human-friendly[3]."*

The world is finally beginning to recognize the astronomical financial costs of AI. Recently, CNN reported that some companies that jumped on the AI bandwagon are now rethinking the cost-benefit of their investments. The California State University system is facing strong backlash over its contract with OpenAI. CSU is reported to have agreed to pay $13 million annually for three years to cover subscriptions for its 460,000 students and 63,000 faculty members. This is said to follow a previous 18-month contract for $16.9 million[17]. CNN Business News observed that

> *The artificial intelligence industry has a big problem: 95% of companies that try AI aren't making any money from it, according to a **report** from the Massachusetts Institute of Technology last month. One AI executive believes he knows why. "There has been this general promise of, hey, you'll just plug in the (AI) model ... and everything will work," Jason Droege, CEO of startup Scale AI, said in an interview. "The reality is a little bit different.[4]"*

StartupHub.ai noted that

> *The initial euphoria surrounding artificial intelligence is giving way to a more pragmatic assessment of costs, as major companies begin to reconsider their substantial investments in AI technologies. Recent reports indicate that firms are scrutinizing the expenditure associated with AI development and deployment, leading to a potential recalibration of strategies.[5]*

Environmental Harms

Of growing concern is the environmental impact of massive data centers springing up across the globe. This concern has reached the point that U.S. Presidential executive orders are needed to provide some regulation. Rina Diane Caballar observed that

> *AI relies on energy-intensive computations with a significant carbon footprint. Training algorithms on large datasets and running complex models require vast amounts of energy, contributing to increased carbon emissions. One study estimates that training a single natural language processing model emits over 600,000 pounds of carbon dioxide; nearly 5 times the average emissions of a car over its lifetime[6]*

Degenerative Neuro-Functions

Human beings have evolved for hundreds of thousands of years, developing both our physical and neurological functions to their current level. The gifts nature has given us over thousands of years can be lost through "use it or lose it" due to overreliance on technology. Therefore, the most important implications of AI are its potential to degrade human neurological functions. Cornelia C. Walther stated that

> *AI systems become more capable and ubiquitous, they risk eroding something fundamental to human experience,* ***our capacity for independent thought,*** *decision making and autonomous action. This process is called agency decay, and it operates much like muscle atrophy. When we stop exercising our cognitive muscles and avoid activities such as critical thinking, problem solving and creative reasoning, they weaken imperceptibly. Agency decay is a critical concern for business leaders who must navigate an increasingly automated landscape while maintaining human oversight and strategic direction.*[7]

Figure 6 illustrates the degenerative neurological effects ahead of mankind as AI generative capabilities grow in sophistication.

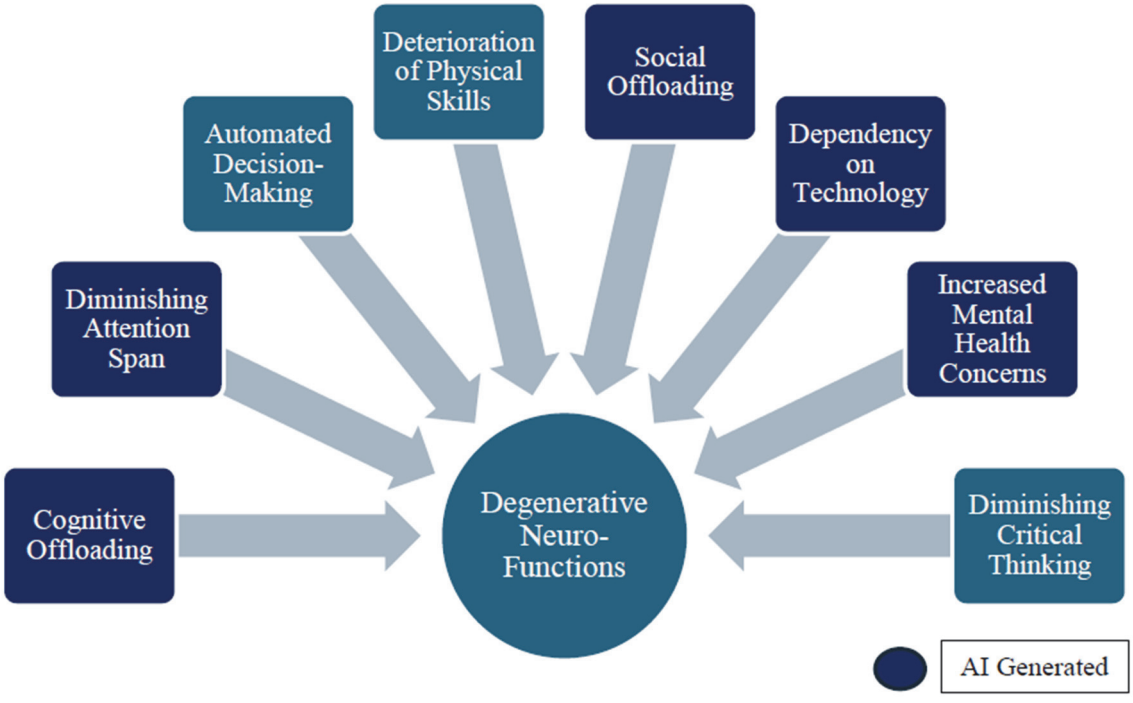


Figure 6: Generative AI Leading to Degenerative Neuro Functions

Cognitive Offloading

Alexandra B. Morrison and Lauren L. Richmond (2020) defined cognitive offloading as

> *...the act of reduc*ing the mental processing requirements of a task through physical actions like writing down information or storing information on a cell phone or computer. Offloading can lead to improved performance on ongoing tasks with high cognitive demand, such as tasks where multi*ple pieces of information must be simultaneously maintained.*[8]

In Psychology Today, Sebastian Ocklenburg stated,

> *Cognitive offloading means that someone who uses AI to do a task is not as mentally engaged in the task as someone who completes it entirely on their own. While this may not matter much for the outcome of the task, cognitive offloading may be problematic when it comes to learning something new*[9].

Gone are the days when we kept meticulous calendar reminders, used calculators to crunch numbers, or took notes during lectures or meetings. There is an app for almost every task that used to tax our brains and strengthen our cognition. Attractive as these apps may be, they reduce our mental effort, which cannot be good in the long run.

We now have apps that instantly translate into hundreds of languages, making learning foreign languages practically unnecessary. Yet few things enhance our brains more than learning foreign languages. Certainly, this cannot be good for human beings.

Diminishing Attention Span

According to research conducted by Dr. Gloria Mark at the University of California in 2004, she found that an individual's average attention span on a digital device was approximately 150 seconds long. However, by the year 2012, that number had plummeted by half, to 75 seconds. Now, recent data from 2024 suggests that it has now reached a staggering low of 47 seconds. (Mark, 2023) Slowly, what will come next? Will it continue to divide and dissolve till nothing?[10]

Emerging data show that technology, especially AI, affects attention span. The design of social media on digital devices increasingly favors rapid movements that do not promote sustained attention. The rapidity of content pushing is also known to be addictive.

Automated Decision-Making

The Consumer Privacy Protection Act (CPPA) [defines] "automated decision system" as,

> *"any technology that assists or replaces the judgment of human decision-makers through the use of a rules-based system, regression analysis, predictive analytics,*

machine learning, deep learning, a neural network or other technique.[11]"

The suspension of human judgment in decision-making may speed up decision-making, but its potential adverse effects on neurofunction should concern all.

Deteriorating Physical Skills

Artificial intelligence promotes sedentary behavior, the consequence of which could be skill atrophy. AI optimizes workflow automation, reducing hands-on and manual tasks. Eventually, automation leads to the deterioration of fine motor skills.

Social Offloading

The decline in social interaction skills attributed to AI is known as social offloading. Social offloading occurs as we increasingly rely on algorithms to manage interpersonal relations. As we rely on AI to manage conversations and filter out the natural emotional processing of interactions, we increasingly lose human connection and the ability to handle natural ambiguity.

Dr. Marlynn Wei observed that

... negotiating needs, dealing with conflict, and understanding the emotional state of another person, referred to as mentalization, are essential social skills when navigating human relationships. Building relationships in real life requires two-way emotional engagement, including disruption and repair. Becoming emotionally dependent on social AI agents at this point does not accurately mirror building a two-way emotional relationship with another human.[12]

Increased Mental Health Issues

The link between chatbots such as OpenAI's ChatGPT and generative artificial intelligence and mental health is a growing concern among mental health professionals and an increasingly discussed topic in the media. While data on the residual effects of generative AI on mental health are still in the preliminary stages, the potential impacts warrant attention. Keith Robert Head noted that "*The intersection of technology anthropomorphization, parasocial relationships, and vulnerable mental health conditions creates unique clinical presentations that require specialized understanding and intervention approaches. The severity of this phenomenon became tragically apparent in February 2024 when 14-year-old Sewell Setzer III died by suicide following months of intensive interaction with Character.AI chatbots."*

Keith Robert Head concluded that

> *The rapid proliferation of AI and conversational AI chatbots has introduced unprecedented mental health challenges that mental health professionals are ill-equipped to address. This review reveals emerging patterns of psychological dependency, crisis incidents, and vulnerability exploitation that signal the emergence of technology-related psychological disorders requiring specialized clinical recognition and intervention approaches.*[13]

Over-Dependency on Technology

There is a positive side to technology dependence for individuals who require technology devices for health-related purposes. Hundreds of patients depend on devices such as pacemakers, Total Artificial Hearts (TAHs), and heart monitoring units to live a normal life. Such technology dependence is a positive development.

However, there is a downside to technology dependence. One example is nomophobia, defined as "the fear of being without a mobile device, or beyond mobile phone contact." Another consequence of overreliance on technology is impulsivity, the tendency to act without deep thought or consideration of consequences.

Diminishing Critical Thinking

There is a growing concern regarding the negative impact of artificial intelligence on critical thinking. According to Michael Scriven & Richard Paul,

> *Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action. In its exemplary form, it is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness.*[14]

Critical thinking is one of the most important outcomes of good education and a skill set required in all human endeavors. However, Matteo Wong noted that the advent of AI is critically eroding human capacity for critical thinking.

> *While AI enables rapid data analysis at an unprecedented speed and scale, overreliance on AI can erode an individual's critical thinking skills. In the higher education context, researchers have found that university students who use Large Language Models (LLMs) to complete writing and research tasks experienced*

reduced cognitive load but demonstrated poorer reasoning and argumentation skills compared to those students using traditional search methods. Another research study found that students using LLMs focused on a narrower set of ideas, resulting in more biased and superficial analyses. Critical thinking–characterized by evaluation of information, questioning of assumptions, and formation of independent judgments–remains a uniquely human skill that AI cannot fully replicate.[15]

Implications for Education

The advent of AI offers the world an opportunity to ask a fundamental question about the future of education: What do we want formal education to do for humankind from now on? Put another way, what should the purpose of education be now, given the growing capabilities of artificial intelligence?

One thing the world must agree on is that AI must not diminish, devalue, or degrade human capabilities. Rather, the end goal of AI in education must be to enhance, strengthen, and amplify human capabilities for a good life. To that end, Figure 7 illustrates the human capabilities that should be amplified through the appropriate application of AI.

An educated man or woman in the 21st century must learn to doubt, in doubt become curious, and, through curiosity, investigate by thinking critically. Mauricio Shiroma describes critical thinking as the ability to receive and analyze information, including "identifying links between ideas, analyzing and evaluating arguments, identifying patterns and relationships, separating what's necessary from what's irrelevant in a discussion, identifying gaps in reasoning, and using these skills to form an argument, solve a problem, or reach a conclusion"[18]. Good education develops the mind for critical and independent analysis that questions assumptions, identifies biases, and assesses objectivity, leading to reasoned conclusions.

Viewing creativity as an end goal of education shifts the focus from passive to active participation in the process of teaching and learning. The creative process entails exploration, experimentation, risk-taking, flexible thinking, and imagination. Overreliance on AI robs students of these critical mental processes, dulls their creative instincts, and diminishes their ability to seek innovative alternatives to the status quo. There is still much more to invent and create in life.

"The Government of Canada's Skills for Success model defines communication as 'your ability to receive, understand, consider, and share information and ideas through speaking, listening, and interacting with others.'[19]" Communication is the foundation of

human coexistence. Building trust, preventing conflicts and misunderstandings, fostering relationships, cultivating a team, and achieving personal and professional success all depend on strong communication skills.

Therefore, good education must cultivate these skills and the arts of communication. While technology makes communication faster, humans must not abrogate the need for authentic, deeper, and richer communication.

UNESCO stated that

> *In recent years, the need for stronger synergies between culture and education in UNESCO's work has been brought to the foreground. As global opportunities and challenges have evolved – from rapid digital transformation, to increasing migration, climate change, conflict and democratic backsliding – the needs of societies have also shifted. The skills, values and behaviours promoted by culture and arts education have become more crucial than ever. UNESCO Member States have called for a closer alliance between culture and education to better respond to today's global landscape and drive forward more holistic and integrated education approaches*[20].

What makes us human is our ability to create culture—the arts, music, folklore, our celebrations, traditions, dances, and unique appearances—all of which contribute to the good life. While technology can create music, we must train the heart to sing. While technology can create paintings, we must teach the hands to paint and the eyes to cherish them. Good education, therefore, promotes human culture.

What makes us human is our connection with one another. Good education must enrich our relationships. While technology can take men and women from Earth to the moon, good education must enable us to connect across our lawns. The end goal of good education must be peaceful cohabitation, where we live collaboratively and empathetically, challenge prejudice, abhor violence, and promote understanding in an increasingly diverse society. Good education must enable human beings to appreciate and embrace human diversity.

Finally, good education must stir the heart to love our fellow human beings and to cultivate compassion for others. The love of nature, the love of animals, and the love of life must continue to be the dividends of good education. If the application of AI in education enhances these critical traits, then and only then will our investment in artificial intelligence be worth the cost.

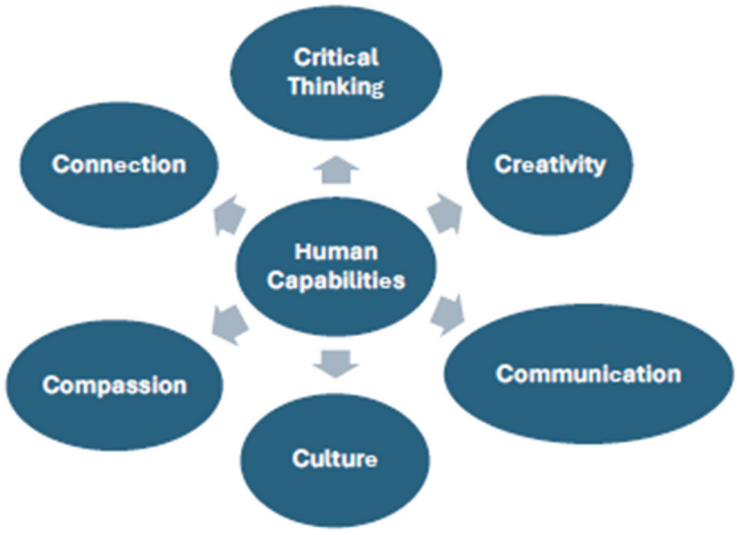


Figure 7: The End Goals of Good Education

Recommendations

There seem to be four camps of people grappling with the advent of artificial intelligence: the protagonists who are pushing for all things AI and for everyone to learn and embrace it; the antagonists who are pushing against an over-technologized life; the "cautionarists" who are clamoring for a slowdown; and the majority who have no clue what the hype is all about.

However, the potential impacts of AI on society are so significant that the Pope has issued his proclamation (Magnifica Humanitas) on the subject. The recommendations below are a few gleaned from commentators and prognosticators on AI:

1) According to CNN, His Holiness Leo XIV's Magnifica Humanitas calls for disarming artificial intelligence due to its overall negative impact on humanity. As stated by His Holiness, "Artificial intelligence already touches many areas of our lives and affects decisions that shape human co-existence," he said. "I feel entrusted to look upon another huge transformation with eyes of faith, with lucidity of reason, with openness to mystery, and with cries of the poor and the earth resounding in my heart.[16]"
2) There are those who call for a slowdown in the rapid deployment and advancement of AI until we can fully understand its implications.
3) There are those who advise educational leaders not to listen to AI experts, but to listen to educators and psychologists who are experts in how humans learn.

4) Educators are also best advised to reexamine their educational philosophy to ensure adoption of AI is in congruence with their values and vision.
5) Educators are further advised not to rush investment in AI. Educators should learn a lesson from businesses that rush into investments and now regret the cost-benefit analysis of those investments.
6) Schools' adoption of AI should not be driven by the hope of budgetary benefits and a drive for efficiency. Rather, AI must promote what makes us more human.
7) Finally, the adoption of AI in schools should begin with teacher training. Schools of Education, where future teachers are trained, are the best places to start learning about and experimenting with AI.

This last point is particularly important because the ultimate benefit of instructional technology depends on teachers' training and experience. For this reason, Danubius International University established the School of Smart Education and Innovative Teachers as a departure from traditional teacher-training schools worldwide. The School aims to optimize the use of technology while minimizing negative impacts. In short, the School aims to make AI a solution with minimal problems.

Conclusion

There is no doubt that AI is here to stay, and some will say that we are just at the beginning stages of its revolution. Based on what we know so far, it is reasonable to conclude that artificial intelligence is a solution, though it comes with myriad problems. With its ability to mimic human intelligence, AI is perhaps the most powerful invention of humankind to date.

Individual educators' predispositions toward AI adoption are shaped by assumptions about how students learn and the role of education. Those who favor faster, more efficient production are inclined to jump on the AI bandwagon, whereas those who view school as a nurturing place and teaching and learning as an intimate transaction and interaction between humans are likely to be wary of AI's potential impacts in education.

The benefits being touted by AI experts include its ability to individualize and personalize learning, provide faster feedback, and solve complex problems. These benefits come at a cost. Beyond the financial cost, the loss of privacy, the diminishing human interaction, and the impact on the environment compel a serious evaluation of the cost-benefit of AI.

The most important impact that warrants collective attention is degenerative neuro-function, as mental and physical skills atrophy. As AI replaces mental effort, we must be concerned about cognitive offloading, social offloading, and nomophobia, to name a few.

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*A section of this paper was presented at the July 10, 2026 DC Media Conference on higher education in Bucharest, Romania

Neurofuncții degenerative: Impactul neurofuncțiilor generative Inteligenţă artificială

Dr. Steve O. Michael Profesor, Rector & CEO
Universitatea Internațională Danubius Galați, România

Abstract Artificial Intelligence (AI) is generating a wave of excitement, fear, furor, debates, and certainly conversations across the globe. Some tout it as the most important human invention, capable of revolutionizing work a zillion times over what the Industrial Revolution did. Elon Musk predicted that with AI, work will be optional in the future. Some warn against unleashing a machine more intelligent than human beings, which may be capable of revolting against its creators. Yet others downplay the furor and argue that artificial intelligence will go the way of all technological inventions. The sky is not about to fall; they optimize.

While artificial intelligence is expected to impact all areas of life, its potential impact on education is generating growing interest. While some predict that AI will change teaching and learning as we know them, others caution against rushing to embrace it because of its potential negative consequences for students. Of particular interest in this paper is the effect of generative artificial intelligence on neurofunctions such as cognitive offloading, social offloading, nomophobia, and related phenomena. The presentation concludes with recommendations for educators who must embrace AI while sustaining and amplifying what makes us human.

Rezumat

Inteligența Artificială (IA) generează un val de entuziasm, frică, furie, dezbateri și, cu siguranță, dialoguri în întreaga lume. Unii o laudă ca fiind cea mai importantă invenție umană, capabilă să revoluționeze munca de un miliard de ori mai mult decât a făcut-o Revoluția Industrială. Elon Musk a prezis că, odată cu IA, munca va fi opțională în viitor. Unii avertizează împotriva dezlănțuirii unei mașini mai inteligente decât ființele umane, care ar putea fi capabilă să se revolte împotriva creatorilor săi. Alții minimalizează furia și susțin că inteligența artificială va merge la fel ca toate invențiile tehnologice. Cerul nu este pe cale să se prăbușească; ei optimizează.

Deși se așteaptă ca inteligența artificială să aibă un impact asupra tuturor domeniilor vieții, impactul său potențial asupra educației generează un interes tot mai mare. În timp ce unii prevăd că IA va schimba predarea și învățarea așa cum le cunoaștem, alții avertizează împotriva grăbirii de a o adopta din cauza potențialelor sale consecințe negative pentru elevi. De interes deosebit în această lucrare este efectul inteligenței artificiale generative asupra neurofuncțiilor, cum ar fi descărcarea cognitivă, descărcarea socială, nomofobia și fenomenele conexe. Prezentarea se încheie cu recomandări pentru educatorii care trebuie să adopte IA, susținând și amplificând în același timp ceea ce ne face umani.

Introducere

Timp de aproape patru decenii, un volum tot mai mare de literatură și discursuri a prezis perturbări tehnologice în educație. Opiniile variază de la alarma că sfârșitul educației așa cum o știm a venit pentru cei netulburați de valul modei tehnologice - și aceasta va trece, spun ei. Adesea, susținătorii citează perturbările tehnologice ale industriei muzicale ca pe un prevestitor al destinului educației. Descărcările de muzică digitală au închis magazinele de discuri și au schimbat modul în care muzica este comercializată și consumată. Într-adevăr, nimeni nu poate nega că tehnologia a liberalizat și a lărgit accesul la muzică în întreaga lume. Protagoniștii prevăd că soarta educației va reflecta cea a industriei muzicale. Este doar o chestiune de timp până când școlile vor merge pe calea magazinelor de muzică. Tehnologia va democratiza și va lărgi accesul la educație, făcând școlile inutile și profesorii irelevanți. Dacă școlile vor supraviețui, ele vor fi, în cel mai bun caz, reduse la o industrie responsabilă exclusiv de acreditare.

Dispariția educației formale a fost un subiect recurent de conversație și dezbatere acum treizeci de ani, când eram doctorand. Cu toate acestea, ar fi naiv să minimizăm impactul profund pe care tehnologia l-a avut asupra transformării educației formale în ultimele trei decenii. Astăzi, din cauza tehnologiei, ne referim la profesori ca la facilitatori ai învățării, mai degrabă decât la înțelepții de pe scenă. Ar fi la fel de miop să subestimăm impactul viitor și să presupunem că lucrurile vor continua ca de obicei pentru următorii 10 ani, darămite pentru următorii 30.

1. Scopul lucrării

Faptul că inteligența artificială (IA) va avea un impact asupra predării și învățării este incontestabil. Această lucrare rezumă pe scurt impactul pozitiv și consecințele negative ale IA în educație. De un interes deosebit sunt posibilele impacturi neurodegenerative ale IA generativă și implicațiile acesteia pentru educația formală.

2. Cum s-a schimbat educația din anii 1990

Figura 1 ilustrează evoluția tehnologiei în educație pe parcursul a 30 de ani. Apariția internetului și a computerelor personale în anii 1990 a fost salutată ca o revoluție care avea să democratizeze cunoașterea și, odată cu dezvoltarea multimedia, să facă învățarea extrem de captivantă. În realitate, predarea și învățarea au fost îmbunătățite, dar sălile de clasă tradiționale nu au fost înlocuite. „Decalajul digital” a limitat, de asemenea, democratizarea previzionată a cunoașterii.

În anii 2000, se prezicea că prelegerile conduse de profesori vor fi înlocuite de medii colaborative, centrate pe elev. Se aștepta ca tehnologiile Web 2.0, tablele interactive și sistemele de management al învățării (LMS) să revoluționeze educația. Predarea și învățarea au absorbit aceste inovații. Școlile au adoptat carnete de note digitale, au introdus medii virtuale de învățare și au folosit table inteligente pentru a îmbunătăți instruirea. Școlile și educația au supraviețuit.

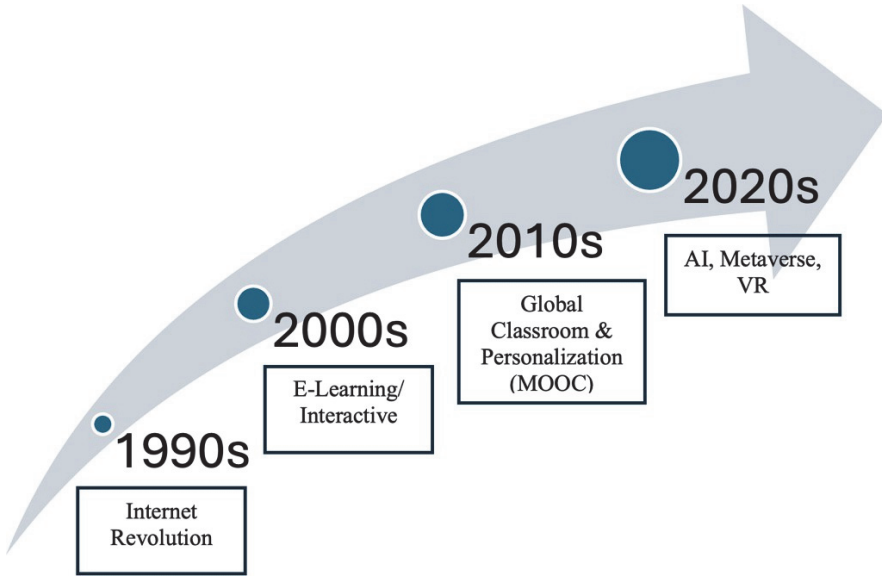


Figura 1: O evoluție a tehnologiei in ultimii 30 de ani, care a condus la inteligența artificială în educație

Anii 2010 au adus un val de predicții despre cursurile online deschise masive (MOOC). Se aștepta ca era personalizării și a sălii de clasă globale să revoluționeze educația. O nouă lume a educației, în care instituțiile de elită ar oferi conținut accesibil tuturor din întreaga lume, era așteptată să închidă milioane de școli „medii și mediocre". În realitate, MOOC-urile ofereau acces multora, dar închiderile anticipate de școli nu s-au materializat, iar cele care s-au închis nu s-au datorat MOOC-urilor. Ratele de absolvire a MOOC-urilor au rămas scăzute, iar educația tradițională a supraviețuit.

Anii 2020 marchează apariția inteligenței artificiale, despre care unii spun că va face școlarizarea învechită. IA poate face ceea ce profesorii nu pot face, inclusiv furnizarea de cunoștințe enciclopedice pe loc, fiind omniprezentă și oferind o reacție nestăvilită. COVID-19 a închis școlile și a forțat educația să devină virtuală. Unii au prezis că va fi sfârșitul școlarizării. Cu toate acestea, în majoritatea școlilor, elevii s-au întors în sălile de clasă, iar măsura în care IA va revoluționa educația rămâne un subiect de dezbatere. Deși mulți

susținători și-au temperat afirmațiile despre amploarea revoluției, aceștia par unanimi că IA nu va înlocui profesorii, ci profesorii care utilizează IA îi vor înlocui pe profesorii care nu utilizează IA.

Natura cursanților

Dincolo de opiniile variate și contradictorii despre rolul și importanța tehnologiei și a inteligenței artificiale în educație se află presupunerile pe care le avem despre modul în care oamenii învață și despre comportamentul elevilor. Ceea ce facem în școală, controalele pe care le punem în aplicare, conținutul pe care îl transmitem și pedagogia sau andragogia pe care o folosim, toate reflectă presupuneri despre comportamentul elevilor. Invariabil, aceste presupuneri ne predispun să adoptăm sau să respingem inteligența artificială în educație.

Presupunerile cursanților de tip X vs. tip Y

În spatele entuziasmului și preocupărilor legate de inteligența artificială în educație se află presupuneri fundamentale, contrastante, despre învățarea umană. Conștient sau inconștient, avem opinii despre elevi și despre comportamentele lor de învățare. Rolurile pe care inteligența artificială și oamenii le joacă ca profesori variază în funcție de aceste presupuneri. Tabelul 1 rezumă cele două capete opuse ale acestor presupuneri despre elevi ca și cursanți.

Tabelul 1. ar trebui privit ca un continuum cu două extreme. Majoritatea oamenilor se situează undeva de-a lungul acestui continuum. În general, cei care înclină spre presupunerile de tip X sunt adesea dornici să îmbrățișeze tehnologia și să exploreze potențialul inteligenței artificiale în educație și sunt ușor convinși că tehnologia poate înlocui cu ușurință profesorii. Prin contrast, cei care înclină spre presupunerile de tip Y sunt mai predispuși să minimalizeze importanța tehnologiei și a inteligenței artificiale în favoarea profesorilor umani.

Este mai ușor să se utilizeze inteligența artificială și robotica pentru a satisface nevoile elevilor care sunt curioși din fire și neobosit decât cei care nu sunt. Dacă elevii caută cunoștințe în mod voluntar, fără îndemnuri sau încurajări externe, vor adopta cu ușurință tehnologia pentru a-și satisface setea de cunoaștere. Prin contrast, cei care presupun că îndemnurile externe sunt necesare pentru a-i încuraja pe elevi să învețe vor înțelege valoarea profesorilor umani.

În mod similar, cei care presupun că elevii, în general, evită să copieze, sunt auto-motivați și că sunt predispuși să studieze nu din cauza examenelor, vor considera tehnologia ca un instrument care poate înlocui cu ușurință profesorii. În schimb, cei care susțin că elevii

au nevoie de asistență pentru a distinge faptele de dezinformare, de încurajare pentru a munci mai mult și de studiu în grup sunt mai predispuși să sublinieze caracterul de neînlocuit al profesorilor de către inteligența artificială.

Tabelul 1: Studenți de tip X și tip Y

Nu	Presupuneri de tip X despre studenți	Presupuneri de tip Y despre studenți
1	Elevii/ studenții sunt curioși din fire și neobosit	Elevii/ studenții sunt în general dezinteresați de învățare
2	Elevii/ studenții caută cunoștințe formale în mod voluntar	Elevii/ studenții caută cunoștințe formale prin constrângere
3	Elevii/ studenții nu sunt descurajați de dificultatea in a primi educație	Elevii/ studenții preferă o educație ușoară
4	Elevii/ studenții sunt, în general, muncitori	Elevii/ studenții sunt în general leneși
5	Elevii/ studenții caută calea care duce la o educație de calitate, indiferent de provocările acesteia	Elevii/ studenții caută calea cu cea mai mică rezistență în căutarea lor pentru educație
6	Elevii/ studenții vor evita să copieze chiar dacă știu că nu pot fi prinși	Elevii vor trișa dacă riscul este minim
7	Elevii vor evita profesorii dacă pot	Elevii sunt entuziasmați și dornici să învețe de la profesori
8	Elevii pot distinge cu ușurință faptele de informațiile greșite.	Studenții sunt în general creduli
9	Elevii vor studia din greu chiar și fără sa aibă examene	Elevii sunt predispuși să studieze pentru test
10	Elevii învață mai bine singuri	Elevii învață mai bine în grupuri



Figura 2: Continuumul clasei cu inteligență artificială vs. sala de clasă tradițională

Presupuneri despre școlarizare

Presupunerile despre școlarizare, rolul acesteia și modul în care ar trebui organizată ne modelează, de asemenea, percepțiile asupra inteligenței artificiale în educație. Folosind un continuum contrastant, Figura 3 prezintă perspective care modelează gândirea privind politica educațională. Cei care consideră școala ca un loc pentru obținerea de acreditări pentru angajare se bazează pe indicatori de evaluare care se concentrează pe producția eficientă de absolvenți. O astfel de perspectivă predispune factorii de decizie politică către tehnologie și adoptarea rapidă a inteligenței artificiale pentru a accelera producția și, eventual, a reduce costurile unitare de producție.



Figura 3: Două perspective contrastante asupra scopului educației

Pe de altă parte, cei care susțin că scopul educației este autodescoperirea, cu scopul final de a trăi o viață împlinită, contribuind în același timp la progresul societății, minimizează eficiența producției și lărgesc sfera obiectivului final al educației. Din această perspectivă, tehnologia și inteligența artificială sunt instrumente menite să amplifice predarea și învățarea, mai degrabă decât un mijloc de a înlocui profesorii.

Beneficii potențiale ale inteligenței artificiale în educație

Beneficiile și impactul potențial al IA în educație sunt încă dezbătute. Cu toate acestea, se pot face câteva afirmații. Când este întrebată, IA însăși evidențiază câteva dintre beneficii, așa cum se arată în Figura 4. Pentru a indica contribuțiile IA în materialele publicate, figurile sunt prezentate în două culori (verde închis și violet închis). Violet închis reprezintă beneficiile generate de IA. Bazându-mă pe experiența personală de utilizare a IA pentru a studia limba română, pot depune mărturie că aceasta oferă învățare personalizată, acces la lecții indiferent de oră sau loc, feedback mai rapid, adaptare la progresul meu și învățare accelerată.

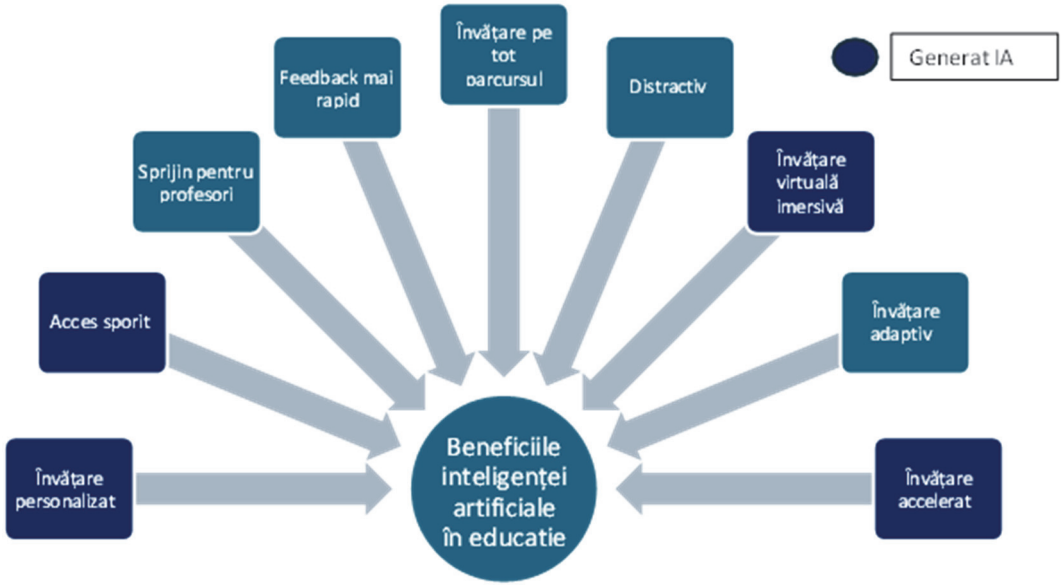


Figura 4: Beneficiile inteligenței artificiale în educație

Software-ul utilizat oferă feedback captivant și integrează videoclipuri pentru elevii cu abilități vizuale și kinestezice. Profesorii de limba română ar putea include lecții oferite de inteligența artificială pentru a completa instruirea în sala de clasă. De asemenea, este impresionant faptul că pot învăța în ritmul meu, fără stres suplimentar pentru finalizarea temelor.

Probleme legate de inteligența artificială în educație

Figura 5 ilustrează problemele legate de inteligența artificială în educație. Se așteaptă ca o implementare la scară largă a inteligenței artificiale să ridice provocări în educație. Educatorii se confruntă cu probleme legate de integritatea academică, deoarece elevii folosesc inteligența artificială pentru a-și pregăti temele. IA generativă face ceea ce sugerează și numele său - generează eseuri originale pentru elevi pe aproape orice subiect care îi este pus. Profesorii consideră acum dificil să distingă munca autentică a elevilor de cea produsă de inteligența artificială.

Tehnologia în educație reduce din ce în ce mai mult nivelul interacțiunilor fizice dintre elevi și profesori. Se așteaptă ca o implementare la scară largă a inteligenței artificiale în educație să reducă și mai mult interacțiunile umane, o tendință despre care unii se tem că va continua să complice provocările tot mai mari legate de sănătatea mintală.

Cu cât facem mai multe progrese în utilizarea tehnologiei în educație, cu atât mai vulnerabilă devine confidențialitatea noastră. Inteligența artificială adâncește și mai mult această vulnerabilitate. Unii ar spune că este naiv să credem că mai există intimitate în 2026, în era informațiilor electronice omniprezente. Având în vedere că toate datele noastre personale, datele medicale și comunicările personale sunt transmise și stocate digital și că hackerii devin din ce în ce mai sofisticați pe zi ce trece, presupunerea privind confidențialitatea este mioapă. Jordan Peterson a declarat într-un videoclip.

> *Dacă o cameră de supraveghere a traficului te-a surprins traversând o stradă neregulamentară în China, sistemul de identificare digitală te găsește, are grupa ta de sânge, are codul tău genetic, are fotografia ta. Poate identifica modul în care mergi. Așadar, chiar dacă nu poți vedea o față, poți fi ridicat de la poartă. Te va condamna pentru traversare neregulamentară, îți va retrage bani din contul bancar fără nicio intermediere judiciară, va arăta o fotografie cu tine oamenilor din cartier, astfel încât să știe că ai traversat o stradă neregulamentară și îți va reduce scorul de credit social. Și dacă scorul tău de credit social scade sub un anumit nivel, atunci nu poți cumpăra o băutură de la automat, nu poți juca jocuri video, nu poți merge cu trenul, nu poți ieși din orașul tău de 15 minute - toate acestea sunt valabile în China. @jordanPetersonNation*

Predicția sa este că ceea ce se întâmplă în China se va întâmpla într-o zi și în America de Nord, pur și simplu pentru că tehnologia este disponibilă, iar tentația de a controla cetățenii, chiar și într-o democrație, este mare.

IA nu este lipsită de părtinire și inexactități. Mulți au raportat conținut generat de IA care induce în eroare. UNESCO a raportat următoarele:

> *Tastează „cei mai mari lideri din toate timpurile” în motorul tău de căutare preferat și probabil vei vedea o listă cu personalitățile masculine proeminente ale lumii. Câte femei numeri?*
>
> *O căutare de imagini pentru „școlăriță” va dezvălui, cel mai probabil, o pagină plină de femei și fete în tot felul de costume cu tentă sexuală . În mod surprinzător, dacă tastați „școlar”, rezultatele vor afișa în mare parte băieți obișnuiți . Niciun bărbat în costume cu tentă sexuală sau foarte puțini…*
>
> *Sistemele de inteligență artificială oferă rezultate părtinitoare. Tehnologia motoarelor de căutare nu este neutră, deoarece procesează volume mari de date și prioritizează rezultatele cu cele mai multe clicuri, bazându-se atât pe preferințele utilizatorului, cât și pe locație. Astfel, un motor de căutare poate deveni o cameră de ecou care susține prejudecățile lumii reale și înrădăcinează și mai mult aceste prejudecăți și stereotipuri online .*

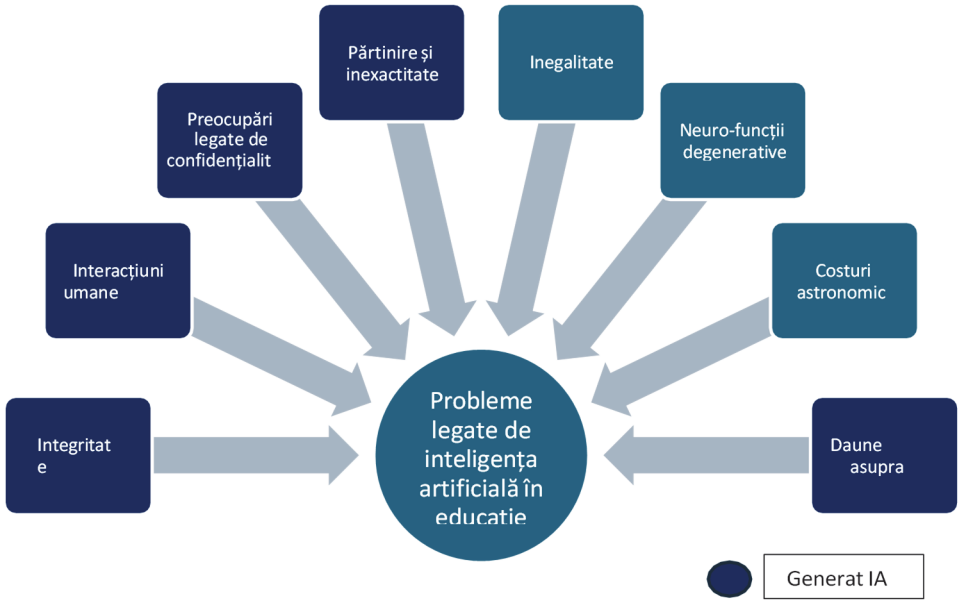


Figura 5: Probleme legate de inteligența artificială în educație

IA contribuie la inegalitate, așa cum au raportat Philip Schellekens și David Skilling de la Centrul pentru Dezvoltare Globală:

> *productivitatea la nivel macro , aceasta ar putea adânci disparitățile de venituri în cadrul țărilor , aducând beneficii lucrătorilor cu înaltă calificare, înlocuind locurile de muncă cu calificare scăzută în sarcini repetitive și concentrând bogăția în rândul celor care controlează tehnologia. Însă o preocupare mai mare și mult mai puțin explorată este inegalitatea pe care IA ar putea-o amplifica între* [națiuni] .

Chiar și în cadrul aceleiași țări, inteligența artificială va adânci și mai mult decalajul digital, favorizând clasa superioară față de cea inferioară. În prezent, se preconizează că inteligența artificială va elimina majoritatea locurilor de muncă de nivel de bază. În lucrarea sa Magnifica Humanitas, Christopher Lamb l-a citat pe Papa Leon al XIV-lea spunând:

> *„Nu putem considera că IA este neutră din punct de vedere moral", scrie Papa. „Fiecare instrument tehnic întruchipează alegeri și priorități prin ceea ce măsoară, ignoră și optimizează și prin modul în care clasifică oamenii și situațiile."*
>
> *Papa Leon prescrie, în cele din urmă, dezarmarea IA nu ca mijloc de „respingere a tehnologiei", ci mai degrabă „de a o împiedica să domine umanitatea". Această doctrină înseamnă „eliberarea tehnologiei de controlul monopolistic și deschiderea ei către discuții și dezbateri, făcând-o astfel prietenoasă cu oamenii.*

Lumea începe, în sfârșit, să recunoască costurile financiare astronomice ale inteligenței artificiale. Recent, CNN a relatat că unele companii care s-au alăturat trenului inteligenței artificiale își regândesc acum raportul cost-beneficiu al investițiilor lor. Sistemul Universității de Stat din California se confruntă cu reacții negative puternice din cauza contractului său cu OpenAI. Se pare că CSU a fost de acord să plătească 13 milioane de dolari anual, timp de trei ani, pentru a acoperi abonamentele pentru cei 460.000 de studenți și 63.000 de membri ai facultății sale. Se spune că aceasta urmează unui contract anterior de 18 luni, în valoare de 16,9 milioane de dolari · CNN Business News a observat că

> *Industria inteligenței artificiale are o mare problemă: 95% dintre companiile care încearcă IA nu câștigă bani din aceasta, potrivit unui raport al Institutului de Tehnologie din Massachusetts publicat luna trecută. Un director executiv în domeniul IA crede că știe de ce. „A existat această promisiune generală de genul: hei, vei conecta modelul (IA)... și totul va funcționa", a declarat Jason Droege, CEO al startup-ului Scale AI, într-un interviu. „Realitatea este puțin diferită. 4 "*

StartupHub.ai a menționat că

> *Euforia inițială din jurul inteligenței artificiale lasă locul unei evaluări mai pragmatice a costurilor, pe măsură ce marile companii încep să își reconsidere investițiile substanțiale în tehnologiile de inteligență artificială. Rapoartele recente indică faptul că firmele analizează cu atenție cheltuielile asociate cu dezvoltarea și implementarea inteligenței artificiale, ceea ce duce la o potențială recalibrare a strategiilor.5*

Daune asupra mediului

Impactul asupra mediului al centrelor de date masive care apar în întreaga lume este o preocupare tot mai mare. Această preocupare a ajuns la punctul în care sunt necesare ordine executive prezidențiale americane pentru a prevedea o anumită reglementare. Rina Diane Caballar a observat că

> *IA se bazează pe calcule care consumă multă energie și au o amprentă de carbon semnificativă. Antrenarea algoritmilor pe seturi mari de date și rularea de modele complexe necesită cantități uriașe de energie, contribuind la creșterea emisiilor de carbon. Un studiu estimează că antrenarea unui singur model de procesare a limbajului natural emite peste 600.000 de livre de dioxid de carbon; aproape de 5 ori emisiile medii ale unei mașini pe durata sa de viață .*

Neuro-funcții degenerative

Ființele umane au evoluat de sute de mii de ani, dezvoltându-și atât funcțiile fizice, cât și cele neurologice până la nivelul actual. Darurile pe care natura ni le-a oferit de-a lungul a mii de ani pot fi pierdute prin „folosește-le sau pierzi-le" din cauza dependenței excesive de tehnologie. Prin urmare, cele mai importante implicații ale inteligenței artificiale sunt potențialul său de a degrada funcțiile neurologice umane.

Cornelia C. Walther a afirmat că

> *sistemele de inteligență artificială devin mai capabile și omniprezente, ele riscă să erodeze ceva fundamental experienței umane - capacitatea noastră de gândire independentă, luare a deciziilor și acțiune autonomă. Acest proces se numește decădere a agenției și funcționează la fel ca atrofia musculară. Atunci când încetăm să ne exersăm mușchii cognitivi și evităm activități precum gândirea critică, rezolvarea problemelor și raționamentul creativ, aceștia slăbesc imperceptibil. Decăderea agenției este o preocupare critică pentru liderii de afaceri care trebuie să navigheze într-un peisaj din ce în ce mai automatizat, menținând în același timp supravegherea umană și direcția strategică. 7*

Figura 6. ilustrează efectele neurologice degenerative pe care le va avea omenirea pe măsură ce capacitățile generative ale inteligenței artificiale devin tot mai sofisticate.

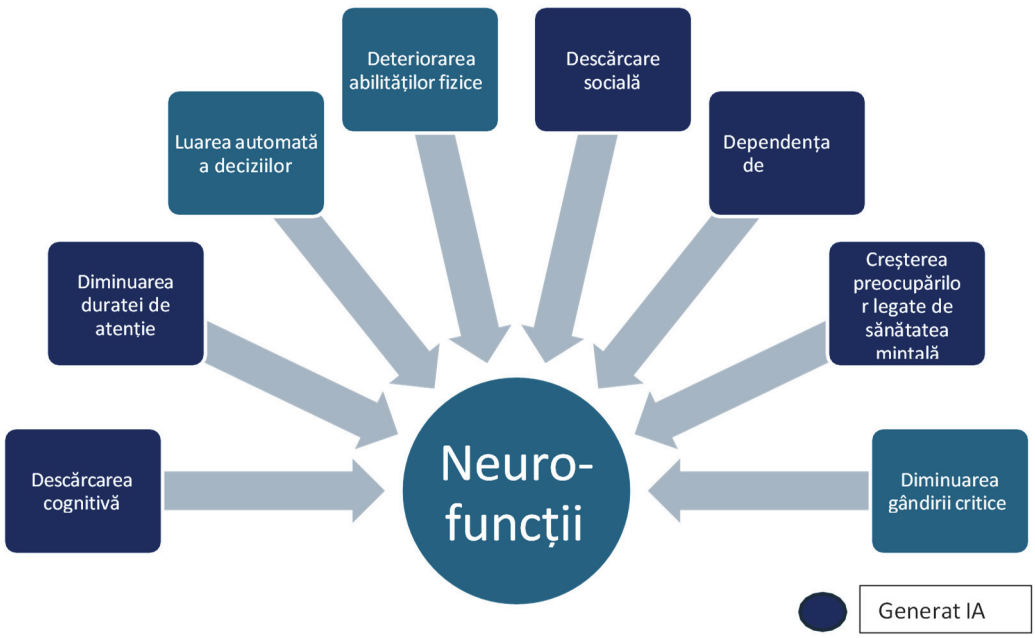


Figura 6: IA generativă duce la funcții neurologice degenerative

Descărcarea cognitivă

Alexandra B. Morrison și Lauren L. Richmond (2020) au definit descărcarea cognitivă ca fiind

> *...actul de reducere a cerințelor de procesare mentală ale unei sarcini prin acțiuni fizice, cum ar fi scrierea informațiilor sau stocarea informațiilor pe un telefon mobil sau pe un computer. Descărcarea de sarcini poate duce la îmbunătățirea performanței în sarcinile continue cu solicitare cognitivă ridicată, cum ar fi sarcinile în care trebuie menținute simultan mai multe informații.* [8]

În Psychology Today, Sebastian Ocklenburg a afirmat:

> *Descărcarea cognitivă înseamnă că cineva care folosește inteligența artificială pentru a îndeplini o sarcină nu este la fel de implicat mental în sarcină ca cineva care o finalizează complet pe cont propriu. Deși acest lucru poate să nu conteze prea mult pentru rezultatul sarcinii, descărcarea cognitivă poate fi problematică atunci când vine vorba de învățarea a ceva nou* [9] .

Au apus vremurile în care păstram mementouri meticuloase în calendar, foloseam calculatoare pentru a face calcule sau luam notițe în timpul prelegerilor sau al întâlnirilor. Există o aplicație pentru aproape fiecare sarcină care obișnuia să ne solicite creierul și să ne întărească funcția cognitivă. Oricât de atractive ar fi aceste aplicații, ele ne reduc efortul mental, ceea ce nu poate fi benefic pe termen lung.

Acum avem aplicații care traduc instantaneu în sute de limbi, ceea ce face ca învățarea limbilor străine să fie practic inutilă. Totuși, puține lucruri ne îmbunătățesc creierul mai mult decât învățarea limbilor străine. Cu siguranță, acest lucru nu poate fi benefic pentru ființele umane.

Diminuarea duratei de atenție

> *Conform unui studiu efectuat de Dr. Gloria Mark la Universitatea din California în 2004, aceasta a descoperit că durata medie de atenție a unei persoane pe un dispozitiv digital este de aproximativ 150 de secunde. Cu toate acestea, până în anul 2012, acest număr scăzuse la jumătate, ajungând la 75 de secunde. Acum, date recente din 2024 sugerează că a atins un minim uimitor de 47 de secunde. (Mark, 2023) Încet, ce va urma? Va continua să se dividă și să se dizolve până la zero?* [10]

Datele emergente arată că tehnologia, în special inteligența artificială, afectează capacitatea de atenție. Designul rețelelor sociale pe dispozitivele digitale favorizează din ce în ce mai mult mișcările rapide care nu promovează atenția susținută. Rapiditatea publicării de conținut este, de asemenea, cunoscută ca fiind adictivă.

Luarea automată a deciziilor

> *Legea privind protecția vieții private a consumatorilor (CPPA) [definește] „sistem decizional automatizat" ca fiind „orice tehnologie care asistă sau înlocuiește judecata factorilor de decizie umani prin utilizarea unui sistem bazat pe reguli, analiză de regresie, analiză predictivă, învățare automată, învățare profundă, o rețea neuronală sau o altă tehnică. [11] "*

Suspendarea judecății umane în luarea deciziilor poate accelera procesul decizional, dar potențialele sale efecte adverse asupra neurofuncției ar trebui să preocupe pe toată lumea.

Deteriorarea abilităților fizice

Inteligența artificială promovează comportamentul sedentar, a cărui consecință ar putea fi atrofierea abilităților. IA optimizează automatizarea fluxului de lucru, reducând sarcinile practice și manuale. În cele din urmă, automatizarea duce la deteriorarea abilităților motorii fine.

Descărcare socială

Declinul abilităților de interacțiune socială atribuit inteligenței artificiale este cunoscut sub numele de descărcare socială. Descărcarea socială are loc pe măsură ce ne bazăm din ce în ce mai mult pe algoritmi pentru a gestiona relațiile interpersonale. Pe măsură ce ne bazăm pe inteligența artificială pentru a gestiona conversațiile și a filtra procesarea emoțională naturală a interacțiunilor, pierdem din ce în ce mai mult conexiunea umană și capacitatea de a gestiona ambiguitatea naturală.

Dr. Marlynn Wei a observat că

> *... negocierea nevoilor, gestionarea conflictelor și înțelegerea stării emoționale a unei alte persoane, denumite mentalizare, sunt abilități sociale esențiale atunci când se navighează în relațiile umane. Construirea relațiilor în viața reală necesită o implicare emoțională bidirecțională, inclusiv întreruperea și repararea. A deveni dependent emoțional de agenții sociali ai IA în acest moment nu reflectă cu exactitate construirea unei relații emoționale bidirecționale cu o altă ființă umană.[12]*

Probleme de sănătate mintală crescute

> *Legătura dintre chatboții precum ChatGPT de la OpenAI și inteligența artificială generativă și sănătatea mintală este o preocupare tot mai mare în rândul profesioniștilor din domeniul sănătății mintale și un subiect din ce în ce mai*

discutat în mass-media. Deși datele privind efectele reziduale ale IA generativă asupra sănătății mintale sunt încă în stadii preliminare, impactul potențial merită atenție. Keith Robert Head a remarcat că „Intersecția dintre antropomorfizarea tehnologiei, relațiile parasociale și afecțiunile vulnerabile de sănătate mintală creează prezentări clinice unice care necesită înțelegere specializată și abordări de intervenție. Severitatea acestui fenomen a devenit tragic evidentă în februarie 2024, când Sewell Setzer III, în vârstă de 14 ani, a murit prin sinucidere după luni de interacțiune intensivă cu chatboții Character.AI."

Keith Robert Head a concluzionat că

Proliferarea rapidă a inteligenței artificiale și a chatboților conversaționali bazați pe inteligență artificială a introdus provocări fără precedent în domeniul sănătății mintale, pe care profesioniștii din domeniul sănătății mintale nu sunt pregătiți să le abordeze. Această analiză dezvăluie modele emergente de dependență psihologică, incidente de criză și exploatare a vulnerabilităților, care semnalează apariția unor tulburări psihologice legate de tehnologie, care necesită recunoaștere clinică specializată și abordări de intervenție. [13]

Dependența excesivă de tehnologie

Există o latură pozitivă a dependenței de tehnologie pentru persoanele care au nevoie de dispozitive tehnologice în scopuri legate de sănătate. Sute de pacienți depind de dispozitive precum stimulatoare cardiace, inimi artificiale totale (TAH) și unități de monitorizare cardiacă pentru a duce o viață normală. O astfel de dependență de tehnologie este o evoluție pozitivă.

Există însă și un dezavantaj al dependenței de tehnologie. Un exemplu este nomofobia, definită ca „frica de a rămâne fără un dispozitiv mobil sau în afara contactului cu telefonul mobil". O altă consecință a dependenței excesive de tehnologie este impulsivitatea, tendința de a acționa fără o gândire profundă sau o luare în considerare a consecințelor.

Diminuarea gândirii critice

Există o îngrijorare tot mai mare cu privire la impactul negativ al inteligenței artificiale asupra gândirii critice. Potrivit lui Michael Scriven și Richard Paul,

Gândirea critică este procesul disciplinat intelectual de conceptualizare, aplicare, analiză, sintetizare și/sau evaluare activă și abilă a informațiilor culese din sau generate prin observație, experiență, reflecție, raționament sau comunicare, ca ghid pentru credință și acțiune. În forma sa exemplară, se bazează pe valori

> *intelectuale universale care transcend diviziunile materiei: claritate, acuratețe, precizie, consecvență, relevanță, dovezi solide, motive întemeiate, profunzime, amploare și corectitudine. 14*

Gândirea critică este unul dintre cele mai importante rezultate ale unei educații bune și un set de competențe necesar în toate demersurile umane. Cu toate acestea, Matteo Wong a remarcat că apariția inteligenței artificiale erodează grav capacitatea umană de gândire critică.

> *Deși inteligența artificială permite analiza rapidă a datelor la o viteză și o scară fără precedent, dependența excesivă de inteligența artificială poate eroda abilitățile de gândire critică ale unui individ. În contextul învățământului superior, cercetătorii au descoperit că studenții care utilizează Modele de Limbaj Mari (LLM) pentru a finaliza sarcini de scriere și cercetare au experimentat o încărcare cognitivă redusă, dar au demonstrat abilități de raționament și argumentare mai slabe în comparație cu studenții care utilizează metode tradiționale de căutare. Un alt studiu de cercetare a constatat că studenții care utilizează LLM s-au concentrat pe un set mai restrâns de idei, rezultând analize mai părtinitoare și superficiale. Gândirea critică - caracterizată prin evaluarea informațiilor, punerea sub semnul întrebării a presupunerilor și formarea unor judecăți independente - rămâne o abilitate unică umană pe care inteligența artificială nu o poate reproduce pe deplin.[15]*

Implicații pentru educație

Apariția inteligenței artificiale oferă lumii oportunitatea de a pune o întrebare fundamentală despre viitorul educației: Ce vrem să facă educația formală pentru omenire de acum înainte? Cu alte cuvinte, care ar trebui să fie scopul educației acum, având în vedere capacitățile tot mai mari ale inteligenței artificiale?

Un lucru asupra căruia lumea trebuie să fie de acord este că IA nu trebuie să diminueze, să devalorizeze sau să degradeze capacitățile umane. Mai degrabă, scopul final al IA în educație trebuie să fie de a spori, consolida și amplifica capacitățile umane pentru o viață bună. În acest scop, Figura 7 ilustrează capacitățile umane care ar trebui amplificate prin aplicarea adecvată a IA.

Un bărbat sau o femeie educată din secolul XXI trebuie să învețe să își pună întrebări, atunci când are îndoieli să devină curioasă și, prin curiozitate, să investigheze gândind critic. Mauricio Shiroma descrie gândirea critică ca fiind abilitatea de a primi și analiza informații, inclusiv „identificarea legăturilor dintre idei, analizarea și evaluarea argumentelor,

identificarea tiparelor și relațiilor, separarea a ceea ce este necesar de ceea ce este irelevant într-o discuție, identificarea lacunelor în raționament și utilizarea acestor abilități pentru a formula un argument, a rezolva o problemă sau a ajunge la o concluzie" [18.] O educație bună dezvoltă mintea pentru analiză critică și independentă care pune sub semnul întrebării presupunerile, identifică prejudecățile și evaluează obiectivitatea, ducând la concluzii argumentate.

Considerarea creativității ca scop final al educației schimbă accentul de la participarea pasivă la cea activă în procesul de predare și învățare. Procesul creativ implică explorare, experimentare, asumarea riscurilor, gândire flexibilă și imaginație. Dependența excesivă de inteligența artificială îi privează pe elevi de aceste procese mentale critice, le estompează instinctele creative și le diminuează capacitatea de a căuta alternative inovatoare la status quo-ul existent. În viață mai sunt multe de inventat și de creat.

„Modelul „Abilități pentru succes" al Guvernului Canadei definește comunicarea ca fiind

«capacitatea ta de a primi, înțelege, lua în considerare și împărtăși informații și idei prin vorbire, ascultare și interacțiune cu ceilalți». [19] " Comunicarea este fundamentul coexistenței umane. Construirea încrederii, prevenirea conflictelor și a neînțelegerilor, cultivarea relațiilor, cultivarea unei echipe și atingerea succesului personal și profesional depind toate de abilități puternice de comunicare. Prin urmare, o educație bună trebuie să cultive aceste abilități și artele comunicării. În timp ce tehnologia face comunicarea mai rapidă, oamenii nu trebuie să abroge nevoia unei comunicări autentice, mai profunde și mai bogate.

UNESCO a declarat că

> *În ultimii ani, nevoia unor sinergii mai puternice între cultură și educație în cadrul activității UNESCO a fost adusă în prim-plan. Pe măsură ce oportunitățile și provocările globale au evoluat – de la transformarea digitală rapidă, la creșterea migrației, schimbările climatice, conflictele și regresul democratic – nevoile societăților s-au schimbat și ele. Competențele, valorile și comportamentele promovate de educația culturală și artistică au devenit mai importante ca niciodată. Statele membre UNESCO au solicitat o alianță mai strânsă între cultură și educație pentru a răspunde mai bine peisajului global actual și a promova abordări educaționale mai holistice și integrate .*

Ceea ce ne face umani este capacitatea noastră de a crea cultură - artele, muzica, folclorul, sărbătorile, tradițiile, dansurile și înfățișările noastre unice - toate acestea contribuind la o viață bună. În timp ce tehnologia poate crea muzică, trebuie să antrenăm inima să cânte. În timp ce tehnologia poate crea picturi, trebuie să învățăm mâinile să picteze și ochii să le prețuiască. Prin urmare, o educație bună promovează cultura umană.

Ceea ce ne face umani este conexiunea unii cu alții. O educație bună trebuie să ne îmbogățească relațiile. În timp ce tehnologia poate duce bărbații și femeile de pe Pământ pe Lună, o educație bună trebuie să ne permită să ne conectăm de-a lungul peluzelor noastre. Scopul final al unei educații bune trebuie să fie conviețuirea pașnică, în care trăim în colaborare și empatie, contestăm prejudecățile, detestăm violența și promovăm înțelegerea într-o societate din ce în ce mai diversă. O educație bună trebuie să permită ființelor umane să aprecieze și să îmbrățișeze diversitatea umană.

În cele din urmă, o educație bună trebuie să îndemne la iubirea semenilor noștri și la cultivarea compasiunii pentru ceilalți. Iubirea pentru natură, iubirea pentru animale și iubirea pentru viață trebuie să continue să fie dividendele unei educații bune. Dacă aplicarea inteligenței artificiale în educație sporește aceste trăsături esențiale, atunci și numai atunci investiția noastră în inteligența artificială va merita costul.

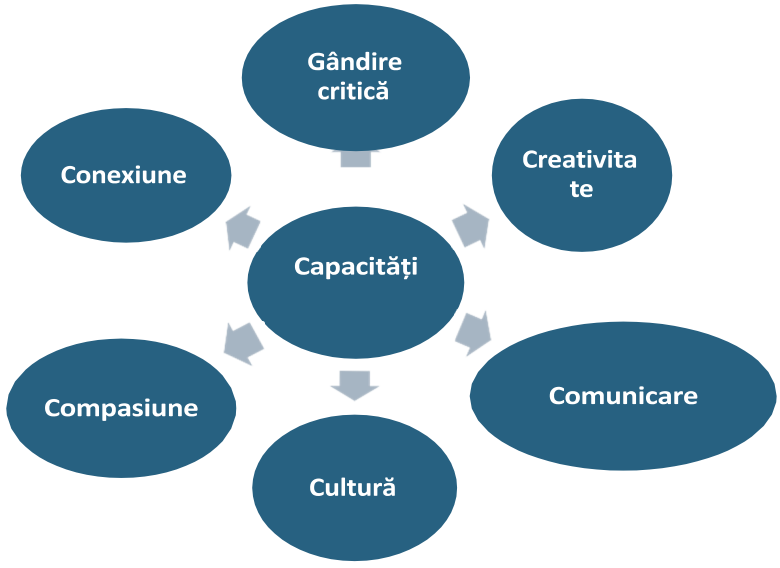


Figura 7: Obiectivele finale ale unei bune educații

Recomandări

Se pare că există patru tabere de oameni care se confruntă cu apariția inteligenței artificiale: protagoniștii care insistă ca tot ce ține de IA să fie important și ca toată lumea să o învețe și să o îmbrățișeze; antagoniștii care se opun unei vieți supra-tehnologizate; „ prudențiștii ” care cer o încetinire a creșterii economice; și majoritatea care nu are nicio idee despre ce este vorba. Cu toate acestea, impactul potențial al IA asupra societății este atât de semnificativ încât Papa a emis proclamația sa (Magnifica Humanitas) pe această temă.

Recomandările de mai jos sunt câteva culese de la comentatori și prognosticatori ai IA:

1) Conform CNN, Magnifica Humanitas a Sanctității Sale Leon al XIV-lea solicită dezarmarea inteligenței artificiale din cauza impactului său negativ general asupra umanității. După cum a afirmat Sanctitatea Sa, *„Inteligența artificială atinge deja multe domenii ale vieții noastre și influențează deciziile care modelează coexistența umană", a spus el. „Mă simt însărcinat să privesc o altă transformare uriașă cu ochii credinței, cu luciditatea rațiunii, cu deschidere către mister și cu strigătele săracilor și ale pământului răsunând în inima mea.* [16] "
2) Există cei care solicită o încetinire a implementării rapide și a avansării inteligenței artificiale până când vom putea înțelege pe deplin implicațiile acesteia.
3) Există persoane care le recomandă liderilor din domeniul educației să nu asculte experții în inteligență artificială, ci să asculte educatorii și psihologii care sunt experți în modul în care învață oamenii.
4) De asemenea, este recomandat ca educatorii să își reexamineze filosofia educațională pentru a se asigura că adoptarea inteligenței artificiale este în concordanță cu valorile și viziunea lor.
5) Educatorilor li se recomandă, de asemenea, să nu se grăbească să investească în inteligență artificială. Educatorii ar trebui să învețe o lecție de la companiile care s-au grăbit să investească și care acum regretă analiza cost-beneficiu a acestor investiții.
6) Adoptarea inteligenței artificiale în școli nu ar trebui să fie determinată de speranța unor beneficii bugetare și de dorința de eficiență. Mai degrabă, inteligența artificială trebuie să promoveze ceea ce ne face mai umani.
7) În cele din urmă, adoptarea inteligenței artificiale în școli ar trebui să înceapă cu formarea profesorilor. Școlile de pedagogie, unde sunt formați viitorii profesori, sunt cele mai bune locuri pentru a începe să înveți despre inteligența artificială și să experimentezi cu aceasta.

Acest ultim punct este deosebit de important deoarece beneficiul final al tehnologiei didactice depinde de pregătirea și experiența profesorilor. Din acest motiv, Universitatea Internațională Danubius a înființat Școala de Educație Inteligentă și Profesori Inovativi, ca o diferență față de școlile tradiționale de formare a profesorilor din întreaga lume. Școala își propune să optimizeze utilizarea tehnologiei, minimizând în același timp impactul negativ. Pe scurt, Școala își propune să facă din IA o soluție cu probleme minime.

Concluzie

Nu există nicio îndoială că inteligența artificială este aici pentru a rămâne, iar unii vor spune că suntem abia la începutul revoluției sale. Pe baza a ceea ce știm până acum, este

rezonabil să concluzionăm că inteligența artificială este o soluție, deși vine cu nenumărate probleme. Cu capacitatea sa de a imita inteligența umană, IA este probabil cea mai puternică invenție a omenirii de până acum.

Predispozițiile individuale ale educatorilor față de adoptarea inteligenței artificiale sunt modelate de presupuneri despre modul în care elevii învață și rolul educației. Cei care favorizează o producție mai rapidă și mai eficientă sunt înclinați să se alăture trendului inteligenței artificiale, în timp ce cei care consideră școala ca un loc de învățare, iar predarea și învățarea ca o tranzacție și o interacțiune intimă între oameni sunt probabil precauți cu privire la impactul potențial al inteligenței artificiale asupra educației.

Printre beneficiile lăudate de experții în inteligență artificială se numără capacitatea sa de a individualiza și personaliza învățarea, de a oferi feedback mai rapid și de a rezolva probleme complexe. Aceste beneficii vin cu un cost. Dincolo de costul financiar, pierderea confidențialității, diminuarea interacțiunii umane și impactul asupra mediului impun o evaluare serioasă a raportului cost-beneficiu al inteligenței artificiale.

Cel mai important impact care necesită atenție colectivă este neurofuncția degenerativă, pe măsură ce abilitățile mentale și fizice se atrofiază. Pe măsură ce inteligența artificială înlocuiește efortul mental, trebuie să ne preocupăm de descărcarea cognitivă, descărcarea socială și nomofobie, ca să numim doar câteva.

**O secțiune a acestei lucrări a fost prezentată la Conferința media DC despre învățământul superior din București, România, din 10 iulie 2026.*

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Conscious Iterative Structuralism (C.I.S.): A New Language in Digital Art, Situated Between Mathematical Structure and Visual Pedagogy

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Abstract

This paper documents and analyses Conscious Iterative Structuralism (C.I.S.), a new visual language in art developed by the Romanian structural-conceptual artist Marius V. Popescu. In C.I.S. an image is not generated. It uses neither artificial intelligence nor code. It arrives through the conscious traversal of a structured field of possibilities opened by a single geometric form, the spiral. Working in a virtual environment, the artist applies a single manual procedural algorithm of his own invention, a sequence of operations executed by hand: deformation, then cloning and mirroring, then superimposition on the horizontal axis in both directions, then rotation, and finally a selective use of color.

The study has three aims. The first is to describe this process precisely enough that it can be examined rather than merely admired or dismissed as a style. The second is to identify the structural properties that set it apart, above all a reproducible link between the orientation of a work and what the work means, which the artist tests by rotating each piece through 180°. The third is to ask what the process implies for teaching, since working inside it appears to cultivate a distinctly structural way of seeing.

The analysis is qualitative. It rests on the foundational documents of C.I.S., on a body of finished works, and on a step-by-step reconstruction of how those works come into being. Two findings stand out. A finished piece is chosen from within an expanding field rather than built toward a fixed idea; and when a piece is turned upside down, the same underlying structure yields a second, genuinely different reading, which suggests the structure reconfigures itself according to an internal rule. C.I.S. is placed here alongside the contemporary automated generation of images, where the point is simply that its decisive act, recognition and choice, belongs to a person and not to the procedure. The paper closes by arguing that C.I.S. is worth reading as more than an artistic practice. It is also a way of thinking, one that sits where visual construction meets structural logic, and it has real uses in animation and science-fiction cinema, in reversible visual identity, and in immersive installation.

Keywords: Art & Music, conscious iterative structuralism, new visual language, generative form, spiral, structural reversibility, visual pedagogy.

1. Introduction

Over the last few years, making a digital image and generating one have quietly become the same act for many people, largely through digitalization and the use of artificial intelligence. A tool proposes; the user picks. And a question follows that is less about software than about authorship: when the result arrives ready-made, is the person still constructing anything, or only choosing among options prepared for them? The line worth drawing runs between producing a result and building a process. A result can be handed off. A process cannot, because it holds decisions inside it, and decisions carry the experience of whoever made them.

The artistic language documented in this paper takes the harder second path on purpose. Conscious Iterative Structuralism, hereafter C.I.S., was created by the Romanian structural-conceptual artist Marius V. Popescu, and it asks whether an image can be constructed as a conscious, iterative process held inside a controlled formal structure. Its founding hypothesis is easy to state and harder to practice: form can serve at once as a means of generation and as a carrier of meaning, but only if it is traversed rather than simply used. The construction itself happens in a virtual environment, in vector software, where the artist executes a single procedural algorithm of his own invention entirely by hand.[9] That manual execution opens a field of practically unlimited variation, and within that field certain configurations settle into finished works.

Three questions organize the study. First, can the C.I.S. process be described closely enough to be examined, rather than asserted as a personal style or defended as a manifesto? Second, what exactly distinguishes it? The most striking candidate is a reproducible relationship between how a work is oriented and how it reads, which the paper examines through the 180° rotation the artist relies on. Third, what does the process teach? There is a claim, worth testing, that working within this language builds a structural kind of visual thinking that does not lean on automation.

The tone throughout is analytical, not promotional. Where the source documents reach for large words, this paper puts the underlying claim into terms one can actually weigh and, if warranted, dispute. The point is not to shrink the work but to set it in its proper company: the interdisciplinary conversation, familiar to readers of this journal, that runs between artistic practice, structural logic, and the study of consciousness. Throughout, C.I.S. is taken to be what its author says it is, a new language in art, not one more technique or one more style.

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[9] On the algorithm defined by clear specification, inputs, outputs, finiteness and effectiveness, see Donald E. Knuth, *The Art of Computer Programming* (Addison-Wesley, 1997). The C.I.S. procedure is algorithmic in exactly this sense, while remaining manual.

2. Background and Position of the Problem

Few motifs are older than the spiral, and through most of art's history it has been an ornament or a symbol. C.I.S. breaks with that from the first move. The spiral here is not something to be looked at; it is an operational base, a rule of growth that exists to be intervened upon.[10] So the thing in front of the artist at the start is not an image but a structure, one of the very few elementary forms that hold order, evolution, and expansion together in a single geometry. What defines the language is never the spiral itself. It is the intervention made upon it.

That starting point places C.I.S. squarely inside a problem of the present moment. As tools make visual variation cheap and endless, the scarce act is no longer producing forms; it is recognizing which form, out of so many, actually carries meaning. C.I.S. can be read as an extended inquiry into precisely that act. Its wager is that value in image-making has shifted, away from the capacity to generate variation and toward the capacity to select meaning from within a structural field. Popescu offers the language on two levels at once, as a practice and as a way of thinking, and supports both with a foundational study and a portfolio that works as a demonstration.

3. Materials and Analytical Approach

This is a qualitative, descriptive study of an artistic language. Three kinds of material were examined. The foundational documents of C.I.S. came first, a research note together with a conceptual thesis on how a work comes to be recognized. To these were added the artist's own account of the process, and a body of finished pieces, among them the works shown as Morphoon, GameOn, Grandparents, and Sanctuary, along with the installation cycle ARCA. The analysis then proceeded on two fronts. One reconstructed the generative sequence step by step from the documents and the artist's account, describing each operation and what it does to the emerging structure. The other read the finished works for recurring structural properties, watching in particular what rotation does, and using the artist's habit of setting a piece at 0° against the same piece at 180°. The object of study is a language, not a population, so the right standard is descriptive adequacy and internal consistency rather than statistical inference. The process is laid out below in the order the artist follows. That order matters: each stage depends on the one before it, and reshuffling them changes the outcome.

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[10] On the spiral as an expression of growth that preserves structural identity as scale increases, see D'Arcy W. Thompson, *On Growth and Form* (Cambridge University Press, 1917). Thompson's logarithmic *spira mirabilis* underwrites the treatment of the spiral in C.I.S. as a rule of growth rather than an ornament.

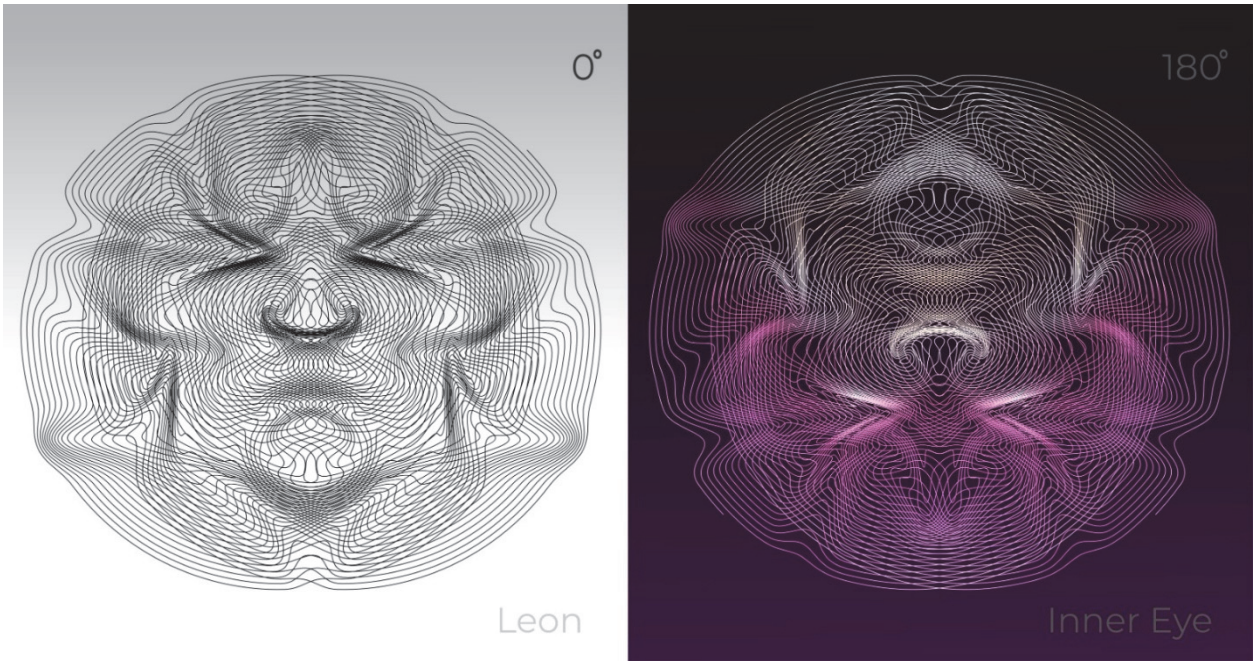


Figure 1. Leon (0°) and Inner Eye (180°)

3.1 The generative form: the spiral as principle

Everything begins from a single spiral, taken as a fundamental structure of organisation.[11] This is the whole starting material: one geometric form, worked by one manual algorithm the artist devised. There is no image yet, and no subject in mind, only a rule of growth. Applying that algorithm by hand in the vector environment opens a theoretical space of nearly unlimited variation. That space is layered: every intervention on the form adds a new level of possibility above the last, and where it leads depends entirely on the person creating it.

3.2. Deformation: the entry of decision

If the spiral is the rule, deformation is the first move against it, and the first decision. The gesture can look trivial, a small displacement, a bit of tension, a curve bent out of true,

[11] Theodore A. Cook, *The Curves of Life* (Constable, 1914), draws the distinction the present argument relies on, between the inert perfection of the mathematical spiral and the "living" spiral that acquires vitality through small deviations. In C.I.S. that deviation is the artist's manual deformation.

yet it changes how the whole thing will evolve from there.[12] Nothing means anything visually at this stage. But something is already intended: the deformation carries a state, an intuition, a direction the artist feels rather than states. This is the moment the author enters the work. From here on, whatever happens bears the mark of that first gesture, which does not fix the form so much as fix the direction the possible will take.

3.3. Controlled iteration: cloning and mirroring

After that first intervention the process starts producing relations rather than images. Cloning does not copy the deformed form; it multiplies it as a carrier of variation, so that each replica already holds the trace of the original gesture.[13] What gets multiplied, in other words, is a deviation and not a static shape. Then mirroring brings in symmetry, though not symmetry as balance. Here it is a mechanism of tension, since it sets the same structure against itself from opposite sides. Cloning widens the field. Mirroring folds it back on itself, and with that fold the possibility of structural conflict appears for the first time. Meaning, when it comes, will come out of exactly this controlled contradiction.

3.4. Superimposition on the horizontal axis: the emergence of meaning

In superimposition the multiplied and mirrored forms are laid over one another along the horizontal axis, in both directions, so that they stop merely sitting side by side and begin to cross, overlap, and interfere. Inside that interference, recognizable structures surface, structures nobody drew but that a viewer recognizes.[14] This is the decisive turn in the process, the point where structure gives way to meaning. And meaning here does not sit in the image alone; it sits in the meeting between the structure and whoever is looking. One configuration will support quite different recognition depending on the viewer, on their

[12] Wassily Kandinsky, *Point and Line to Plane* (Bauhaus Books, 1926), analyses the line as an active force produced by tension applied to the point, a reading that supports the account of deformation given here.

[13] Benoit Mandelbrot, *The Fractal Geometry of Nature* (W. H. Freeman, 1982). The self-similarity that generates complexity through iteration is applied manually in C.I.S., the deformed spiral serving as the repeated unit.

[14] Rudolf Arnheim, *Art and Visual Perception* (University of California Press, 1974), and E. H. Gombrich, *Art and Illusion* (Pantheon, 1960). Both establish that recognition is an active, structuring act of the perceiving mind, which is why an emergent figure can be recognised without having been drawn.

memory, their eye, their tolerance for abstraction.[15] Some people report faces. Others see organisms, or machinery. The work opens a field of possibilities, and meaning switches on inside that field, differently, at the moment of looking.

3.5 The 180° return

Once superimposition has done its work, the process turns the whole thing through 180°. This is not an occasional move but a constant of the language: it happens with every C.I.S. work, without exception. What the rotation changes is not the form but the meaning. Inverted, the same structure does not just repeat; it delivers a second configuration that reinterprets the first.[16] In practice two related works come out of one structure. There is the form at 0°, which the artist controls and builds deliberately, and there is the form at 180°, which the artist did not fully see coming and which, in his own phrase, is offered by the structure itself. The first is intention. The second is discovery. Nothing is lost in the turn; the same information is reorganized.[17] Rotation does not close the work; it opens a second line of interpretation. More than that, the 0°/180° relation guarantees an infinite polysemy: because the reading is a function of orientation and of the viewer, the structure never exhausts the meanings it can carry.

Two further effects belong here, before color is introduced. The first is an emergent three-dimensionality: a sense of depth and volume that is not constructed by the classical means, neither chiaroscuro nor the perspective line, but arises from the density and interference of the lines themselves. The second is a simultaneous infinite polysemy, distinct from the polysemy of rotation: several readings held at once within a single configuration. These two effects are not universal to every C.I.S. piece. They appear, reliably, only in works whose spiral is built from many turns, a minimum of some twenty to thirty spires; below that density the field is not rich enough to sustain them. Taken together, these features define the language and recur across the corpus: a single algorithm invented by the artist, a single geometric form, the 0°/180° reversal, an infinite polysemy, an emergent (not

[15] C. H. Waddington's notion of the "epigenetic landscape", in *The Strategy of the Genes* (Allen & Unwin, 1957), offers a biological analogy for a form that settles into stable configurations by moving through a field of possibilities rather than being fixed in advance.

[16] Douglas R. Hofstadter, *Gödel, Escher, Bach: An Eternal Golden Braid* (Basic Books, 1979). The 180° rotation functions as a "strange loop", a change of level that discloses a new yet equally coherent structure within the same whole.

[17] The principle is Lavoisier's, *Traité élémentaire de chimie* (Cuchet, 1789): nothing is lost, nothing created, everything is transformed. Transposed to structure, rotation loses no information; it reorganises it.

constructed) three-dimensionality, and a simultaneous infinite polysemy, each of them, on works of sufficient density, a constant rather than an accident.

3.6 Colourisation and clarification: committed choice

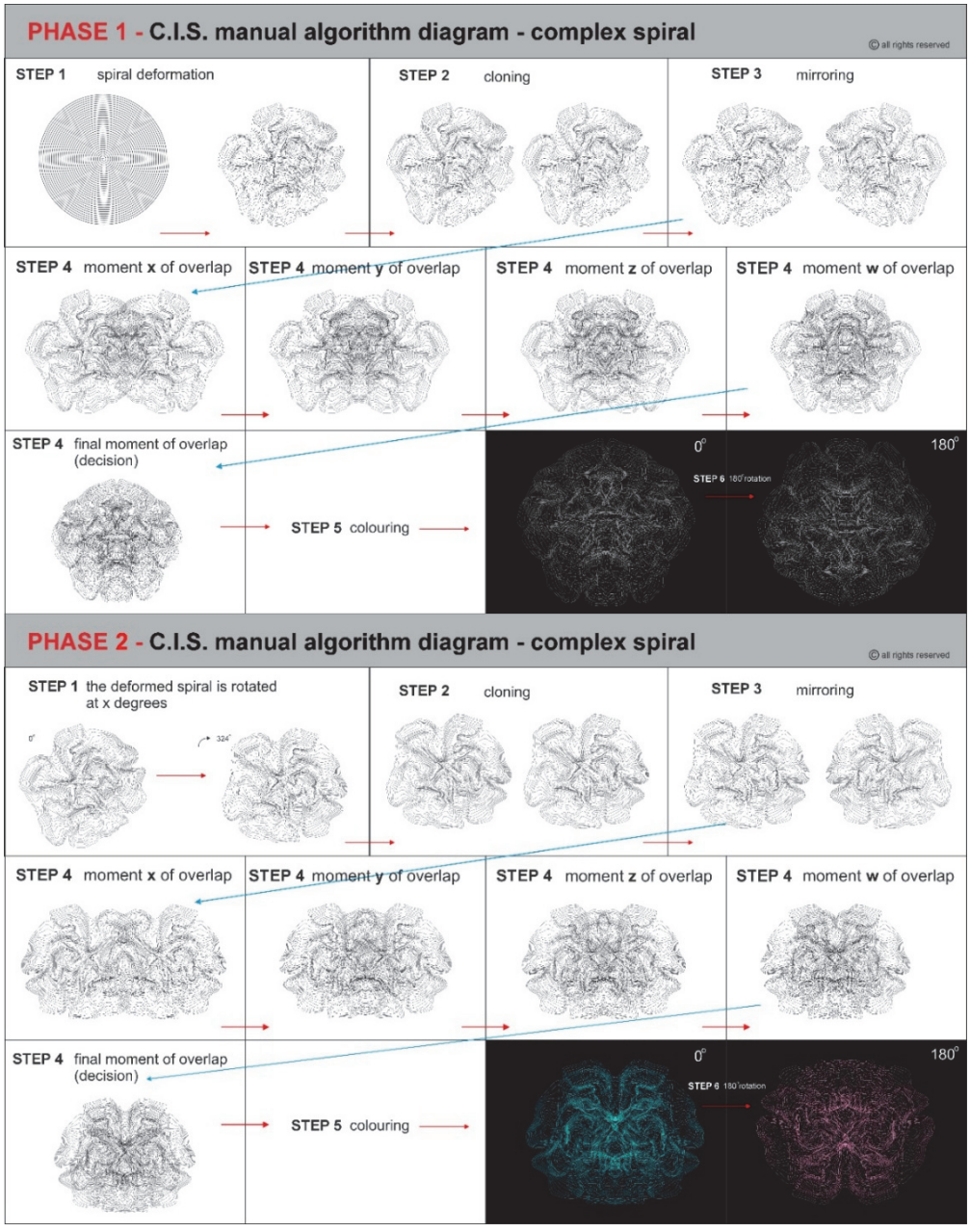


Figure 2. C.I.S. - phases

Color comes last, and it is not decoration. It is an instrument of selection. Out of the dense mesh of lines the artist lights up the traces that carry a gaze, an organic edge, a point of tension. Color also deepens the optical impression of relief, so a flat surface seems to gain planes it does not physically have.[18] And it individualizes, which is the moment a structure reads as a particular being rather than a pattern. A last operation, which the artist calls clarification and does not always use, strips away visual noise so the chosen configuration can be read cleanly. Where superimposition held an open field, color and clarification are the committed choices, the point at which the maker says, in effect: this is what I found in the structure.

4. Results: Structural Properties

A number of properties recur across the body of work, and together they mark C.I.S. as a coherent visual language rather than a stack of images: a single algorithm invented by the artist working on a single geometric form; the selection of the work from within an expanding field; the 0°/180° reversal; an infinite polysemy carried by that reversal; and, on works of sufficient spiral density, an emergent three-dimensionality together with a simultaneous infinite polysemy. The two that most sharply distinguish the language are examined below; the others have been set out in the account of the process above.

4.1. The work is chosen, not generated

Each stage of the process multiplies the field of variation, so the work advances through a run of dependent expansions, each one growing out of the last. Any single configuration is therefore one instance among an enormous number of possible instances. Out of that field the finished work is not produced toward a preconceived image; it is chosen.19 The artist looks for the configuration where formal tension, structural balance, and the arrival of meaning come into coherence at once. That choice is neither arbitrary nor automatable, because it rests on an act of discernment. The consequence for authorship is exact. The author is less a producer of forms than an operator moving through a field of possibilities, and the artistic act slides from execution toward decision. This positioning within the field turns on the maker's conscious intervention, and the procedure on its own cannot reproduce it.

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[18] György Kepes, *Language of Vision* (Paul Theobald, 1944), shows that depth and volume can be induced by the density and interference of lines, without linear perspective, which grounds the “emergent volume” reported in the works.

[19] Luigi Pareyson, *Estetica. Teoria della formatività* (Edizioni di Filosofia, 1954), gives the philosophical ground for post-determination: form is not the application of a pre-existing idea but invents itself as it is made.

4.2. Structural reversibility: orientation as a carrier of meaning

The second property is that reproducible link between position and interpretation under 0°/180° rotation. Across the corpus, turning a finished work upside down does not flatten it into a mirror image. It produces a genuinely distinct reading that the same structure holds. Sanctuary is the clearest case: one animal is legible at 0°, a different animal at 180°, both inside a single graphic sign. The behavior points to an internal reconfiguration, as though the structure keeps more than one stable reading folded inside it and orientation is what selects between them.[20] Alongside reversibility stand the two density-dependent effects already named: an emergent three-dimensionality that arrives without any conventional perspective technique, and, in works built from many spirals, a simultaneous polysemy in which several readings are held at once. On works of sufficient spiral density these are constants of the language rather than happy accidents; why they occur perceptually is a question worth a study of its own.

5. Discussion

Put together, these properties suggest that C.I.S. is best understood as a way of mapping a space of possibilities and then moving through it, so that the finished image is a position taken inside that space rather than an object imported from outside it.[21] This quietly rearranges three familiar terms, structure, process, authorship, and it does so in a way that opens onto a larger question about how meaning comes out of form at all.

The language also carries a particular order of cognition. On the traditional account, an artist moves from intention through design to execution and then to a finished work, with feeling arriving in some outside viewer at the very end. C.I.S. rearranges that order. A structure is generated and seen, processed intellectually, and felt by the artist, who is at once the maker and the first person to look, and only then is a decision taken and the work finished for anyone else. One need not accept this as a universal account of art to grant that it names something specific about this practice: here recognition and feeling happen inside the process, at the point of choice, and not only after it.

Read this way, and only this way, C.I.S. touches the contemporary automated generation of

[20] Umberto Eco, *Opera aperta* (Bompiani, 1962). The “open work”, rigorously constructed yet sustaining a plurality of readings, is the closest theoretical precedent for the simultaneous polysemy described here.

[21] On complex order emerging spontaneously from unstable dynamics, see Ilya Prigogine and Isabelle Stengers, *Order out of Chaos* (Bantam, 1984). The “dissipative structures” they describe are a scientific counterpart to the self-organisation of dense line-fields in C.I.S.

images, but not as a quarrel. An automated tool can turn out to be varied in enormous quantity, and yet that abundance is, in a real sense, undifferentiated; it fills a uniform field. What C.I.S. isolates is the complementary act: the differentiation of that field by a consciousness that recognizes which configuration matters.[22] The point does not need any claim about what machines are unable to do. It is enough to notice that the decisive move, choosing under recognition, is defined as human and, by the way the process is built, cannot be handed to the procedure. The point is not to oppose automation but to locate it, to say where, in a process that machines can partly take over, the interpretive act still has to be human.

5.1. What the process teaches

If exploring the field is a human act, then it can be taught, and the educational side of C.I.S. grows out of its structure instead of being tacked on afterward. Working within the language builds three things. It builds discipline, because the process is sequential and its stages cannot be skipped or rushed; each one asks for attention. It builds patience, because complexity accumulates rather than arriving at all at once, so the practitioner learns to sit with a process and not just collect a result. And it builds the harder capacity to see past the form, to notice meanings that are not obvious and to interpret rather than merely register what is there. On this reading C.I.S. trains structural visual intelligence, one grounded in relation and recognition, and that competence grows more useful, not less, as the tools around it grows more automated.

5.2 Applications

The same properties carry C.I.S. well beyond the studio. In animation, science-fiction cinema, and game design, the 0°/180° duality meets a real production need: a single geometric matrix can give a character at one orientation and an altogether different entity at the other, so an entire family of related figures can be drawn out of one complex spiral while the style holds together across all of them. This is directed morphogenesis, not random generation. In visual identity the same reversibility supports what one might call semantically reversible signs, where a single mark carries two complementary identities through rotation, as Sanctuary does, letting a brand hold a duality inside one memorable form instead of multiplying symbols. And in monumental or immersive work the installation cycle ARCA stretches the language from form into time and space, arranging a

[22] Lev Manovich, *Software Takes Command* (Bloomsbury Academic, 2013), frames the passage from traditional media to software, against which the "manual algorithm" of C.I.S. can be read as a form of creative resistance.

sequence of collections into an evolutionary narrative and treating the spiral as an instrument of conceptual construction rather than a decorative one.[23] Beyond these, the same properties open several further directions, each drawing on a mechanism the earlier sections have already established rather than on a new claim.

- **Architecture and façade design.** Treated as a generative armature rather than an ornament, the spiral translates into parametric panels, contemporary mashrabiya, and façades of variable density, where a mathematical rule of growth becomes a physical, load-bearing surface. This is the most direct passage from the structure's geometry to built form.
- **Neuroaesthetics and visual therapy.** Because one configuration sustains different recognitions in different viewers, the works offer a controlled instrument for studying perception, attention, and projection, a structurally governed counterpart to the Rorschach image, and a point of contact with the study of consciousness.
- **Textile and material design.** Patterns that change meaning under rotation give woven and printed surfaces a legible double identity, carrying the reversibility of the sign from the page onto cloth and material.
- **Visual cryptography and anti-counterfeiting.** A mark whose second reading emerges only at 180° and cannot be reconstructed without the manual process becomes a mechanism of authentication, since the decisive positioning is, by construction, not reproducible by the procedure alone.
- **STEM and STEAM education.** Beyond the pedagogy set out above, the process is a concrete way to teach iteration, symmetry, and self-similarity, letting students watch abstract mathematical principles become visible form.

What commends C.I.S. to these fields is not only what it produces but how, through rigor, through reproducibility, and through a controlled density of meaning.

6. Conclusion

This paper set out to describe Conscious Iterative Structuralism as a process, to name what distinguishes it structurally, and to place it inside current questions about how images are made. C.I.S. begins with one geometric form and one manual algorithm invented by the

[23] Sol LeWitt, "Paragraphs on Conceptual Art" (*Artforum*, 1967): "the idea becomes a machine that makes art." C.I.S. shares LeWitt's procedural rigour, the rules preceding execution, but adds a level of cognitive control, since the work does not appear without the operator's conscious selection. The exhibition title *Ideea, mașina care face artă* acknowledges this lineage directly.

artist and, through a strictly ordered sequence carried out by hand, opens a layered field of possibilities from which a coherent work is chosen rather than generated. Its force lies not in any single trait but in the features that hold together at once: the single algorithm and single form, the 0°/180° reversal, the infinite polysemy that reversal carries, and, on works of sufficient spiral density, an emergent three-dimensionality and a simultaneous infinite polysemy. It is the combination that generates the impact and invites exploration and use. Taken at its widest, C.I.S. is not only a practice but a new language in art, and an instrument for probing how form, process, and knowledge relate, where the structure belongs to mathematics and the recognition of meaning belongs to a human being.[24] That division of labour, and not any posture of opposition to automated tools, is the language's central and most durable claim.

Note on Sources: This study draws on the foundational research note and conceptual documentation of C.I.S. and on the artist's own presentation of the generative process, including the theoretical and visual dossier compiled by the artist. C.I.S. and its manual algorithm are the original work of the structural-conceptual artist Marius V. Popescu; the analysis, framing, and argument of the present paper are the author's.

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Comparative evaluation of the concepts of administrative-territorial reform in Moldova

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Abstract

Administrative-territorial reform is one of the essential conditions for the modernization of local public administration in the Republic of Moldova. Territorial fragmentation reduced administrative and fiscal capacity of numerous administrative-territorial units, unequal access to public services and demographic decline require the identification of a reorganization model adapted to national realities and the objective of European integration. The article makes a comparative assessment of four contemporary reform concepts: the model promoted by the Government of the Republic of Moldova, the Congress of Local Authorities of Moldova model, the Integrated Functional Administrative Reform and the model proposed by the think-thank Europe 2028 initiative. The research combines the literature review with a multi-criteria evaluation based on administrative, financial-budgetary, socio-economic and governance criteria. The article concludes that a sustainable reform must be based on a synthesis scenario, combining territorial consolidation, fiscal decentralization, democratic representation, phased implementation and continuous evaluation of results.

JEL: H77, H83, R58. CZU: 352/353:35.071

Introduction

Administrative-territorial reform is one of the most complex and persistent issues on the agenda of modernization of public administration in the Republic of Moldova. In the last two decades, numerous studies, strategies and public policy proposals have highlighted the need to reduce territorial fragmentation, strengthen the administrative capacity of local public authorities and improve the quality of public services provided to citizens.

The acceleration of the debates in the last two years has led to the outlining of distinct reform concepts. The concept promoted by the Government emphasizes the amalgamation of administrative-territorial units and the reorganization of the second level of local public administration [2]. The Congress of Local Authorities of Moldova (CALM) concept favors asymmetric decentralization and inter-community cooperation [5]. The Integrated

Functional Administrative Reform (RAFI) model proposes a multidimensional and gradual approach [6], and the Europe 2028 (UE28) initiative promotes a single-level model inspired by the experience of the Baltic States [7].

The purpose of the article is to comparative the main concepts of administrative-territorial reform promoted in the Republic of Moldova, by examining their conceptual foundations, proposed institutional mechanisms and their capacity to respond to the challenges of local public administration. The analysis uses criteria on administrative viability, functional efficiency, fiscal sustainability, democratic representativeness, territorial development and compatibility with the objectives of European integration.

The contribution of the paper consists in the application of a unitary analytical framework to the four concepts, as well as in the formulation of a synthesis scenario that capitalizes on their complementary elements. The article is not aimed at the mechanical designation of a single superior model, but at the identification of institutional compromises and the necessary conditions for sustainable reform.

The literature and concept review

The literature highlights the existence of persistent structural deficiencies of the administrative-territorial system: excessive fragmentation of administrative-territorial units, reduced administrative capacity, fiscal imbalances and difficulties in uniform provision of public services. The responses formulated in public policies are mainly based on amalgamation, inter-community cooperation, asymmetric decentralization and the reorganization of the second level of local public administration. The 2012 National Decentralization Strategy [1] enshrined the reduction of fragmentation and the strengthening of administrative capacity as strategic objectives, promoting a gradual approach, oriented towards local autonomy and the efficiency of services.

The Joint Program for Integrated Local Development [3] linked administrative-territorial fragmentation with economic inefficiency, reduced fiscal capacity and difficulties in providing public services, especially in rural areas. In this framework, three instruments were promoted: administrative-territorial amalgamation, inter-community cooperation and asymmetrical decentralization. At the same time, the reorganization of the second level into regional structures capable of supporting economic development and access to European funding was discussed. Subsequent studies, including the spatial optimization model developed with the support of GIZ, introduced quantifiable criteria such as population, fiscal capacity and road distance from the administrative center [4].

The Public Administration Reform Strategy 2023-2030 promotes voluntary

amalgamation as a tool for administrative consolidation, using financial incentives and monitoring mechanisms [2]. However, the contemporary debate goes beyond the simple opposition between amalgamation and maintaining the existing structure, including options on the distribution of competences, financial autonomy, the system of representation and the organization of regional functions.

The methodology

The research uses a qualitative and multi-criteria approach to assess the main concepts of administrative-territorial reform promoted in the Republic of Moldova. In the first stage, the documentary analysis of the relevant academic studies and public policy documents, including national strategies, under UNDP and GIZ studies, as well as the concept documents associated with the Government's models, CALM, RAFI and UE28, was carried out.

The analytical framework comprises five conceptual dimensions: diagnosis of structural problems; instruments of administrative-territorial consolidation; organization of the second level of local public administration; relationship between voluntary and normative mechanisms; correlation of reform with decentralization and European integration.

The multi-criteria assessment includes fifteen criteria grouped into four areas. The administrative area examines the reduction of fragmentation, administrative capacity, access to services and the efficiency of the decision-making process. The financial-budgetary area includes implementation costs, administrative savings, own revenue generation capacity and dependence on transfers from the state budget. The socio-economic area covers the population's access to services, territorial equity, local economic development and employment. The governance area examines democratic representativeness, local autonomy, transparency and institutional accountability.

The evaluation was carried out with the participation of eleven national and international experts with experience in public administration, decentralization, local public finances and territorial development. Each expert evaluated the scenarios on a scale from 1 to 5, where a value of 1 indicates a very unfavorable impact, and a value of 5 indicates a very favorable impact. For each criterion, the arithmetic average of the scores awarded by the experts was calculated, and the results were aggregated at the level of the four evaluation areas.

To avoid overestimating the potential benefits, the aggregate score was adjusted by applying a risk coefficient, reflecting political, administrative, financial and social feasibility. The formula used is:

Adjusted score = Aggregate score × (1 - Risk coefficient).

The risk assessment takes into account political acceptance, support for local authorities

and the population, complexity of institutional changes, costs, administrative capacity, risk of litigation or bottlenecks and experience of comparable reforms. Depending on the result, the scenarios were classified into three categories: low risk, between 0% and 15%; moderate risk, between 16% and 25%; high risk, above 25%. RAFI is analyzed qualitatively, as the data available in the evaluation exercise did not allow the calculation of a comparable quantitative score. This limitation must be taken into account when interpreting the results).

Benchmarking of reform concepts

The results of evaluation of territorial reform concepts is presented in the following figures:

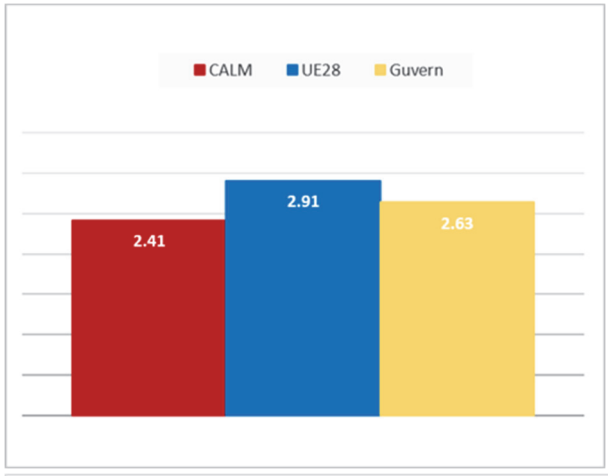


Figure 1. Adjusted Scores for the Evaluation of Territorial Reform Concepts

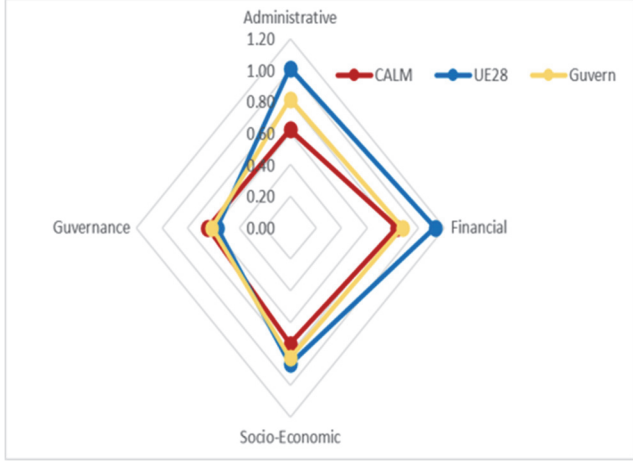


Figure 2. Scores by criteria category

Government concept: gradual consolidation and implementation capacity

The concept promoted by the Government of the Republic of Moldova is based on the

premise that excessive fragmentation at the first administrative level is one of the main causes of limited institutional capacity. The proposed solution involves consolidating administrative-territorial units through amalgamation and reorganizing the second administrative level by re-establishing counties. The model's principal advantage is its operational character. It is supported by a legislative framework, implementation mechanisms, and dedicated financial resources. Financial incentives for amalgamation, together with experience gained through pilot initiatives, increase the prospects for achieving tangible institutional change.

The model's limitations arise from its predominant reliance on demographic criteria and the insufficient consideration of functional, geographical, and socioeconomic factors. Moreover, a transition from voluntary to mandatory amalgamation could generate political and social resistance. The model achieves a final adjusted score of 2.63, with a risk coefficient of 16%. Contributions across the four evaluation areas are relatively balanced: financial-budgetary (0.87), socioeconomic (0.82), administrative (0.81), and governance (0.64), without revealing a clearly dominant strength. Its main weaknesses concern territorial equity and its overall efficiency compared with the other scenarios. Consequently, the government model represents an intermediate, although comparatively less competitive, reform option.

CALM concept: local autonomy and subsidiarity

The CALM model is grounded in the principles of subsidiarity and local autonomy. It advocates the abolition of districts, the strengthening of municipalities, the expansion of inter-municipal cooperation, and the application of asymmetric decentralization.

The model's primary strength lies in its emphasis on democratic representativeness, financial autonomy, and decision-making that is closer to citizens. In the multi-criteria assessment, it performs particularly well in the socio-economic and governance dimensions, reflecting its focus on territorial equity, local participation, and democratic legitimacy.

Its main weakness is the preservation of a large number of small local authorities. While inter-municipal cooperation can improve service delivery, it cannot fully substitute for the institutional capacity of larger and more consolidated administrative units. Furthermore, the model's strong reliance on voluntary mechanisms may slow the pace of territorial restructuring and limit the reduction of administrative fragmentation.

The model achieves a final adjusted score of 2.41, with a risk coefficient of 15%. Its strongest contributions come from the socio-economic (0.84) and governance (0.79) dimensions, where it performs particularly well in terms of territorial equity and democratic

representation. The financial dimension (0.82) delivers moderate results, while the administrative dimension (0.52) remains its weakest area, constrained by persistent fragmentation and limited administrative capacity. Overall, the CALM model prioritizes social cohesion, democratic governance, and local autonomy, but does so at the expense of administrative efficiency and structural consolidation.

RAFI: functional, integrated and differentiated approach

The Integrated Functional Administrative Reform goes beyond the perspective of border reorganization and deals with administrative capacity as a result of the interaction between territorial, institutional, functional, financial and human dimensions.

The model combines the normative reorganization of very small localities, the stimulation of voluntary amalgamation, inter-community cooperation and the reorganization of the second level into functional counties. Its advantage is adaptability to territorial heterogeneity and the possibility of adjusting policies through ex-post monitoring and evaluation.

Complexity is the main limitation. The application of a differentiated system requires significant administrative and coordination capacities. RAFI was not included in the quantitative assessment, so its positioning in relation to the other scenarios remains a qualitative one.

Europe 2028: radical consolidation and structural efficiency

The UE28 scenario proposes the organization of local public administration on a single administrative level, replacing the existing municipalities and districts with approximately 40 large municipal administrations. Administrative proximity would be preserved through the establishment of local prefectural representatives (praetors) operating within component communities. The model achieves the highest adjusted final score of 2.91, with a risk coefficient of 19%. This result reflects its strong potential to reduce territorial fragmentation, strengthen fiscal consolidation, and enhance the capacity to manage public services, infrastructure, and development projects. Its performance is driven primarily by the financial (1.13) and administrative (1.01) dimensions, indicating a high level of efficiency, institutional capacity, and long-term sustainability. The socio-economic contribution (0.87) is also substantial, reflecting improved access to services and development opportunities.

Governance, however, records the lowest contribution (0.57), highlighting concerns regarding local representation and democratic proximity. Overall, the Europe 2028 scenario emerges as the most balanced and highest-performing option among the reform concepts evaluated. However,

the model also entails significant political and social costs. The dismantling of existing local government structures requires broad political consensus, considerable transitional capacity, and effective safeguards to ensure the representation of smaller communities. Furthermore, the successful operation of a single-tier administrative system would require the development of new institutional arrangements for coordinating regional functions and maintaining accountability. Consequently, while Europe 2028 offers the greatest potential for administrative efficiency and fiscal sustainability, its implementation would depend on strong political commitment, careful transition management, and sustained public support.

Summary of results

The analysis highlights two major orientations. The first prioritizes administrative efficiency and institutional strengthening, being represented by Europe 2028 and, in a gradual form, by the governmental concept. The second emphasizes democratic legitimacy, local autonomy and subsidiarity, being represented by CALM. RAFI occupies an integrative position, combining territorial, functional and institutional instruments.

No single model provides complete answers. The government concept has implementation tools but faces difficulties of local acceptance. CALM protects autonomy and representation but insufficiently reduces fragmentation. Europe 2028 maximizes structural efficiency but generates transition costs and political risks. RAFI provides a coherent conceptual synthesis but requires a high institutional capacity. The differences between models reflect real tensions between efficiency and democracy, speed and legitimacy, uniformity and territorial adaptation. Therefore, the choice should not be formulated strictly between voluntarism and normativism, but in terms of a proportionate and predictable combination of instruments.

The results support the development of a synthesis scenario that combines the objective of reducing territorial fragmentation and strengthening fiscal consolidation advanced by the Europe 2028 model, the emphasis on local autonomy and democratic representation promoted by CALM, the implementation capacity of the Government concept, and the functional, gradual, and differentiated approach proposed by RAFI.

The synthesis scenario would be based on the following principles:

- ***Phasing and predictability:*** adoption of a stable public implementation calendar aligned with budgetary and administrative cycles.
- ***Multidimensional criteria:*** use of population size, fiscal capacity, accessibility, geographical conditions, infrastructure, and functional territorial linkages as key determinants of territorial organization.

- ***Combination of incentives and normative instruments:*** gradual and proportionate application of state intervention, following the exhaustion of voluntary measures and an objective assessment of local administrative capacity.
- ***Proximity and representation***: maintenance of local service delivery points and the establishment of representative mechanisms for constituent communities within larger administrative units.
- ***Fiscal decentralization:*** alignment of transferred competences with adequate, predictable revenue sources and transparent fiscal equalization mechanisms.
- ***Monitoring and evaluation:*** continuous assessment of implementation costs, service quality, financial autonomy, territorial equity, and citizen satisfaction.

This scenario seeks to reconcile the objectives of administrative efficiency, fiscal sustainability, democratic legitimacy, and territorial cohesion. Rather than treating the competing reform concepts as mutually exclusive alternatives, it integrates their complementary strengths into a coherent framework capable of addressing the structural challenges of local public administration in the Republic of Moldova].

Conclusions and recommendations

The comparative assessment demonstrates a broad consensus regarding the need to reduce territorial fragmentation and strengthen administrative capacity. At the same time, it highlights significant differences among the reform concepts in terms of institutional design, implementation mechanisms, and the pace of transformation.

The evaluation confirms that no single model achieves optimal results across all dimensions. The Europe 2028 scenario offers the greatest potential for administrative efficiency and fiscal sustainability, but it requires a profound restructuring of the existing system of local government. The CALM model provides stronger safeguards for local autonomy, democratic representation, and citizen participation, yet it does not sufficiently address the challenges associated with territorial fragmentation. The Government's concept is pragmatic and operationally feasible, supported by existing implementation instruments, but it would benefit from a broader set of territorial criteria and stronger guarantees of democratic legitimacy. RAFI presents the most comprehensive and flexible conceptual framework, integrating territorial, functional, and institutional perspectives; however, its successful implementation would require substantial administrative capacity and coordination.

The findings suggest that the most viable reform option is a synthesis scenario that combines territorial consolidation, fiscal decentralization, democratic representation, phased implementation, and continuous monitoring and evaluation. Administrative-

territorial reform should be understood not merely as a process of redrawing boundaries, but as a broader transformation of local public governance aimed at improving institutional performance, service delivery, and territorial development.

Ultimately, the success of the reform will depend not only on the quality of its technical design, but also on the ability to build and maintain broad political and social consensus. In the context of European integration, demographic decline, and increasing fiscal pressures, the Republic of Moldova can neither preserve the status quo nor pursue a radical transformation without adequate public support. Dialogue, predictability, transparency, and a balanced combination of policy instruments are therefore essential prerequisites for the modernization of local public administration and the sustainable development of the country's territories.

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Exilul și reconstrucția apartenenței în *Parisul personal. Casa cu daruri* de George Banu

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Abstract

This study examines the distinctive features of the concept of exile in George Banu's work. The theatre scholar moves between two worlds, two cultural and geographical spaces, and this liminal perspective, *entre-deux,* becomes a defining characteristic of his understanding of exile. Moreover, his writings on exile generate fertile spaces for reflection on identity, memory and belonging. Exile entails not only geographical displacement but also an affective, cultural and symbolic rupture that compels the individual to reconstruct his relationship both to the world and to the self. The volume *The Personal Paris. The House of Gifts* offers a profound insight into the way the home becomes a space of self-recovery. The objects it contains, as repositories of the past and witnesses to lived experience, serve as links between different geographical locations and temporal dimensions. In this context, exile gives rise to nostalgia, which becomes embodied in gifts capable of reconstructing a sense of belonging.

Keywords: Linguistics & Literature, belonging, *entre-deux*, exile, gifts, nostalgia

Rezumat

Lucrarea se bazează pe definirea specificului conceptului de exil la George Banu. Teatrologul pendulează între două lumi, două teritorii, iar perspectiva aceasta intermediară, *entre-deux,* devine o marcă a raportării sale la problematica exilului. Totodată, scrierile care au în vedere exilul generează spații fertile de reflecție asupra identității, memoriei și apartenenței. Exilul nu presupune doar o dislocare teritorială, ci și o ruptură afectivă, culturală și simbolică, care obligă individul să își reconstruiască raportul cu lumea și cu sine însuși. Volumul *Parisul personal. Casa cu daruri* oferă o perspectivă profundă asupra modului în care locuința devine un spațiu al recuperării de sine, iar obiectele depozitare ale trecutului, martori ai experiențelor trăite, devin liantul între spații geografice și temporale diferite. Astfel, exilul generează nostalgie, iar aceasta se concretizează în obiecte capabile să reconstruiască sentimentul apartenenței.

Cuvinte cheie: Lingvistică și Literatură, apartenență, *entre-deux,* exil, daruri, nostalgie

Exilul ca poziționare liminală

O figură culturală pe care o considerăm reprezentativă pentru problematica exilului și pe care o vom analiza în lucrarea noastră este George Banu, o personalitate artistică aparte ce pornește de la analiza teatrului din multiple perspective și pentru a scoate în evidență caracterul său „impur", situat la intersecția dintre viață și artă, iar această alcătuire „impură" este specifică și exilului. Fenomen al rupturii, dislocării, înstrăinării, înțelegerea exilului conține și opusul, integrarea, acceptarea unei noi ordini, o nouă înrădăcinare a individului în spațiul de adopție. Întotdeauna pentru a supraviețui acestui context este necesară o abordare ambivalentă, o glisare între spații: „Ființă hibridă, recompensă a dorinței de integrare și totodată a neuitării de țară. Din acest punct de vedere, m-am recunoscut într-un entre-deux care nu e sfâșiere, ci alianță. Comuniune impură!" (Banu, 2016, p. 16). Situarea aceasta între, intermediară, devine o marcă a raportării lui George Banu la problematica exilului.

Scriitorul abordează într-un mod rațional, realist, integrarea, nu se autoiluzionează, e conștient de limite și încearcă mereu să mențină un echilibru identitar. „Integrarea absolută e o negație. Un refuz identitar. Integrarea parțială e o condiție de inserție socială, culturală, intelectuală. E ceea ce, organic, am considerat că putea să-mi fie condiția proprie" (Banu, 2016, p. 14). Totodată nu încearcă să-și estompeze originea, ci în mod inteligent o include, o integrează în noul construct identitar modelat de exil: „Și de aceea, împreună cu prietenii de aici, din lume și din România, m-am integrat, fără a căuta să-mi sacrific apartenența" (Banu, 2016, p. 15).

Momentul declanșator al conștientizării faptului că părăsirea țării se va impune ca o urgență, în contextul din ce în ce mai agresiv al comunismului este relatat și analizat de George Banu în revista Secolul 21, George Banu, Contemporanul nostru I, în secțiunea intitulată „Istorie și decizii autobiografice". Tensiunea plana în atmosfera de început a anilor '70, exista un presentiment generator de neliniște, care prefigura întorsătura dramatică ce avea să schimbe destine. Momentul crucial este adânc înscris în memoria lui George Banu, alături de detaliile cele mai nesemnificative. Aflat la 2 mai, în 1971, alături de prietenul său Ovidiu Iuliu Moldovan, într-o dimineață la plajă, în timp ce citea Scânteia, teatrologul conștientizează situația în toată gravitatea ei, iar plecarea se impune ca singura soluție salvatoare.

> *„Totul e fixat în memorie, și intensitatea luminii, și singurătatea mea destinsă, și agitația discretă a valurilor, totul... dar mai ales paginile ziarului a căror lectură confirmă presentimentul și decretă cutremurul. Aceasta mi-a fost revelația ce a catalizat dorința plecării iminente. Regimul autoritar reînvia și ne proiecta în universul său dogmatic, rigid, irespirabil.*

Sub impactul Tezelor din Iunie mi s-a impus obligația de a-mi pregăti ceea ce nu numeam încă nobil «exil» (Banu, 2019, pp. 26-27)".

Perspectiva universitară în străinătate poate fi realizată cu ajutorul doctoratului, pe care Banu îl finalizează în 1973, printre proiectele terminate înaintea plecării se numără și antologia Arta teatrului, întocmită împreună cu Mihaela Tonitza. Plecarea se conturează în urma unei invitații fictive, necesare pentru obținerea unui pașaport, o misiune foarte dificilă la vremea respectivă. Documentul care motiva cererea de plecare era un acord pentru „Conservatorul de muzică din arondismentul 5" și astfel teatrologul ajunge la Paris pe 31 decembrie 1973.

Reflectând asupra exilului și a cauzelor socio-istorice care îl determină, desigur, luând în calcul și aportul biografic, Banu stabilește două categorii: „exilul de perspectivă" și „exilul de supraviețuire". De asemenea, criticul de teatru aduce în discuție și exilul economic, o problemă tot mai acută a zilelor noastre, „care a determinat mutații demografice sfârșind recent într-o problemă mondială, din America până în Europa" (Banu, 2019, p. 28).

Încă de la început, Banu precizează că decizia desprinderii de țară nu i-a aparținut, nu s-a fundamentat inițial pe decizia accesului la o altă cultură, iar în cazul său sunt și alți mulți colegi de generație. Decizia impusă a exilului se deosebește de cazurile lui Brâncuși, Picasso sau Joyce „ce au ales Parisul ca orizont de împlinire" (Banu, 2019, p. 28). De cealaltă parte, presiunea condițiilor istorice nefavorabile generează „exilul de supraviețuire" și aici sunt menționate cazurile bine-cunoscute ale lui Brecht sau Thomas Mann. Din această perspectivă, criticul de teatru meditează asupra verbului „a fugi" în mod figurat și a conotațiilor sale în funcție de context. Astfel pentru „exilații de supraviețuire" există o diferență de nuanță:

„[...] noi nu ne-am îndreptat spre, ci ne-am extras din...cu precipitare și riscuri! Fuga – prealabil existențial și doar apoi pentru unii, șansa de creație! Eu și mulți dintre noi n-am părăsit țara nici în numele unei vocații nici în numele unei rezerve critice față de identitatea națională – nu de România am resimțit nevoia să mă despart ci de dictatura lui Ceaușescu a cărei accelerare periculoasă am intuit-o la lectura pe plajă a Scânteii!" (Banu, 2019, p. 30).

Distingând între cele două categorii, pentru „exilații de perspectivă" verbul potrivit este „a pleca", un verb care exprimă mai puțin accentuat necesitatea plecării. În acest caz, revenirea este permisă și nu comportă dificultăți, precum în primul caz, în care, dacă s-ar fi întors, exilații s-ar fi supus unor riscuri majore. „Exilații de supraviețuire" trăiesc sub zodia unui paradox dramatic: „Imperativul e categoric: «fuga» îi face invalizi și sunt drastic amputați de returul la origine" (Banu, 2019, p. 30). Realitatea exilului menține o stare accentuată de scepticism, criticul de teatru încearcă să fie din nou echilibrat în raport cu

acest subiect, în timp ce numeroși alți reprezentanți ai exilului trăiesc sentimentul resemnării în raport cu durata ilimitată a comunismului. Monica Lovinescu și Cioran sunt două dintre exemplele de intelectuali, citate de Banu, care nu cred în ameliorarea stării ce persistă într-o existență crudă și lipsită de libertate.

În ceea ce privește ideea „emigrației" române, Banu mărturisește că nu i se asociază într-o manieră declarată datorită legăturilor neîntrerupte cu Europa, asociate teatrului, prietenilor și călătoriilor în postura de iubitor avizat al spectacolelor artistice. În același timp, separarea de țară, de estul Europei nu s-a produs niciodată. Drept dovadă stau mai multe din acțiunile sale, precum un număr din les Cahiers de l'Est, revistă condusă de Dumitru Țepeneag, număr pe care Banu îl dedică mai multor scene ale lumii din Praga, București sau Varșovia. Un alt exemplu este luarea de cuvânt de la Europa Liberă pentru a informa și a menține un dialog cu iubitorii de teatru. „Un dialog minimal", așa cum îl numește scriitorul, dar extrem de relevant, demers care își atinge ținta, iar replica „Te-am ascultat" din partea unui reprezentant al publicului e dovada că dialogul a avut cu adevărat ecou: „[...] mărturie pe care am asimilat-o unei recompense" (Banu, 2019, p. 31).

După căderea comunismului, revenirea se impune ca o nevoie organică „[...] reîntoarcerea devenea indispensabilă" (Banu, 2019, p. 34). În noul context, libertatea este celebrată printr-o sărbătoare a teatrului la București, festivalul le Printemps de la liberté, condus de Banu și de Patrice Martinet, este un astfel de eveniment care reunește personalități de talie mondială precum Antoine Vitez, Patrice Chéreau, Gérard Desarthe, Hélène Delvault, urmat câteva luni mai târziu de vizita lui Peter Brook. Revenirea în țară oferă satisfacția redescoperirii vechilor prietenii, dar și construirea unora noi, toate aceste legături afective au conotații specifice, amplificate de valențele locului de origine. „Reîntoarcerea mi-a permis să mă hrănesc cu energiile de o natură diferită față de Paris a prietenilor din țară" (Banu, 2019, p. 35). În egală măsură, exilatul reîntors trăiește bucuria imensă a regăsirii limbii materne, eveniment care îi dă prilejul să se simtă el însuși, acasă, într-un spațiu căruia îi aparține. „Revenirea a însemnat regăsirea limbii materne în spațiul orașului unde nimeni nu mă mai întreba «de unde vin?»" (Banu, 2019, p. 35).

Experiența exilului dă posibilitatea de a explora lumea și a chestiona universul interior îmbogățit în urma celor trăite, dar și modificat de suferința produsă de dezrădăcinare, inadecvare, nepotrivirea cu un teritoriu nou. Eliberat de povara exilului prin posibilitatea reîntoarcerii, ființa surghiunitului, obișnuită cu alegerile sau forțată să trăiască în aceste condiții, își pune din nou problema opțiunii pentru un spațiu sau altul. În lumina acestor

alegeri, Banu rămâne consecvent25 optând pentru ambele posibilități, el va rămâne permanent și prin excelență o ființă definită de conceptul entre-deux.

> *„Întrebarea care s-a formulat însă pentru mine constă în imperativul de a alege: țara de origine sau țara de elecție. Să consider închis traseul sau să mă refuz reintegrării în contextul de plecare? Fără ezitare de astă dată am refuzat să aleg pentru a putea circula alternativ între cei doi termeni și a asuma astfel dualitatea condiției mele de emigrant ce face drumul de întoarcere fără a-și dezice cealaltă alegere: Franța și România! Îmi asum simultan cele două apartenențe. Și circulația între ele mi-a definit opțiunea" (Banu, 2019, p. 36).*

Astfel, creația lui George Banu ilustrează într-un mod exemplar felul în care exilul devine un spațiu fertil al reflecției și creației, iar conceptul de entre-deux nu rămâne doar un instrument de analiză, ci se transformă într-o metaforă a propriei existențe.

Reconstrucția apartenenței în Parisul personal. Casa cu daruri

Scrierile despre exil conțin experiența dezrădăcinării, a rupturii și a căutării unui loc al apartenenței, însă în cazul lui George Banu nu se manifestă sub forma unui discurs traumatic, ci printr-o subtilă reconstrucție a sinelui în interiorul unui spațiu privat care este mai mult decât un decor autobiografic. Spațiul domestic ajunge să funcționeze ca un depozit de funcționare a memoriei și ca un mecanism de compensare a pierderii. Casa păstrează coerența identității, ea nu permite dezagregarea identitară specifică exilului, devine un loc protector al reconfigurării apartenenței. Volumul care reflectă foarte bine aceste metamorfoze identitare, aplicate unui spațiu personal, este Parisul personal. Casa cu daruri, al doilea dintr-o trilogie, care conține, de asemenea, Parisul Personal. Autobiografie urbană și Parisul personal. Familia din Rivoli 18. Adina Dinițoiu vorbește despre toate aceste trei volume într-un articol din Observator Cultural, intitulat George Banu și Parisul său „personal":

[25] Consecvența lui Banu nu implică doar opțiunea pentru spațiile din care provine, ci și un acord în interiorul ființei, teatrologul este din nou preocupat de echilibru, de măsură, dorește să rămână fidel sieși, să fie un consens între imaginea sa construită, reflectată și propria imagine despre sine: „Să te recunoști și să te lași recunoscut fără iluzii sau decepții… să admiți trecutul rezistenței exersată de artiștii indigeni rămași în țară și să eviți «complexul de statuie» suscitat uneori de revenirea «aureolată» în țară. Nu trebuie uitat că noi am plecat tineri și ne-am întors adulți… că pariul consista în a cultiva echilibrul între istoria unei culturi și biografia celui care își regăsea țara. Challenge dificil! Când sfâșierea ia sfârșit cum să-i respecți cicatricea? Ce aduci cu tine și ce primești? Ele sunt indisociabile, dar câte erori s-au comis din irespectul acestui echilibru!" (Banu, 2019, p. 36).

„[...]cele trei volume de colecţie alcătuiesc o geografie – în mod asumat – intimă şi afectivă a românului emigrat la Paris, care ajunge să-şi problematizeze, în fond, dubla apartenenţă şi dubiul identitar: echilibrat, el declară că se află undeva la jumătatea drumului, nici francez, nici român pe de-a-ntregul, incertitudine pe care tinde să o compenseze prin crearea acestui spaţiu „personal", numai al său, spaţiu de refugiu, de reculegere, de repliere (Dinițoiu, 2017)".

În continuare ne vom axa pe volumul al doilea al trilogiei menționate, în care obiectele ocupă un loc privilegiat. Ele nu sunt doar dovezi ale memoriei, ci funcționează ca dispozitive de reconstrucție a apartenenței. Obiectele reflectă foarte bine condiția entre-deux, deoarece poartă amprenta trecutului și generează o formă de nostalgie, care nu urmărește doar recuperarea a ceea ce a fost, a originilor, ele stabilesc un dialog între cele două lumi diferite.

De asemenea, prin raportarea la conceptul de entre-deux, specific lui George Banu, făcând apel și la teoria ce vizează les lieux de mémoire, care îi aparține lui Pierre Nora din studiul Between Memory and History: Les Lieux de Mémoire, precum și la nostalgia reflexivă, descrisă de Svetlana Boym în The Future of Nostalgia, se poate susține că obiectele sunt simbolurile centrale ale cărții. Acestea devin locul de intersecție pentru identitate, memorie și nostalgie, care va produce o nouă formă de apartenență, de înțelegere a lumii, de reconciliere între spații culturale diferite. Conceptul de entre-deux desemnează tocmai această situare între două limbi, două culturi, adăugarea unei noi forme de apartenență la cea originară, fără ca un univers să îl excludă pe celălalt. „Și într-adevăr am rămas, ezitant, între două lumi... vocație ce în timp s-a confirmat. Vocația dublei apartenențe, a lui entre-deux, a intervalului și a incapacității de a alege. Mereu dublu, nicicând unic" (Banu, 2015, pp. 104-106).

Conceptul nu se referă doar la o poziționare geografică, devine o condiție existențială definitorie, astfel cel în cauză își negociază permanent coordonatele existențiale, situate între trecut și prezent, spațiul originar și cel de adopție. Deși apartenența inițială este fragmentară, acest sentiment poate fi reconstruit cu ajutorul obiectelor. Acestea, multe dintre ele dobândite, cadouri, devin reperele ferme ale unei lumi caracterizate de fragmentar, instabilitate și îi permit omului de teatru să se plaseze simbolic între ele. Casa cu daruri se transformă dintr-o simplă locuință într-un teritoriu al indeterminatului, care reunește și reorganizează părți ale diferitelor apartenențe, concretizate în obiecte.

„De aceea, mă asum ca infidel – e adevărat, în proporții economicoase – și nu mă fac experiența disparatului. Accea a unui comportament «insular» ce exclude nemișcarea proprie colecționarului și produce un arhipelag plural, fără o autoritate centrală. Obiectele ce mă înconjoară care se succed și mă constituie. În ele mă recunosc" (Banu, 2015, pp. 11-12).

Obiectele dau un sens ființei, o restructurează. O asemenea atitudine definește condiția exilatului, care se opune încremenirii, este nevoită să facă față provocărilor, să se adapteze. Perspectiva sa e în contradicție cu o autoritate centrală, psihologia artistului Banu e dornică să exploreze necunoscutul, care se opune centrului, întreaga construcție memorialistică intră în dialog cu perifericul.

Teoria lui Pierre Nora din studiul Between Memory and History: Les Lieux de Mémoire oferă o perspectivă interesantă pentru interpretarea cărții lui Banu, în aceasta istoricul francez susține că modernitatea a cauzat destrămarea mediilor tradiționale ale memoriei (milieux de mémoire), ceea ce a condus la apariția unor „locuri ale memoriei" (lieux de mémoire)26. Acestea sunt reprezentate de spații, gesturi, imagini sau obiecte în care memoria se conservă și se transformă27.

Autorul studiului analizează permanent memoria în raport cu istoria și constată că sunt într-o permanentă opoziție. Istoricul caracterizează memoria ca fiind strâns legată de viață, „în permanentă evoluție", aceasta se supune dinamicii dintre amintire și uitare, nu este conștientă de „deformările sale succesive", „vulnerabilă la manipulare", memoria este „un fenomen actual", care ne conectează cu „un prezent etern". Istoria i se opune, este o „reconstrucție, întotdeauna problematică și incompletă [...] o reprezentare a trecutului". Memoria ține de afect, este „colectivă, plurală și totuși individuală, pe când istoria „aparține tuturor și niciunuia", are o „autoritate universală". Memoria este spontană, iar istoria este analitică și critică, susține Pierre Nora28.

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[26] ‘There are *lieux de mémoire*, sites of memory, because there are no longer *milieux de mémoire*, real environments of memory’ (Nora, 1989, p.7).

[27] ‘Memory takes roots in the concrete, in space, gestures, images and objects; history binds itself strictly to temporal continuities, to progressions and to relations between things. Memory is absolute, while history can only conceive the relative’ (Nora, 1989, p. 9).

[28] ‘Memory and history, far from being synonymous, appear now to be in fundamental opposition. Memory is life, borne by living societies founded in its name. It remains in permanent evolution, open to the dialectic of remembering and forgetting, unconscious of its successive deformations, vulnerable to manipulation and appropriation, susceptible to being long dormant and periodically revived. History, on the other hand, is the reconstruction, always problematic and incomplete, of what is no longer. Memory is a perpetually actual phenomenon, a bond tying us to the eternal present; history is a representation of the past. Memory, insofar as it is affective and magical, only accomodates those facts that suit it: it nourishes recollections that may be out of focus or telescopic, global or detached, particular or symbolic – responsive to each avenueof conveyance or phenomenal screen, to every censorship or projection. History, because it is an intellectual and secular production, calls for analysis and criticism. [...] memory is by nature multipleand yet specific; collective, plural and yet individual. History, on the other hand, belongs to everyone and to no one, whence its claim to universal authority’ (Norra,1989, pp. 8-9).

Casa lui Banu poate fi considerată un „loc al memoriei” sugestiv, autentic, în care darurile păstrate funcționează ca elemente concrete ale memoriei personale. În timp ce Nora ne aduce în prim plan memoria colectivă, la criticul de teatru suntem martorii unei concepții mult mai personale, în care „locurile memoriei” definesc o identitate care se află într-un proces permanent de reconstrucție. Toate obiectele, cadourile primite de la apropiați, nu țin doar de rememorarea unui eveniment, ele reactivează relațiile și legăturile simbolice ale individului cu persoanele care le-au dăruit, o parte din prezența celor dragi se continuă astfel în prezent.

Obiectele sunt liantul dintre lumi. Ele readuc în prezent semnificația altor locuri și altor timpuri. Darurile convertesc ruptura în continuitate, iar memoria este un amplu mecanism care împiedică dezintegrarea identității. Situarea liminală a ființei ajunge la un sens în prezent și datorită memoriei, care este mai mult decât o colecție de amintiri, ea devine un proces de reactivare a legăturilor cu diferite ipostaze culturale, afective, prieteni dragi. În lumina caldă a memoriei, prietenia devine o valoare în sine, fără contururi fizice, ci doar simbolice, ce țin de emoție, de sentiment, de empatie și nostalgie, astfel chiar și îmbătrânirea pare suportabilă, atunci când vedem esența umanului și nu carcasa efemeră a lumii:

> *„De ce îmbătrânim? Ca să ne putem regăsi imaginar şi fizic să nu ne recunoaştem nici pe noi, nici pe cei apropiaţi. Pe el însă, definitiv tânăr, un asemenea pericol nu-l pândeşte. Balthus îi fixează definitiv imaginea. O privesc, mereu splendidă, şi ea mă priveşte pe mine, din ce în ce mai degradat! Niciunul din noi nu e mut, dincolo de diferenţe, comunicăm. Şi aceasta, graţie generozităţii prietenului care mi-a făcut darul ce atestă cât de just citise în mine. Un cadou e şi consecinţa unui diagnotic afectiv. Merci, Patrice!” (Banu, 2015, pp. 86-87).*

În relația dintre identitate și memorie apare și nostalgia, care nu trebuie privită doar ca o dorință arzătoare de întoarcere, ea reprezentând o manieră de reflecție asupra pierderii și a timpului, așa cum este descrisă în cartea Svetlanei Boym, The Future of Nostalgia. Autoarea înțelege istoria nostalgiei ca rezultat al relației dintre biografia personală și istoria unui grup sau a unei națiuni, precum și a legăturii dintre memoria personală și cea colectivă. Cercetătoarea definește parcursul nostalgiei de la o boală vindecabilă, așa cum era percepută în secolul al XVIII-lea, la o stare a timpurilor moderne.

Svetlana Boym face distincția între două tipuri de nostalgie: nostalgia recuperatoare și nostalgia reflexivă29. Prima încearcă să reconstruiască trecutul în forma sa idealizată, este

[29] ‘Instead of a magic cure for nostalgia, a typology is offered that might illuminate some of nostalgia’s mechanism of seductionand manipulation. Here two kinds of nostalgia are distinguished: the restorative and the reflexive. Restorative nostalgia stresses *nostos* and attempts a transhistorical reconstruction of the lost home. Reflective nostalgia thrives in *algia*, the longing

o formă de nostalgie centrată pe tradiție și pe adevărul absolut. Cea de-a doua acceptă ireversibilitatea timpului și transformă memoria într-un exercițiu de reflecție, este un construct ambivalent, situat între dor și apartenență, generând memoria socială. Parisul personal. Casa cu daruri se înscrie în acest registru al nostalgiei reflexive, în care nu se dorește recuperarea unui trecut pierdut, se merge spre o continuitate afectivă într-o lume marcată de mobilitate și exil. Obiectele reflectă simultan prezența și absența, producând nostalgie, nu pentru că trimit la trecut, ci pentru că îl reconstituie într-o formă incompletă, fragmentară, iar identitatea este tocmai suma fragmentelor dispersate ale mai multor lumi.

„Tânăr fiind, am citit un roman al lui Henrich Böll care ne invita, după dezastrul războiului, să apreciem mai degrabă oamenii decât monumentele. Mi s-a părut atunci o invitație la dispreț față de cultură, la o tabula rasa a memoriei colective. Azi însă nu mai resping această propunere cu o egală intransigență, o înțeleg altfel, dar continui să-mi spun: oamenii se salvează nu doar prin prezența lor, ci și prin urma pe care o lasă, modestă, personală, fragmentară, moștenire senimentală. Aceste metonimii ale unor prietenii îmi sunt necesare…" (Banu, 2015, p. 132).

Apartenența în cazul lui George Banu trebuie reinventată, iar acest proces are loc prin intermediul obiectelor.

Concluzii

Darurile conturează un univers simbolic al mai multor apartenențe, iar casa este spațiul reconcilierii lor. Cu ajutorul darurilor memoria capătă contururi mult mai concrete, nostalgia se transformă într-o experiență reflexivă, iar apartenența nu mai este legată de un singur spațiu cultural. Cadourile vor configura o triplă perspectivă, trimit la „locuri ale memoriei", declanșează nostalgia și mediază între lumi diferite.

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itself, and delays the homecoming – wistfully, ironically, desperately. Restorative nostalgia does not thing of itself as nostalgia, but rather as truth and tradition. Reflective nostalgia dwells on the ambivalences of human longing and belonging and does not shy away from the contradictions and modernity. Restorative nostalgia protects the absolute truth, while reflective nostalgia calls it into doubt' (Boym, 2001, p. XVIII).

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Dialectica eliadescă sacru-profan ca reprezentare a exilului în *Iarba zeilor* de Bujor Nedelcovici

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Abstract

In this study, we aim to examine how Eliade's theory of the camouflage of the sacred within the profane is reflected in Bujor Nedelcovici's short stories. Taking as our starting point the volume *The Grass of Gods*, which brings together a series of short stories centered on the theme of *waiting* as a manifestation of exile, this Eliadean dialectic expressed through a recovery and revitalization of sacred space and time translates, in Nedelcovici's work, into a reconstruction of identity. In this sense, however, this revaluation on a personal, individual level is mediated by multiple creative instances, and Nedelcovici's characters (who are the author's alter egos) embody many facets of creative becoming. Real-life experiences transcend the physical, profane realm and take on new meanings, becoming part of the sacred realm, and writing thus becomes a form of catharsis.

Keywords: Linguistics & Literature, sacred-profane dialectic, exile, identity, Nedelcovici's short stories

Rezumat

În acest studiu ne propunem să observăm felul în care teoria eliadescă a camuflării sacrului în profan se reflectă în nuvelistica lui Bujor Nedelcovici. Pornind de la volumul *Iarba zeilor*, care reunește o serie de nuvele ce au drept coordonată – *așteptarea* – ca formă de manifestare a exilului, această dialectică eliadescă concretizată printr-o recuperare și actualizare a spațiului și a timpului sacru se traduce, la Nedelcovici, ca reconstrucție identitară. În acest sens, această revalorizare în plan personal, individual este însă mijlocită de mai multe instanțe creatoare, iar personajele lui Nedelcovici (care sunt alter-egouri ale autorului) transcriu tot atâtea fațete ale devenirii creatoare. Experiențele reale transcend planul fizic, profan și capătă semnificații noi, încadrându-se în planul sacru, iar scrisul devine astfel o formă de catharsis.

Cuvinte cheie: dialectică sacru-profan, exil, identitate, nuvelistica lui Nedelcovici

Introducere

În ceea ce privește exilul studiat ca fenomen individual, particular, așa cum îl definea și Laurențiu Ulici, Nedelcovici declara într-un volum autobiografic realizat sub forma unui interviu apărut în 2010, intitulat *Cine sunteți, Bujor Nedelcovici? Bujor Nedelcovici în*

dialog cu Sergiu Grigore, că exilul poate fi exterior și interior, voluntar sau involuntar. Exilul său fizic începe în 1987, când pleacă la Paris, unde obține azil politic. Această formă de exil apare ca urmare a unui exil interior ce se petrece cu mult înainte. Cenzura cărților sale, interdicția de a publica diverse lucrări, supravegherea de către autorități și obligarea de a lucra în medii neconforme studiilor, toate au contribuit în mod negativ la plecarea din țară. Un exemplu reprezentativ este romanul *Al doilea mesager*, interzis publicării, a fost trimis clandestin în Franța, unde a fost publicat și a obținut premiul Pen Club francez. În 1992, romanul a fost distins cu Premiul Academiei Româno-Americane de Arte și Științe.

1. Sacru-profan – dialectică eliadescă

Volumul în care sunt reunite nuvelele pe care le analizăm este intitulat sugestiv *Iarba zeilor*. Încă din titlu este menționată această dublă perspectivă profan-sacru. Lumea „zeilor" numită de Nedelcovici trimite de altfel la geneza universului și la arhetipurile mitice pe care le găsim în studiile lui Mircea Eliade, fie cele teoretice, fie cele literare – beletristice. În studiul dedicat teoriei camuflării sacrului în profan, Eliade menționa:

O dată așezați în perspectiva omului religios aparținând societăților arhaice, putem constata că *Lumea există pentru că a fost creată de zei*, și că existența însăși a Lumii „spune" ceva, că Lumea nu este nici mută, nici opacă, nu este ceva inert, fără sens și fără scop. (Eliade, 2005, p. 124).

Cât privește mitul, Lucian Blaga îl considera ca „(Mitul e) încercarea de a revela un mister cu mijloace de imaginație." (Blaga, 1987, p. 219).

În studiul *Bujor Nedelcovici – între atracția scriiturii și datoria mărturisirii*, pornind pe linia lui Gilbert Durand, Maria-Mirabela Neagu subliniază că „Atât romanele, cât și prozele scurte ale autorului demonstrează aplecarea acestuia spre sfera miturilor, pe care le actualizează. Majoritatea cărților sale demonstrează o structură mitică." (Neagu, 2014, p. 144).

Într-un soi de abordare metatextuală, în nuvela *Ka*, ce prezintă o doamnă în etate, care trăiește într-un spațiu retras, într-o așteptare a descoperirii profunzimilor, este subliniată această dialectică sacru-profan: „[...] văzuse potențialul mitic" care se ascundea în fiecare cuvânt, gest sau acțiune, dobândise o cunoaștere enigmatică ce se afla în spatele adevărurilor relative [...]" (Nedelcovici, 1998, pp. 79-80).

Așteptarea – formă de manifestare a exilului

În acest studiu ne propunem să observăm felul în care teoria eliadescă a camuflării sacrului în profan se reflectă în nuvelistica lui Bujor Nedelcovici.

Nuvelele din volumul amintit, *Iarba zeilor* (Nedelcovici, 1998), au drept coordonată – *așteptarea* – ca formă de manifestare a exilului. Pentru exilați, exilul este un soi de așteptare a cărei destinație nu o cunosc, o așteptare continuă.

Personajele parcurg un soi de traseu inițiatic necesar obținerii unei existențe capabile de revelare a sacrului. Puse într-o lumină comună, aceste personaje sunt oameni comuni, aflați în spații obișnuite, în situații comune. De exemplu, nuvela *Iarba zeilor* se deschide cu o acțiune cotidiană, zilnică ce îl prezintă cititorului pe domnul Hubert, un fost profesor universitar, aflat acasă, în spațiul personal, în mediul său familiar. Întâmplările zilnice sunt prezentate cât mai firesc, iar ieșirea din acest spațiu conduce la depășirea planului profan.

Despre acest cotidian vorbește și Doina Ruști, *Dicționar de simboluri în opera lui Mircea Eliade*, unde precizează că: „Cotidian – Toate marile revelații, mesajele esențiale se află camuflate în fapte și lucruri banale." (Ruști, 1998, p. 47)

Situarea inițială pregătește cititorul pentru „așteptarea" pe care personajele ar părea că o anticipează încă din incipit.

Acest traseu relevă o aventură/un parcurs gnoseologic și ontologic. Pe de o parte, personajele trăiesc niște experiențe profane pentru a reuși să transcendă într-o experiență superioară, cea a cunoașterii.

În nuvela intitulată metaforic *Așteptarea*, incipitul este ex-abrupto. Alain, personajul central, aflat într-o vacanță la mare, are conștiința unei revelații pe care însă nu o poate desluși. Lucrurile comune care se întâmplă capătă sensuri diferite (mersul la plajă, înotul etc.), iar apa devine un element de revelare a sacrului. De altfel, inclusiv numele personajului poate fi un element intertextual eliadesc, iar, la fel ca Alain-ul din *Maitreyi*, acesta încearcă să descopere sensuri noi ale existenței. Acest lucru reprezintă o transcendere a timpului și a spațiului real, adică o dispariție. Doina Ruști sublinia că: „Dispariție – În proza lui Eliade dispar din planul realității case, păduri, vehicule și oameni, dar este vorba doar despre o altă dimensiune, camuflată, și de aceea se produc uneori și reapariții la fel de misterioase." (Ruști, 1998, p. 50)

Pe de altă parte, toate aceste experiențe conduc către o căutare existențială. Reconstrucția identitară se produce printr-o permanentă căutare a sinelui:

> *„[...] înălțimile îi conduc ființa spre o stare de revelație, extaz și căutare de sens: spiritul purificat și transfigurat prin imagine, contact fulgurant cu transcendența, apoi brusca întoarcere în sine și în real." (Nedelcovici, 1998, p. 78)*

Această „refacere" se realizează nu numai la nivel metatextual și intertextual, cât mai ales la nivelul receptării textuale. Despre puterea pe care o investește Nedelcovici cititorilor vorbește și Anastasia Dumitru (2015) în monografia *Bujor Nedelcovici. Conștiința de scriitor*: „ [...] lectorii – cei care conștientizează necesitatea darului și umplu cu sens durata

Operei.” Observăm, în acest sens, că există mai multe instanțe creatoare ale operei, care se realizează pe trei niveluri: biografic, estetic și receptiv.

Din perspectivă biografică, personajele lui Bujor Nedelcovici sunt niște alter-egouri ale autorului, care transcriu tot atâtea fațete ale devenirii creatoare. Personajele lui Nedelcovici sunt niște exilați ce resimt exilul în diferite forme. Reconstrucția identitară a acestora se produce prin reactualizarea unui timp și a unui spațiu sacru. Experiențele lor reale, la fel ca cele ale lui Nedelcovici, contribuie la revelarea sacrului, ceea ce conduce la o viziune panoramică asupra existenței:

„Citea cărți vechi indiene, studia Coranul și Scriptura, era preocupată de Cabbală... a înțeles că adevărul despre viața ei nu poate fi dobândit și nici descris, iar lipsa de decizie îi fracturase întreg destinul.” (Nedelcovici, 1998, p. 80)

> *„[...] confuzia de-o viață dintre spațiul real și cel imaginar... n-am dobândit conștiința profundă a propriei mele existențe, n-am câștigat o semnificație superioară, n-am izbutit să mă transform atât cât să văd invizibilul dincolo de vizibil...” (Nedelcovici, 1998, p. 80)*

Din punct de vedere estetic, scrisul devine pentru Nedelcovici o formă de catharsis. Într-o dialectică platoniciană, creația se situează la nivelul secund, într-o lume pură a ideilor. Astfel, experiențele reale/ biografice, care se încadrează în planul profan, articulează noi experiențe metamorfozate în stări spirituale, ce transcend planul fizic, material pentru a se situa la nivelul sacrului.

În nuvela *Cealaltă Marie*, cele două prietene care se confesează menționează că „[...] sensul profund al unei idei se află dincolo de cuvinte și nu poate fi explicat, iar învățătura nu poate fi transmisă, ci doar deprinsă prin faptă și har [...]” (Nedelcovici, 1998, p. 91).

Din perspectiva receptării textuale, Nedelcovici îi oferă lectorului posibilitatea de a construi/deconstrui actul creator: „[...] adevărul nu poate fi obținut, ci doar sugerat.” (Nedelcovici, 1998, p. 83), însă cititorul este cel care decide dacă intervine sau nu în parcursul personajelor: „Și a ignora este o artă, nu numai a afla” (Nedelcovici, 1998, p. 81).

Putem spune că toate cele trei instanțe – autor, narator, receptor – sunt complementare și articulează un discurs identitar, al revelației prin scris.

Concluzii

Această dialectică eliadescă manifestată printr-o recuperare și actualizare a spațiului și a timpului sacru se traduce, la Nedelcovici, ca reconstrucție identitară. În acest sens, această revalorizare în plan personal, individual este mijlocită de mai multe instanțe creatoare, iar personajele lui Nedelcovici (care sunt alter-egouri ale autorului) transcriu tot atâtea fațete

ale devenirii creatoare. Experiențele reale transcend planul fizic, profan și capătă semnificații noi, încadrându-se în planul sacru, iar scrisul devine astfel o formă de catharsis.

Majoritatea personajelor trăiesc un exil exterior sau interior și reușesc să îl depășească prin această așteptare de revelare a sacrului, a misterelor universului ce transgresează dimensiunea personală a fiecărui individ și devin un soi de predestinare.

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Andrei Șerban, George Banu, Basarab Nicolescu – Prietenie dincolo de timp și spațiu

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Abstract

This article analyses the contribution of the philosopher and physicist Basarab Nicolescu to the formulation and development of the concept of transdisciplinarity. Starting from the author's intellectual biography, the paper explores the logical, epistemological, and ontological foundations of transdisciplinarity, with a particular focus on concepts such as the logic of the included middle, levels of reality, and the dialogue between science, art, and spirituality. The article also highlights the practical applicability of this approach in education, research, and culture, as well as its international impact through initiatives such as CIRET. Furthermore, it discusses the main criticisms directed at transdisci-plinarity and provides an argument in favor of its validity and contemporary relevance. The study argues that transdisciplinarity is not a fusion of disciplines but rather a space of dialogue that respects difference while seeking meaning within complexity.

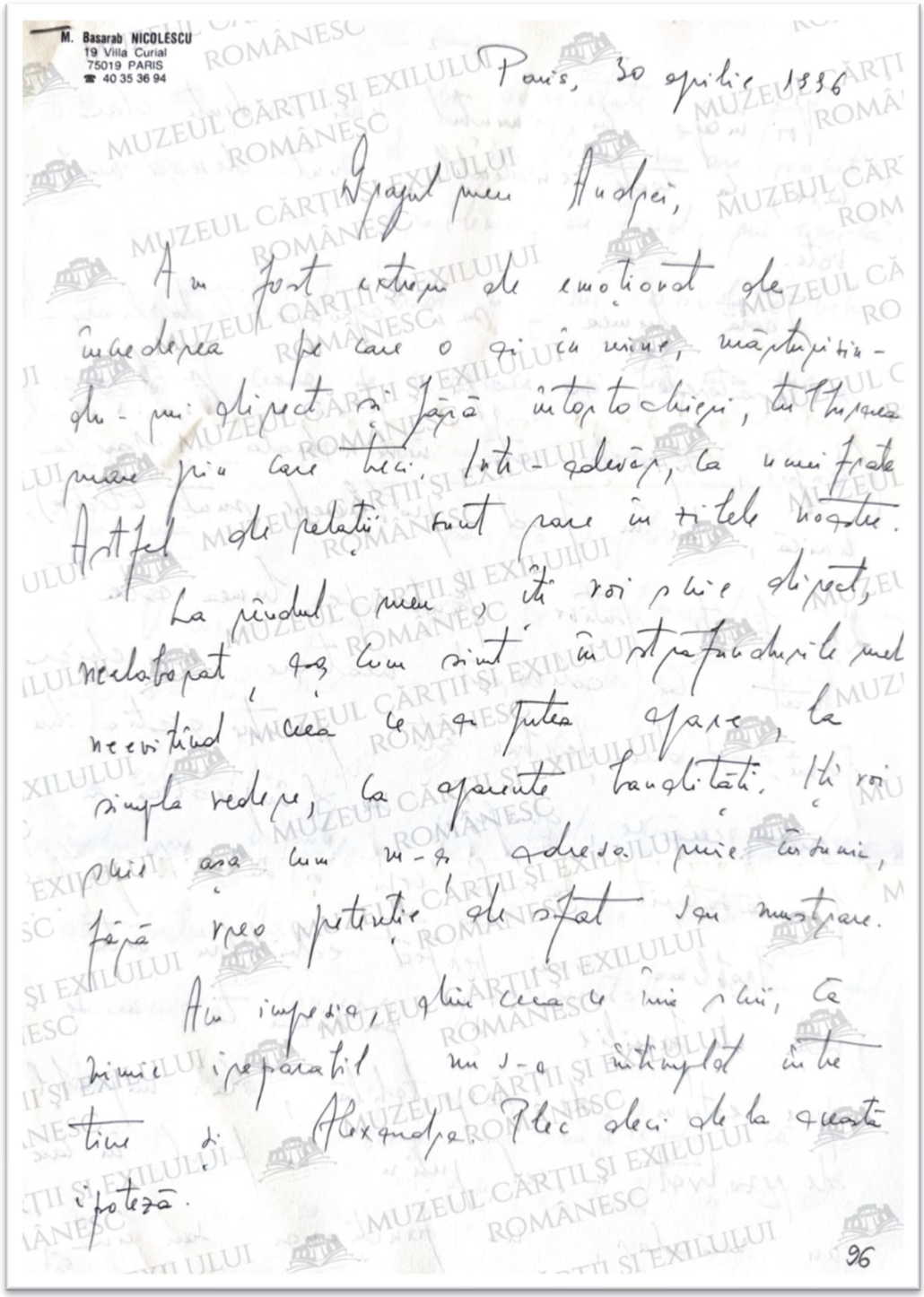
Keywords: Transdisciplinarity; Basarab Nicolescu; Levels of Reality; Non-Classical Logic; Education; Science and Spirituality.

Expoziția ***Andrei Șerban, George Banu, Basarab Nicolescu – Prietenie dincolo de timp și spațiu*** a propus valorificarea unui ansamblu documentar ce ilustrează relațiile intelectuale și umane dintre trei personalități marcante ale exilului cultural românesc din a doua jumătate a secolului XX.

Realizată pe baza documentelor provenite din arhivele academicianului Basarab Nicolescu, Andrei Șerban și George Banu din colecțiile Muzeului Cărții și Exilului Românesc, expoziția reconstituie ceea ce poate fi definit drept o veritabilă arhivă a unei prietenii intelectuale transnaționale, dezvoltate de-a lungul deceniilor între Paris, New York, Viena și București



Foto. Andrei Șerban, Basarab Nicolescu, George Banu


M. Basarab NICOLESCU
19 Villa Curial
75019 PARIS
☎ 40 35 36 94

Paris, 30 aprilie 1996

Dragul meu Andrei,

Am fost extrem de emoționat de
încrederea pe care o ai în mine, mărturisin-
du-mi direct și fără întortocheri, în limba
mamei pe care știu. Între-adevăr, ca unui frate
Între astfel de relații sunt rare în ziua noastră.

La rândul meu, îți voi spune direct,
necalculat, așa cum sunt în străfundurile mele
necenzurat de ceea ce ar putea părea, la
simpla vedere, la aparențe banalități. Îți voi
spune așa cum mi-ar adresa mie însumi,
fără vreo pretenție de stat la masă.

Am impresia, ținând cont de mine și de
timpul imperativ nu s-a întâmplat încă
ființa de Alexandra. Plec chiar de la această
ipoteză.

96

Foto. Scrisoare de la Basarab Nicolescu pentru Andrei Șerban

Andrei Șerban, unul dintre cei mai importanți regizori români contemporani, **George Banu**, reputat critic și teoretician al teatrului, și **Basarab Nicolescu**, fizician, filosof al științei și fondator al transdisciplinarității, au fost uniți de o profundă afinitate intelectuală și umană. Stabilirea lor în afara României nu a însemnat o ruptură de cultura română, ci o continuare a dialogului cu aceasta prin creație artistică, reflecție critică și activitate intelectuală desfășurată în spațiul occidental.



Foto. Andrei Șerban, Basarab Nicolescu

Nucleul expoziției este constituit din corespondența dintre cei trei, reprezentată prin scrisori și cărți poștale care surprind nu doar dimensiunea personală a relațiilor dintre ei, ci și schimburile de idei, proiectele culturale comune și preocupările care le-au marcat parcursul profesional.

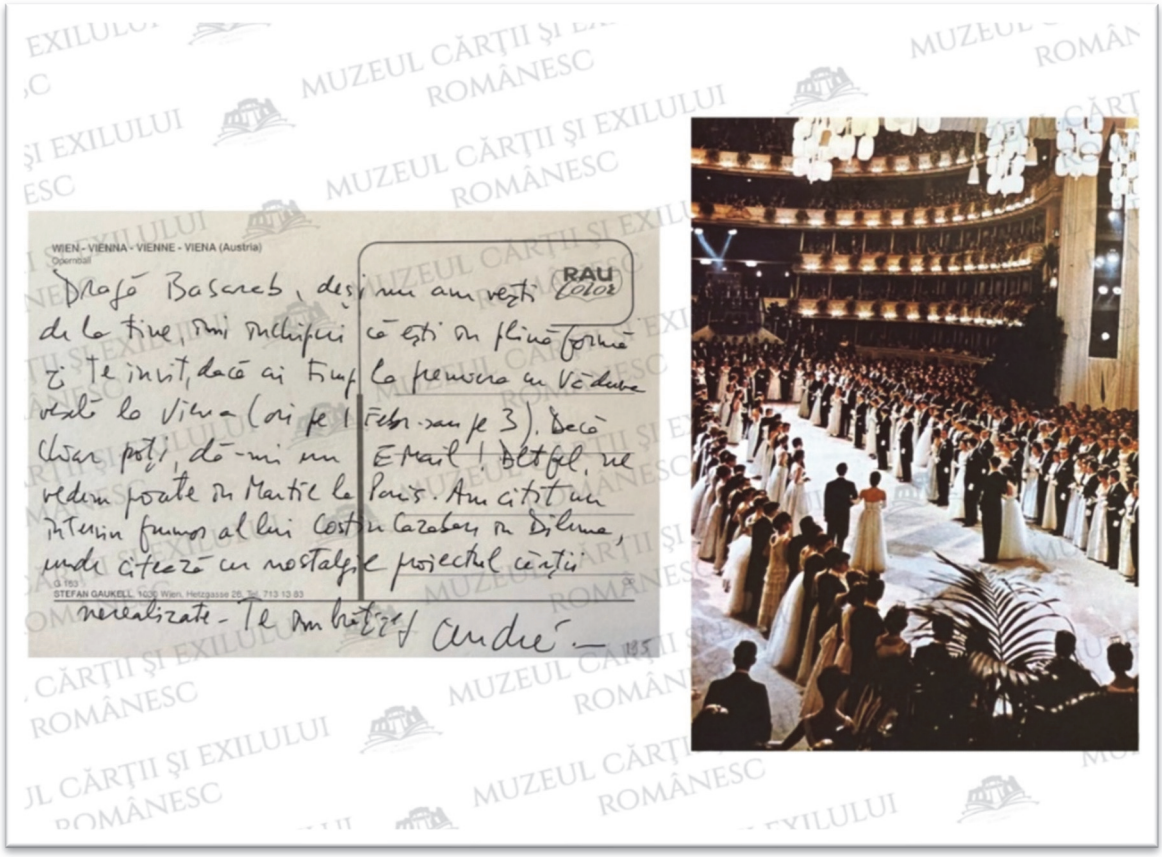


Foto. Carte poștală de la Andrei Șerban pentru Basarab Nicolescu

Aceste documente sunt completate de fotografii de arhivă, volume semnificative pentru relația dintre protagoniști, precum și de alte mărturii documentare care ilustrează continuitatea unei legături construite în jurul culturii, prieteniei și dialogului.

Un loc aparte îl ocupă volumul Andrei Șerban. O biografie, prezent în expoziție, în care Basarab Nicolescu îl definește pe regizor drept un „perpetuu căutător al Adevărului”. Formula surprinde nu doar personalitatea artistică a lui Andrei Șerban, ci și valorile care au stat la baza relației dintre cei trei intelectuali: căutarea sensului, libertatea spiritului și deschiderea către dialogul dintre discipline și domenii de cunoaștere.

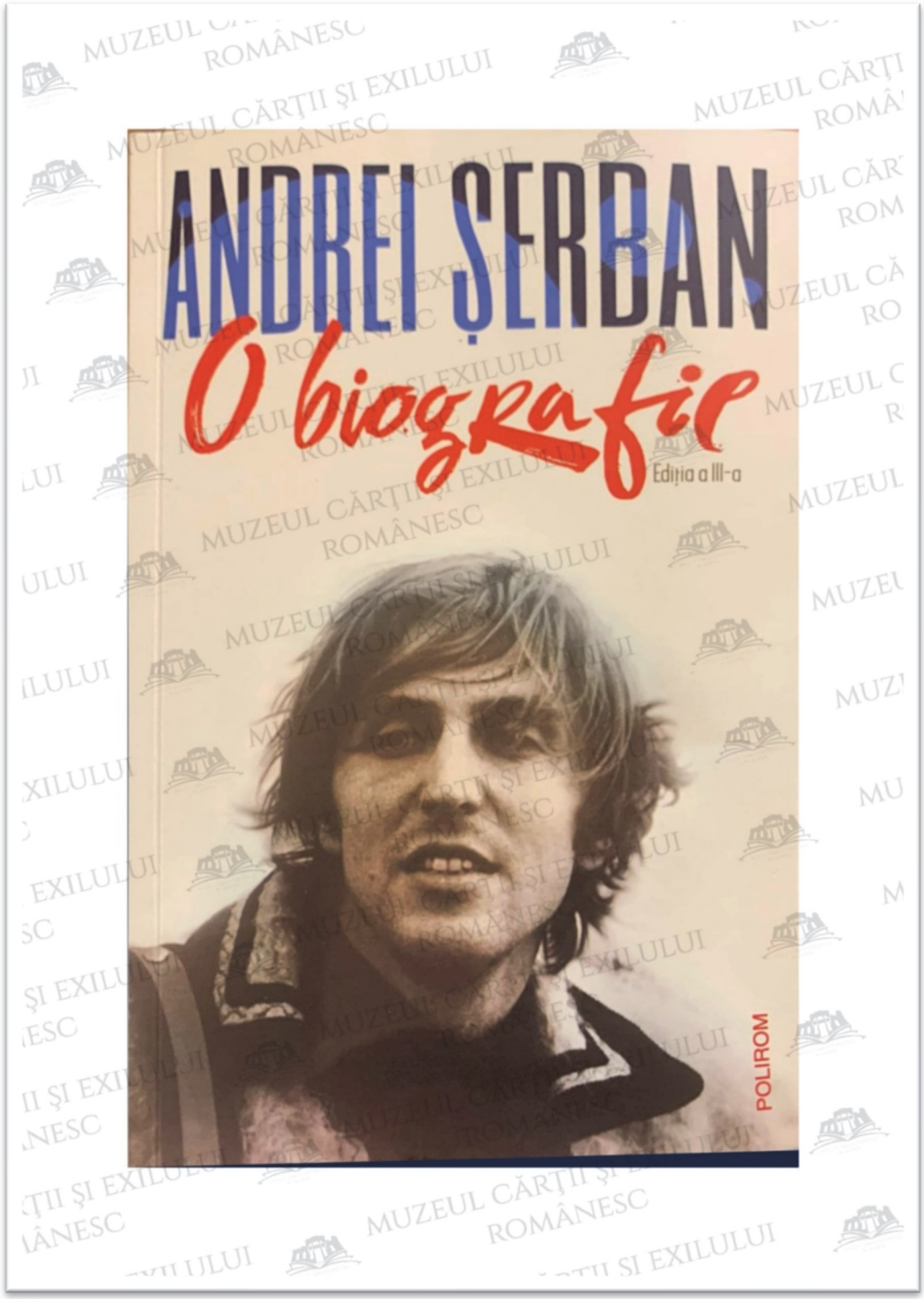
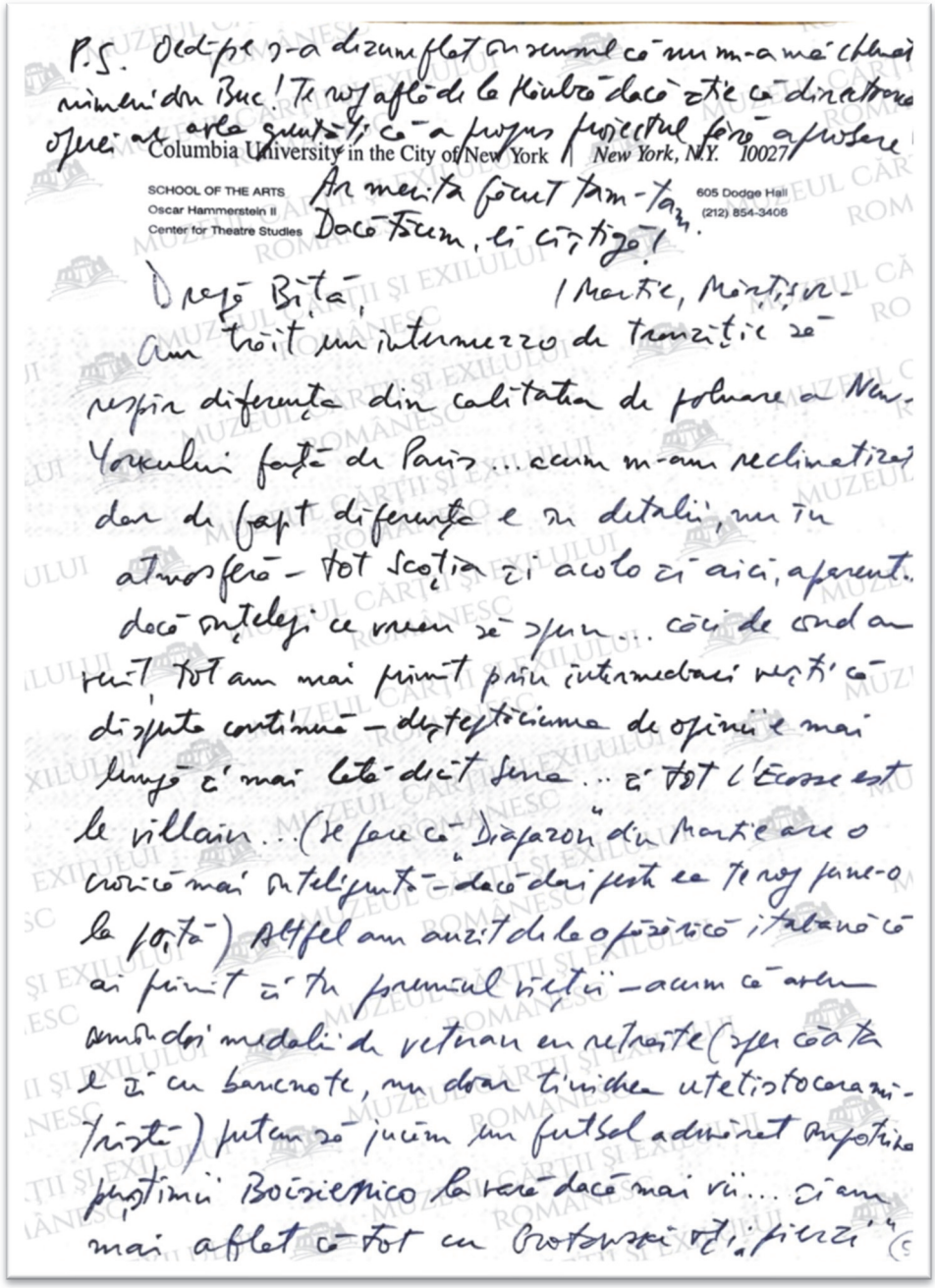


Foto. Coperta cărții lui Andrei Șerban, *O biografie*

Prin documentele expuse, expoziția evidențiază importanța arhivelor personale pentru recuperarea memoriei culturale și pentru cercetarea istoriei recente a exilului românesc.


P.S. Oct-pe 7-a dizum flat cu zeama că nu m-a mai chemat
nimeni din Buc! Te voi afla de la Ploiești dacă știe că dinatorno
ofrei ar avea curtoazie, că a pus pușcărul fără a-l vedea

Columbia University in the City of New York | New York, N.Y. 10027

SCHOOL OF THE ARTS
Oscar Hammerstein II
Center for Theatre Studies

605 Dodge Hall
(212) 854-3408

Ar merita făcut tam-tam.
Dacă facem, îi câștigăm!

Dragă Bită, 1 Martie, Mărțișor-
Am trăit un intermezzo de tranziție ce-
respiră diferența din calitatea de folosire a New-
Yorkului față de Paris ... acum m-am reclimatizat
dar de fapt diferența e în detalii, nu în
atmosferă - tot Scoția și acolo și aici, aparent..
dacă înțelegi ce vreau să spun ... căci de când am
venit tot am mai primit prin intermediari vești că
dispute continuă - dezgheț cinic de opinii e mai
lungă și mai lată - dicit Seneca ... și tot l'Ecosse est
le villain ... (Se face că "Diapazon" din Martie are o
cronică mai inteligentă - dacă dai peste ea te rog pune-o
la poștă) Altfel am auzit de la o prietenă italancă că
ai primit și tu premiul vieții - acum că ați avea
amândoi medalii de veterani cu retrăite (spre coada
lui și cu bancnote, nu doar timbrele utelistocrano-
tiriste) putem să jucăm un fotbal admirat după
gustimi Boicsiencu la vară dacă mai vii ... și am
mai aflat că tot cu Protosevii ți-a fierbe

Foto. Scrisoare de la Andrei Șerban pentru Basarab Nicolescu

Dincolo de evocarea unor destine individuale remarcabile, ea oferă publicului perspectiva unei rețele intelectuale care a contribuit la promovarea valorilor culturii române în spațiul internațional și demonstrează modul în care prietenia, dialogul și schimbul de idei pot depăși limitele timpului și ale spațiului. Curatorii expoziției au fost dr. Lucian Dindirică, Președintele Consiliului Științific al Muzeului Cărții și Exilului Românesc, și Radu Vințeanu, Managerul Bibliotecii Județene „Alexandru și Aristia Aman”.

ABSTRACTS

Morphing Unmanned Aerial Systems UAS-S4 and UAS-S45 Performance Methodologies

Ruxandra Mihaela Botez, Full Professor, PhD, Eng., FAIAA, FRAeS, FCAE, FCASI

École de technologie supérieure, 1100 Notre Dame Ouest, Montréal, Que, Canada, H3C-1K3

Abstract

In this abstract, we present research done at our Laboratory of Active Controls, Avionics and AeroServoElasticity LARCASE at the École de technologie supérieure in University of Quebec in Montreal, Canada in the areas of Morphing Unmanned Aerial Systems Technologies.

Our LARCASE laboratory is equipped with two Unmanned Aerial Systems UAS-S4 and UAS-S45 from the Mexican company Hydra Technologies, two Level D flight simulators for the Cessna Citation X business aircraft and for the commercial regional jet CRJ-700 from CAE Inc., Cessna and Bombardier companies, and the Subsonic Blowdown Price-Païdoussis Wind Tunnel from McGill University.

Some of these equipment, more precisely, the UAS-S4, UAS-S45 and the subsonic blowdown wind tunnel, are used in our research realized for morphing unmanned aerial systems with the aim to improve their aerodynamic performances, expressed in terms of drag reduction, lift, lift-to-drag ratio and rate of climb increased, delay of the flow transition from laminar to turbulent regime, stall delay, fuel consumption reduction and many other benefits.

An overview of methodologies and results for the Morphing UAS-S4 and UAS-S45 Aerodynamic and Structural Analysis, and various types of Morphing Wing Design, Manufacturing and Testing at the Price-Païdoussis Subsonic Wind Tunnel expressed in terms of Morphing Leading Edge and Trailing Edge designs will be presented in details, including their benefits for aerodynamic performance increase.

Keywords: Morphing Leading Edge, Morphing Trailing Edge, Morphing Camber System, Aerodynamics, Structural Design, Controls, UAS-S4, UAS-S45.

Structural Principles of Scientific Network Formation: A New AI-Powered Collaboration Tool for the Romanian - American Scientific Community

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[1]DRG Innovation LLC | Indiana University School of Medicine, U.S.A.
[2]American Romanian Academy of Arts and Sciences

Romanian - American scientific organizations sustain a productive community through annual conferences and informal exchanges, yet these interactions rarely mature into the funded, publication-generating, project-based collaborations that define durable scientific partnerships. The structural gap between acquaintance and collaboration has resisted decades of well-intentioned networking.

Research in microvascular biology offers a mechanistic framework for understanding why. Functional vascular networks emerge not from random contact, but through phenotype matching between structurally compatible fragments, selective resource allocation, and — most critically — the presence of a shared morphogenic task that compels independent units into coordinated action. It is proposed that scientific collaboration networks are governed by analogous principles, and that their failure to consolidate within existing Romanian - American organizations reflects the absence of precisely these conditions: compatibility mapping, resource alignment, and a common project as organizational nucleus.

Over three decades of transatlantic research, more than 90 scientists, clinicians, and engineers across more than 15 institutions in the United States, Romania, Norway, Denmark, France, and Ireland have been engaged in collaborative work — in each case anchored by a shared scientific problem rather than shared origin.

Drawing on this experience, a tool has been developed to operationalize these biological principles at the scale of a professional network — one capable of identifying non-obvious compatibilities across disciplines, career stages, and institutions, and of surfacing concrete collaborative projects from the latent structure of a community's collective expertise — with the potential to fundamentally accelerate the pace at which scientific communities move from introduction to meaningful, sustained collaboration.

The Exhibition "Andrei Șerban, George Banu, Basarab Nicolescu – Friendship beyond time and space"

Curators: Lucian Dindirică, Radu Vințeanu
Museum of the Romanian Book and Exile

The exhibition Andrei Șerban, George Banu, Basarab Nicolescu – Friendship Beyond Time and Space highlights a documentary corpus illustrating the intellectual and personal relationships among three major figures of Romanian cultural exile in the second half of the twentieth century.

Based on materials from the archives of academician Basarab Nicolescu, Andrei Șerban and George Banu from the collections of the Museum of the Romanian Book and Exile, the exhibition reconstructs what may be described as the archive of a transnational intellectual friendship, developed over decades between Paris, New York, Vienna, and Bucharest.

Andrei Șerban, one of the most important contemporary Romanian theatre directors, George Banu, a renowned theatre critic and theorist, and Basarab Nicolescu, physicist, philosopher of science, and founder of transdisciplinarity, were united by a profound intellectual and human affinity. Their lives abroad did not represent a separation from Romanian culture; rather, they continued to engage with it through artistic creation, critical reflection, and intellectual activity carried out in the Western cultural sphere.

The core of the exhibition consists of correspondence exchanged among the three protagonists, including letters and postcards that reveal not only the personal dimension of their friendship but also their exchange of ideas, collaborative cultural projects, and shared concerns. These documents are complemented by archival photographs, significant publications connected to their relationship, and other documentary materials illustrating the continuity of a dialogue sustained through culture, friendship, and intellectual exchange.

A special place within the exhibition is occupied by the volume Andrei Șerban. A Biography, in which Basarab Nicolescu describes the director as a "perpetual seeker of Truth." This characterization reflects not only Șerban's artistic personality but also the values that united the three intellectuals: the search for meaning, freedom of spirit, and openness to dialogue across disciplines and fields of knowledge.

Through the documents on display, the exhibition highlights the importance of personal archives in preserving cultural memory and in researching the recent history of Romanian exile. Beyond commemorating remarkable individual destinies, it offers insight into an intellectual network that contributed to the international dissemination of Romanian cultural values and demonstrates how friendship, dialogue, and the exchange of ideas can transcend the boundaries of time and space.

70 years of Romania in UNESCO – Past Lessons, Future Horizons

Part II: Roundtable Discussion

An interactive discussion gathering diplomats, scholars, cultural professionals, and specialists in international relations. This session will reflect on lessons learned from Romania's UNESCO legacy and consider new directions for strengthening Romania's role in multilateral diplomacy.

Moderator: Gabriela GABOR, Codrin TĂUT
Panel members: Adrian Tudor, Alexandru Andrasanu, Andrei Luca, Ioana Dragan, Lucian Jora, Madalina Iacob

In the context of the 70th anniversary of Romania's accession to UNESCO, the American Romanian Academy of Arts and Sciences (ARA) and the Romanian National Commission for UNESCO will organize, on June 30, 2026, a thematic panel dedicated both to reflecting on this shared history and to exploring future perspectives for cooperation. The panel will be held within the framework of the 47th Congress of the American Romanian Academy of Arts and Sciences, taking place on June 30 – July 1, 2026, at the Transilvania University of Brașov, Romania. Organized by ARA in collaboration with Transilvania University of Brașov, the 2026 ARA Congress provides an important setting for intellectual exchange across disciplines and institutions. The event will bring together representatives of the academic community, practitioners, and institutional stakeholders for a dialogue on Romania's longstanding engagement with UNESCO's values and programs. The discussions will highlight key moments in this seventy-year relationship, while also addressing the challenges and opportunities that lie ahead in areas such as education, culture, science, and international intellectual cooperation. By creating a space for exchange between scholars and professionals, the panel aims to reaffirm the relevance of UNESCO's mission in today's world and to encourage renewed forms of collaboration capable of responding to contemporary global and regional realities.

Bioactive Copper(II) Complexes and Their Potential Involvement in the Treatment of Coppe Deficiency-Related Diseases

Mircea Alexandru Mateescu[1,2,*], Mariela Gomez Perez[1], Ispas-Szabo Pompilia[1], Marius Andruh[2], Borhane Annabi[1]

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Impaired cellular copper uptake is a principal etiologic determinant in various severe inherited disorders, including Menkes disease and hypertrophic cardio-encephalomyopathy. In this context, a series of Cu(II) coordination complexes were recently synthesized using small ligands as L-histidine, L-serine, urea, and biuret [1]. The complexes were prepared by reacting the corresponding ligands with $CuCl_2$, followed by purification through alcohol precipitation. The novelty of this work was the successful isolation of these compounds in solid state.

Structural and physicochemical characterization by elemental analysis, X-ray diffraction, and FTIR spectroscopy demonstrated that the complexes adopted the general formula $[Cu(ligand)_2]$. Coordination analysis further revealed distinct ligand-binding modes to the copper center: tridentate for L-histidine, bidentate for L-serine and biuret, and monodentate coordination for urea.

The complexes [Cu(His)2Cl2] and [Cu (Ser)2], were stable in physiological media and presented a good potential as therapeutic agents. Their biocompatibility was investigated on intestinal differentiated Caco-2 cells model and their action on the integrity and permeability of cell membranes was evaluated by the transepithelial electrical resistance (TEER) at concentrations up to 100 μM. In parallel, the distribution of the copper complexes was quantified on both apical and basolateral compartments of the cell monolayer. The results suggested a copper paracellular flow. The intracellular copper retention was lower than 2.7%. This is of interest, showing the availability of absorbed Copper (II) to be released in circulation for further therapeutic functions. No differences in intracellular copper content between 6 h and 48 h, indicated an early copper retention process. At the molecular level, both $[Cu(His)_2Cl_2]$ and $[Cu(Ser)_2]$ induced transcriptional downregulation of the four principal copper transporters: CTR1, DMT1, ATP7A and ATP7B, while simultaneously promoting upregulation of metallothionein. Importantly, treatment of cells with these Cu(II) complexes at concentrations of 50-100 μM resulted in a recovery of cytochrome c oxidase: a copper-dependent mitochondrial enzyme with a key role in cellular respiration. Collectively, these findings indicate these complexes as candidates with therapeutic relevance for patients affected by copper deficiency disorders.

Keywords: Medicine, Biochemistry, Rare (Orpheline) diseases, Menkes disease, Hypertrophic cardioencephalomyopathy, Copper complexes, Cytochrome c oxidase, Intestinal Caco-2 cells.

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Green Polymers Based Membranes as a Solution for Global Water Crisis

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Until the end of the nineteenth century, the use of water exactly as it was found in nature was not a problem, mainly due to the minimal impact that humans had on its quality. The main sources of pollution were represented by household or domestic activities, and the only methods used for water purification were sand filtration (used in stations that supplied water to large cities) and distillation (used specially to produce very pure water for the medical and pharmaceutical field). However, the development of cities and industry lead to a constant growth of water pollution and, therefore, the need for fast and effective filtering methods. Therefore, in 1804, Robert Thom designed the first municipal water treatment station in Scotland. The use of polymer membranes for water filtration and purification became a necessity after the Second World War. In Germany, the newly founded the Millipore company, through the Marshall Plan of the United States, transformed huge quantities of nitrocellulose (used as an explosive powder for bomb production) into microfiltration and ultrafiltration membranes. It should be noted that until the appearance of the first water treatment station in 1804, for almost 1 million years of human existence, in the current evolutionary form, a large-scale filtration method to obtain drinking water was not required, and, in the next 150 years, it was necessary to go from sand filtration to polymer membrane filtration through micro and ultrafiltration processes. In another 50 years (from 1950 to 2000), installations with high capacity for microfiltration and desalination with high energy consumption, working pressures and increased material requirements were also needed, due to a drastic decrease in the size of the species to be removed [1]. Over the past three decades, humanity has been facing an unprecedented drinking water crisis. The main causes for this crisis are three in number – population growth (which puts pressure on existing water sources), climate change (which through global warming leads to a reduction in the number of drinking water sources) and pollution (which leads to affecting the quality of existing water sources). One of the main solutions to this crisis is desalination, a process that consists of filtering seawater to produce drinking water. If at the beginning of the process, in 1970, the total installed capacity worldwide was 100,000 cubic meters/day, today it exceeds 100 million cubic meters/day. Desalination, however, is an efficient process if the seawater does not contain additional impurities such as micro oil emulsions, microplastics or other types of pollutants. The main technical solutions that are currently available in the field of polymeric membranes to solve this crisis will be presented, as well as the future prospects for avoiding a major global water crisis.

Keywords: water availability, water crisis, membranes, filtration.

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Advanced APS Coatings for Agricultural Components: From Microstructure and Electrochemistry to Enhanced Mechanical Performance

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In the present work, various APS coatings (namely W2C/WC-12%Co (Metco71NS), Cr2O3-4SiO2-3TiO (Metco136F), Co25.5Cr10.5Ni7.5W0.5C (Metco45C-NS) and WC-12%Co (WOKA 3101) deposited by Sulzer Metco 9MCE on disc harrows and reversible plough parts (mainshare and foreshare) exposed to high abrasive and corrosive service conditions were investigated.

SEM/EDS/XRD characterization revealed lamellar splat morphology, controlled porosity and strong substrate adhesion. Thicknesses ranged from tens of microns (Metco136F) to over 200 μm for carbide and alloy systems.

The phase analysis confirmed the presence of WC/W2C, Cr2O3/TiO2 and NiCr intermetallics. The base materials possess ferrite-pearlite and Widmanstätten structures (disc harrow) and microstructures of pearlite (plow parts). Electrochemical tests in simulated soil environments indicated that WC- and Cr2O3-based coatings exhibited excellent corrosion resistance, attributed to their dense microstructures and stable passive oxide layers. The tribological tests (CETR-UMT-2) measured the friction coefficient, Young's modulus, hardness and stiffness. The WC-12%Co coatings showed the highest hardness and lowest friction, while the Co-based alloy showed better ductility and impact tolerance.

The results validate APS as a viable strategy for extension of the service life of agricultural working components, with each coating system providing specific advantages depending on the dominant degradation mechanism.

Keywords: atmospheric plasma spray (APS); disc harrow; plow; WC-Co; Cr_2O_3; microstructure; electrochemistry; tribology; mechanical properties

Electrochemical Approaches to Surface Bioactivation of Metallic Biomaterials

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The performance and clinical applicability of biomaterials in the human body are of major importance for the development of biomedical devices and tissue engineering strategies. Ongoing advances in materials science and engineering have enabled the development of a wide range of metallic biomaterials designed to address increasingly complex biomedical demands. Beyond their traditional load-bearing role, metallic biomaterials are currently being tailored to exhibit additional functionalities, including bioactivity, antimicrobial behavior, drug delivery capability, and even antitumor effects [1]. Since the interactions occurring at the biomaterial–tissue interface is strongly governed by surface properties and protein adsorption, surface engineering has become a key approach for improving the biological performance of metallic implants [2]. Biofunctionalization represents an effective strategy for modifying the surface composition, structure, and morphology of a material while preserving its bulk mechanical properties. In this context, both wet- and dry-based surface treatment methods have been developed to enhance the compatibility of metallic biomaterials with hard tissues.

A wide range of surface functionalization approaches have been applied to titanium and its alloys, beginning with mechanical surface treatments and extending to advanced electrochemical methods such as anodic oxidation and electrochemical deposition of hydroxyapatite-based bioactive ceramic coatings. These coatings were investigated either in their undoped form or after incorporation of biologically active ions such as Ag, Zn, Sr, or Mg, with the aim of improving osseointegration [3]. The resulting surfaces were characterized in terms of roughness, wettability, morphology, crystalline structure, corrosion resistance, and bioactivity. The obtained results demonstrated that electrochemical bioactivation is an effective route for tailoring the surface properties of metallic biomaterials toward enhanced biological response and functional performance.

The surface properties of metallic biomaterials can be effectively tailored to meet specific biological requirements through appropriate biofunctionalization strategies. In this regard, electrochemical approaches provide versatile and efficient tools for the design of bioactive implant surfaces with improved biomedical performance.

Keywords: Engineering, electrochemical deposition, hydroxyapatite, biocompatibility, apatite formation

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Evaluation of the Corrosion Behavior of APS-Coated Steel in Acidic Environments with Controlled H_2S Concentration

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Ceramic coatings obtained by various methods have recently been successfully used to improve some properties of metallic elements such as: the resistance to corrosion, high temperatures and thermal shocks, and the harmful effects of hydrogen or hydrogen sulphide [1]. Current literature [2] presents a detailed analysis of the main hydrogen permeabilities for state-of-the-art barrier coatings containing different oxides, carbides and nitrides according to the literature, and Cr2O3 coatings are considered as a suitable solution for hydrogen protection [5]. However, no results are reported for composite coatings (ceramic-oxide combinations). This study investigates the corrosion protection performance of multi-layered coatings deposited via Atmospheric Plasma Spraying (APS) on a stainless-steel substrate. The coatings were engineered using varying proportions of Metco 6156 (Ni-based alloy) and Metco 207 (High-Yttria Stabilized Zirconia 20% Y2O3) to create a complex ceramic-metallic structure. Three distinct samples were prepared, each featuring a 6-layer architecture designed to optimize the transition from the metallic substrate to the ceramic-rich top surface. The protective performance against corrosion was evaluated in a 1M Na2SO4 solution acidified to pH 3. A controlled concentration of 20 ppm H2S was generated in situ through the stoichiometric addition of Na2S. To simulate high-pressure industrial conditions and prevent the oxidation of the sulfide species, the system was deaerated with argon at 4-5 bar. Electrochemical testing, including Open Circuit Potential (OCP), potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) was performed at 25C. The results demonstrate that the multi-layered approach and the high yttria content in the Metco 207 phase significantly enhance the chemical stability of the coating. The layered gradient effectively mitigates the mismatch in thermal expansion coefficients and reduces the interconnected porosity, providing a superior barrier against the diffusion of HS- ions compared to traditional monolithic coatings.

Keywords: APS,StainlessSteel, Metco, Multi-layered coatings, corrosion, High-Yttria YSZ.

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Experimental evaluation of anti-sparking alloys for safer tools used in explosive atmospheres

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This study presents the experimental assessment of two copper-based alloy systems, CuAlBe and CuTi, proposed for the manufacture of anti-sparking tools and safety components with improved functional performance [1]. The investigated alloys were produced by classical casting followed by thermo-mechanical processing and characterized in terms of spark behavior, corrosion resistance, and mechanical properties. Wear tests involving up to 16.000 friction cycles indicated that neither alloy system generated dangerous hot sparks capable of initiating ignition, confirming their suitability for hazardous environments. Both alloy families showed low friction coefficients, around 0.2, favorable for moving mechanical assemblies and hand tools. Mechanical testing revealed higher hardness values for CuAlBe alloys, reaching approximately 2.1 GPa, while CuTi alloys exhibited values near 1.7 GPa but demonstrated significantly higher elastic modulus, recommending them for components requiring greater stiffness and dimensional stability. These complementary behaviors indicate that CuAlBe alloys are advantageous for impact and wear-resistant tools, whereas CuTi alloys are attractive for precision parts and structural elements. Electrochemical corrosion tests in 3.5% NaCl solution showed that both alloy systems formed partially protective surface layers consisting of oxides, chlorides, and salts. Thermo-mechanically processed CuAlBe alloys exhibited a corrosion current reduction of nearly one order of magnitude compared with the as-cast state, while cast CuTi alloys showed superior intrinsic corrosion resistance. The results demonstrate that CuAlBe and CuTi alloys represent viable alternatives to conventional spark-producing steels for the production of safer industrial tools and components.

Keywords: anti-sparking alloys; occupational safety; explosive atmospheres; corrosion; mechanical properties; non-sparking tools; worker protection

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Degradation and Biocompatibility Studies on Cellulose-Acetate-Based Composite used as Coatings for Biodegradable Magnesium Implants

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The main limitation in the implementation of magnesium as an orthopaedic biomaterial is that the degradation occurs before the formation of stable tissue around the implant, so it is necessary to improve the corrosion resistance.

A common method for improving corrosion resistance is element alloying method. And as a degradable implant material, alloying elements must be chosen with careful consideration of the possible systemic effects. Mg dissolves as Mg2+ which reacts with water, generates hydrogen bubbles, creates hydroxyl groups, and increases pH. Micro-bubbles that get larger and float in the air are generated from pitting or active corrosion sites. Dissolved Mg2+ ions react with hydroxyl groups (OH--) and precipitate as Mg (OH)2. Also, a passive interlayer is formed on the degradation surface.

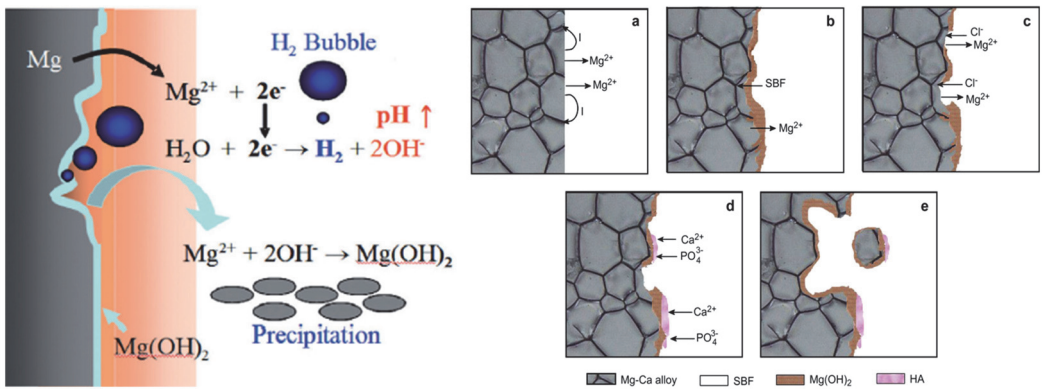


Figure 1. Schematic representation of Mg degradation in human body envinronment

The aim of this study was to develop new composite coatings made of polymeric materials (cellulose acetate) reinforced with Mg and hydroxyapatite, with superior osseointegration potential. Composite coatings for osseointegration were designed to be used at the interface between implants and bone in order to facilitate and improve the integration of implants in bone.

The magnesium alloys are suitable for development the orthopaedic applications like screw for fracture fixation (small implants are recommended). We obtain and characterize different experimental magnesium alloys (Mg-Zn-Zr alloys looks to be very promising alloys).

Keywords: Materials Engineering; Magnesium alloys; Coatings; Corrosion.

Acknowledgement: This work was supported by the grant POCU/993/6/13 -153178, co-financed by the European Social Fund within the Sectorial Operational Program Human Capital

Bioinspired Materials and Antimicrobial Technologies for Healthcare

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Nature has long provided inspiration for the development of advanced materials with unique structural, functional, and biological properties. Today, bioinspired materials and antimicrobial technologies are emerging as key drivers of innovation in healthcare, offering new approaches to address major clinical challenges such as infections, implant failure, and tissue regeneration. By mimicking natural systems and combining multifunctional properties, these materials are contributing to the development of safer, smarter, and more effective biomedical devices and therapies.

This keynote will explore recent advances in bioinspired biomaterials for healthcare applications, with emphasis on antimicrobial and bioactive solutions for orthopaedics, dentistry, and regenerative medicine. Particular attention will be devoted to calcium phosphates, bioactive glasses, nanostructured coatings, and functionalized implant surfaces designed to enhance tissue integration while simultaneously preventing bacterial adhesion and biofilm formation. Such strategies are increasingly important in reducing implant-associated infections and improving long-term clinical outcomes.

The presentation will further discuss how surface engineering, nanotechnology, and biomimetic approaches can be combined to create multifunctional materials capable of actively interacting with biological systems. Emerging developments in antibacterial coatings, biodegradable materials, and advanced diagnostic-related biomaterials will also be highlighted, illustrating the strong interdisciplinary convergence between materials science, nanotechnology, biology, and medicine.

As healthcare increasingly demands personalized, sustainable, and high-performance solutions, bioinspired materials are paving the way toward a new generation of intelligent biomedical technologies. These innovations have the potential not only to improve patient care and implant safety, but also to redefine the future role of materials in modern medicine.

High-Entropy Alloys (HEAs): Microstructural, Mechanical and Thermal Properties of B4C Reinforced Spark Plasma Sintered $CoCrFeNiAl_{0.6}$ HEAs

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High-entropy alloys (HEAs) are promising materials for high-temperature structural applications due to their properties, including high mechanical strength and high-temperature stability.

In this study, a mechanically alloyed CoCrFeNiAl0.6 HEA was reinforced with 2–4 vol.% boron carbide (B4C) and consolidated via spark plasma sintering (SPS) at 1000 °C under a pressure of 40 MPa for 5–6 minutes.

This study aims to investigate the effects of B_4C addition on the microstructural, mechanical, tribological and thermal properties of the alloy.

The alloy structure exhibited both FCC and BCC phases. The hardness value increased from 4.29 GPa to 5.02 GPa. The wear resistance improved up to 80% at room temperature and by 70% at 600 °C as the B4C content increased.

The addition of B4C had a negative effect on high-temperature oxidation resistance.

The findings demonstrate the potential of B4C-reinforced HEAs for high-temperature wear-resistant applications.

The Approaches of Economic Integrated Informatics Systems

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In the present work management of the material activities (fabrication, distribution (commercialization), consumption) system, as a unitary information and material nucleus, that acts automatically, in real time, is analysed in the. In this context we have highlighted the objectives according to which is characterized the current situation of the existent information situation in the material (physics) environment. Based on the results of the analysis of this situation, of the formulated objectives of the prospect of the evolution of in cause systems, have been disclosed the problems of their constitution and daily activities in the functional -informatics plan.

Nowadays, most basic human material processes (fabrication, distribution (commercialization), consumption) and informational (informative, decisional), under a spatial aspect, are separated and function in different periods of time. The galloping progress of the elaboration, production and massive implementation of informatics means and methods, in both spheres of scientific and practice activities, more insistently requires and approach in fulfilling and functioning of information systems that are spatially and temporally integrated in the material management.

Considering the created situation, in the given context and from the afore – mentioned positions, of the major importance are the issues of analysis in the field, as well as highlighting and formulating the objectives and the problems of the constitution of functioning of the material integrated informational systems. Are formulated some concepts of elaboration (projection) and functioning of these systems: Whis the emergence of the possibilities of the interconnected informatics processing of any processes, it is necessary to approach them both in practical and scientific terms, from unitary positions Therefore, the management system also needs to be interpreted as an inseparable spatial-temporal unit of the material and informational compartments. The general concept of the prospective material (economic) management information system must be based on the automatic integration of all the resources involved in its operation. After the role played in the unitary management process, the informational compartment is divided into two sub-compartments: informative and decisional. The core idea of the new unitary material economic management system resides in the and functionally inter-connected spatial-temporal organization of constituents. From the previously formulated position, it has been established that the present economic information management system is characterized by preserving the more descriptive (reflective) role of situational information; and spatial – temporal approach and realization of information and material processes; direct dependence of the informational potential of the material; increasing the share of external information through the intensification of external relations; the grafual increase of volumes and complicating the composition of situational information. On this basis, it is justified to apply the principle of new problems", which, contain do not deal with informative but alsu decision-making issues.

Only after solving the problem of the automatic obtaining of situational information are created objective conditions of real transition, in mass, at a new, more efficient and qualitative stage of development of the material (economic) management system.

Keywords: analysis, current situation, integrated informatics system, management of human material activities, objectives, issues, constitution

JEL: CF88, D83, G14, L15, O31, O33

Digital versus Conventional Workflows in Prosthodontics and Implant Dentistry

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The integration of digital technologies in prosthodontics and implant dentistry has fundamentally transformed clinical workflows over the past two decades. From intraoral scanning and CAD/CAM fabrication to computer-guided implant surgery and 3D-printed surgical templates, digital tools now compete with — and increasingly complement — long-established conventional techniques. However, the question of when digital workflows offer measurable clinical and economic advantages over conventional ones remains incompletely answered.

Objective: This presentation provides an evidence-based comparative analysis of digital and conventional workflows across the principal stages of prosthodontic and implant treatment, evaluating their performance on two pivotal dimensions: clinical accuracy and treatment time.

Methods: Outcomes evaluated include trueness and precision of digital versus conventional impressions, marginal and internal fit of CAD/CAM versus conventionally fabricated restorations, linear and angular deviation in computer-guided versus freehand implant placement, chair-side and laboratory time, and treatment cost analyses including learning-curve considerations.

Conclusions: Digital and conventional workflows are not mutually exclusive; current evidence supports a stratified, hybrid approach in which clinical indication, case complexity, and operator expertise determine the optimal pathway. The transition from analogue to digital must be guided by outcome-driven evidence rather than technological enthusiasm.

Keywords: Digital workflow; Conventional workflow; CAD/CAM; Computer-guided implant surgery; Intraoral scanning; Prosthodontics; Implant dentistry; Accuracy.

News in Antimicrobial Photodynamic Therapy

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Antimicrobial resistance (AMR) has emerged as one of the most significant global public health challenges, driving the search for alternative antimicrobial strategies other than conventional antibiotic therapy. Antimicrobial photodynamic therapy (aPDT) has gained increasing attention as a promising non-antibiotic approach due to its ability to inactivate a broad spectrum of microorganisms, including multidrug-resistant bacteria, fungi, and biofilm-associated pathogens. The therapeutic mechanism of aPDT involves the activation of a photosensitizer by light of a specific wavelength in the presence of molecular oxygen, resulting in the generation of reactive oxygen species (ROS) that induce oxidative damage to microbial cellular structures and ultimately lead to cell death (1). Recent advances have significantly expanded the clinical and technological potential of aPDT. Nanotechnology-based delivery systems have improved photosensitizer stability, solubility, targeting capacity, and penetration into microbial biofilms, thereby enhancing antimicrobial efficacy. In parallel, the development of novel photosensitizers and near-infrared (NIR)-activated platforms has enabled deeper tissue penetration and improved treatment outcomes in challenging infections (2).

Clinical evidence has demonstrated beneficial applications of aPDT in dentistry, particularly in endodontics and periodontal therapy, while growing research supports its use in dermatological, antifungal, and wound-care settings. Furthermore, emerging combination strategies integrating aPDT with bacteriophage therapy and other antimicrobial approaches have shown synergistic effects against resistant pathogens. Despite these advances, challenges remain regarding treatment standardization, optimization of light delivery parameters, long-term safety, and large-scale clinical validation. Nevertheless, the multitarget mechanism of aPDT and its low propensity for inducing microbial resistance position this technology as a promising adjunctive or alternative therapeutic modality in the era of increasing antimicrobial resistance.

This review summarizes the most important developments reported during 2025–2026 and discusses future perspectives for the clinical translation and broader implementation of antimicrobial photodynamic therapy.

Keywords: antimicrobial photodynamic therapy; aPDT; antimicrobial resistance; reactive oxygen species; nanotechnology; biofilms; photosensitizers.

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Nexus TMJ: Innovative RAG Based Chatbot Designed for Dentistry Student Centered Learning Approach

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Introduction: The use of generative AI chatbots as study aids in dental education has seen a steep increase in recent years, however, their reliance on unfiltered internet sources produces factual errors and hallucinations that render them unreliable for clinical education. The study of the temporomandibular joint (TMJ) and the stomatognathic system remains a challenge in the dental curriculum, for which no validated AI-assisted learning tool currently exists. We developed Nexus: Temporomandibularis, a Retrieval-Augmented Generation (RAG)-based chatbot designed for Romanian dental students, trained on a validated dataset based on the dental curriculum bibliography.

Methods: Nexus: Temporomandibularis comprises a web-based interface and a Python back-end RAG architecture, indexing 11 textbooks selected from the bibliography of all Romania's dental schools. Nexus was benchmarked against ChatGPT-4 on 100 domain-specific questions. Accuracy and response latency were measured and compared using a 2-Proportion Z-test. An user-experience survey was subsequently administered to 50 undergraduate dental students and faculty members at a Romanian dental school, who were asked to interact with either Nexus or ChatGPT-4 using identical prompts and rate their satisfaction with the answers.

Results: On internal benchmarking on Timișoara's dental school study curriculum, Nexus achieved a domain-specific response accuracy of 92% compared to 70% for ChatGPT-4 on a 100 domain-specific questions. The evaluation involved delivering identical prompts to Nexus TMJ and ChatGPT-4 and assessing performance by quantifying correct, relevant phrases and the frequency of errors for each output, using the official bibliography of Romanian dental schools as the reference standard. The 50 participants were divided in 2 groups, 25 participants each. Group A was using ChatGPT-4 and got 72 out of 100 domain-specific questions correct. Group B got 92 out of 100 on the same set of questions, resulting in a $p<0.001$. These findings indicate that the specialized Nexus TMJ platform outperformed the generalized large language model in accurately answering the selected medical questions. Response latency was higher for Nexus, operating in two modes, quick thinking (10 seconds) and complex reasoning (50 seconds), compared to 5 seconds for ChatGPT-4. In the satisfaction survey, respondents in the Nexus group reported 20% higher satisfaction scores than the ChatGPT-4 group.Nexus TMJ yielded a significantly higher mean user satisfaction score than ChatGPT-4 (88.5 ± 5.2 vs. 73.2 ± 6.8 out of 100; $p < 0.001$, independent t-test), representing an approximate 20% relative advantage.

Discussions and conclusion: These results suggest that restricting AI retrieval to validated curricular sources improves both response accuracy and user satisfaction in domain-specific dental education. Current limitations include response latency in complex reasoning mode, a small sample size, and the absence of objective learning outcome measures. Future work should focus on expanding the bibliographic database, improving processing speed, and evaluating long-term impact on academic performance through controlled studies across multiple institutions.

Keywords: AI learning, Dentistry Chat-Bot, Retrieval-Augmented Generation, Temporo-mandibular Joint.

Dynamic OCT Monitoring of Bioceramic Endodontic Sealers Under Acidic Challenge: A Pilot Investigation

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Introduction Calcium silicate–based sealers are widely used in contemporary endodontics due to their bioactivity and favorable sealing properties. Nevertheless, exposure to the acidic microenvironment associated with periapical inflammation may compromise their physicochemical stability and sealing performance. While previous studies have investigated the influence of acidic pH on setting time, microhardness, solubility, and antimicrobial activity, limited information is available regarding the dynamic behavior of different generations of bioceramic sealers under acidic challenge. Aim To evaluate the stability and sealing behavior of three generations of calcium silicate–based endodontic sealers exposed to an acidic environment using optical coherence tomography (OCT) and microscopic analysis.

Materials and Methods Six extracted multirooted teeth were included in this ongoing pilot investigation. Following standardized chemomechanical preparation, each root canal was obturated using a different calcium silicate–based sealer representing three generations of bioceramic materials: an MTA-based sealer (Generation I), a powder–liquid calcium silicate sealer (Generation II), and a premixed calcium silicate sealer (Generation III). Specimens were immersed in either an acidic medium (pH 5) or phosphate-buffered saline (PBS) for 5, 10, and 15 days prior to evaluation. OCT imaging was performed to assess filling integrity, structural discontinuities, and material stability over time. Subsequent DOM evaluation was performed to correlate OCT findings with direct microscopic observations.

Preliminary Results Data acquisition and image analysis are currently ongoing. Preliminary OCT observations suggest that this methodology enables repeated assessment of filling integrity and material-related changes under acidic challenge. The complete dataset is expected to provide comparative information regarding the stability and sealing performance of different generations of calcium silicate–based sealers exposed to acidic environments.

Conclusions This investigation introduces a multimodal evaluation strategy combining OCT and direct optical microscopy for monitoring the behavior of bioceramic sealers under acidic challenge. The proposed approach may contribute to a better understanding of material behavior in clinically relevant environmental conditions.

The Influence of Botulinum Toxin in Reducing Bruxism

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Bruxism is a masticatory muscle disorder associated with temporomandibular dysfunction, myofascial pain, and dental wear. Botulinum toxin type A (BoNT-A) has gained increasing attention as a therapeutic option due to its ability to inhibit acetylcholine release and reduce masticatory muscle hyperactivity (1). In addition, Nd:YAG photobiomodulation (PBM) has emerged as a non-invasive treatment for temporomandibular disorders (2).

A narrative review of clinical trials, systematic reviews, and meta-analyses was conducted to evaluate the effectiveness of BoNT-A in bruxism and Nd:YAG PBM in temporomandibular disorder management. The analyzed studies demonstrated that BoNT-A significantly reduces pain, occlusal force, and masticatory muscle activity, with therapeutic effects lasting approximately 3–6 months (1). Electromyographic evaluations confirmed decreased muscle hyperactivity and improved patient-reported outcomes. Nd:YAG photobiomodulation exhibited significant analgesic and anti-inflammatory effects, improving mandibular function, quality of life, and accelerating functional recovery in temporomandibular joint disorders (2).

BoNT-A acts through neuromuscular blockade, reducing muscle contraction intensity and associated symptoms, whereas PBM promotes tissue regeneration, modulates inflammation, and improves microcirculation.

Both therapies demonstrated favorable safety profiles and clinical effectiveness. Their integration into a multidisciplinary treatment approach may improve clinical outcomes and patients' quality of life. Further studies are required to establish standardized protocols and assess long-term efficacy.

Keywords: botulinum toxin type A, bruxism, photobiomodulation, Nd:YAG laser, temporomandibular disorders, masticatory muscles.

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Silent Infection, Aggressive Disease: HPV and Oral Cancer

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Introduction: Human papillomavirus (HPV) is one of the most prevalent viral infections worldwide and is increasingly recognized as a major etiological factor in oral and oropharyngeal carcinogenesis. While most HPV infections are transient and asymptomatic, persistent infection with high-risk genotypes, particularly HPV-16, can induce malignant transformation through the action of viral oncoproteins that disrupt key cellular regulatory pathways.

Aim: This presentation aims to highlight the role of HPV in oral carcinogenesis and to review contemporary and emerging strategies for the early detection of HPV-associated oral cancer.

Methods: A narrative review of current evidence was performed, focusing on the molecular mechanisms of HPV-induced carcinogenesis and innovative diagnostic approaches, including salivary biomarkers, circulating tumor HPV DNA (ctHPV-DNA), Optical Coherence Tomography (OCT), and micro-computed tomography (micro-CT). These technologies were evaluated regarding their potential clinical applications in screening, diagnosis, monitoring, and personalized patient management.

Results: High-risk HPV genotypes promote carcinogenesis primarily through the viral oncoproteins E6 and E7, which inactivate the tumor suppressors p53 and pRb, leading to genomic instability and uncontrolled cellular proliferation. Emerging diagnostic technologies offer significant advantages over conventional approaches. Salivary diagnostics and liquid biopsy provide minimally invasive methods for molecular detection and disease surveillance, while OCT and micro-CT enable high-resolution visualization of early structural alterations within oral tissues. The integration of molecular and imaging biomarkers has the potential to improve diagnostic accuracy and facilitate earlier intervention.

Conclusions: HPV-associated oral cancer frequently develops silently before clinical manifestations become evident. Advances in molecular diagnostics and optical imaging are transforming the landscape of oral oncology by enabling earlier detection, more precise monitoring, and personalized treatment strategies. Dentists play a crucial role in prevention, early recognition, and timely referral of patients at risk.

Keywords: HPV, oral cancer, oral oncology, HPV-16, liquid biopsy, salivary biomarkers, optical coherence tomography, micro-CT, early diagnosis, precision dentistry.

Beyond Smoke: The Oral Consequences of Tobacco and Vaping

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Introduction: The increasing popularity of electronic cigarettes has generated significant debate regarding their safety compared to conventional tobacco products. While both smoking and vaping expose the oral cavity to potentially harmful substances, their biological effects on the oral ecosystem remain an area of active investigation. The oral microbiome, a complex microbial community essential for maintaining oral health, may serve as a key mediator linking tobacco-related exposures to oral disease.

Objective: To evaluate and compare the effects of conventional cigarette smoking and electronic cigarette use on the oral microbiome and to explore their potential implications for oral health and disease.

Materials and Methods: Unstimulated saliva samples were collected from 100 participants, divided equally between conventional cigarette smokers and electronic cigarette users. Microbial DNA was extracted using standardized protocols and analyzed through real-time quantitative polymerase chain reaction (RT-qPCR) and 16S rRNA next-generation sequencing (NGS) using the Illumina iSeq 100 platform. Taxonomic profiles and microbial abundance patterns were compared between the two groups.

Results: Both smoking modalities were associated with significant alterations of the oral microbiome. Conventional smokers demonstrated an increased abundance of anaerobic periodontal pathogens, particularly Porphyromonas and Fusobacterium, organisms strongly associated with periodontal tissue destruction. In contrast, electronic cigarette users exhibited higher relative levels of Streptococcus and Veillonella, suggesting a distinct microbial adaptation to aerosol exposure. Although the microbial signatures differed, both groups displayed evidence of oral dysbiosis and inflammatory imbalance.

Conclusions: The findings indicate that tobacco smoke and electronic cigarette aerosols exert different selective pressures on the oral microbiome, leading to distinct but potentially harmful microbial profiles. Conventional smoking appears to promote a more aggressive periodontal environment, whereas vaping induces alternative ecological shifts whose long-term clinical consequences remain uncertain. Advanced molecular profiling techniques such as RT-qPCR and NGS provide valuable insights into these changes and may support the development of personalized preventive and therapeutic approaches in modern dentistry.

Keywords: tobacco smoking, vaping, oral microbiome, oral dysbiosis, periodontal disease, electronic cigarettes, next-generation sequencing, oral health.

Next-Gen Scaffolds: Additive Biomanufacturing of Tissues

Diana Bianca Patrulescu[1,2], Armin Yahyazadeh[1,2], Larisa Cojocaru[1,2], Ioan Iustin Rîpaș[2,3], Ana-Maria Drai[1,2], Daniela Maria Pop[1,2], Emanuela Lidia Crăciunescu[1,2], Andreea Codruța Novac[1,2], Meda Lavinia Negruțiu[1,2], Cosmin Sinescu[1,2]

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Introduction: Bone tissue engineering is advancing rapidly through 3D bioprinting which allows the fabrication of customized scaffolds using biocompatible materials that support bone regeneration and mimic natural tissue structure.

Aim of Study: This study aims to highlight the potential of 3D bioprinting in dental medicine and its applications in bone tissue regeneration.

Materials and Methods: A review of recent scientific literature on 3D bioprinting in dentistry was conducted using databases such as PubMed, Web of Science, and ScienceDirect. Preliminary experimental work was also performed using the BIO X (Cellink) bioprinter with polycaprolactone (PCL) and Cellink Alginate to evaluate printability and scaffold stability.

Results and Discussions: Current research confirms the growing role of 3D bioprinting in regenerative dentistry, especially for bone reconstruction. In our experiments the PCL scaffold showed good structural stability while the alginate scaffold demonstrated lower mechanical resistance and slight deformation. Printing 1 × 1 × 1 cm scaffolds required repeated parameter adjustments making the process technically challenging.

Conclusions: 3D bioprinting has strong potential in regenerative dentistry due to its ability to create precise and customizable scaffolds. However technical limitations and material related challenges still require further optimization and research.

Keywords: 3D bioprinting, tissue engineering, bone scaffold, additive manufacturing, biomanufacturing, biomaterials, bioinks, mechanical strength.

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Redefining Dental Diagnostics: AI, Fluorescence Imaging and Early Lesion Detection

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Introduction: Artificial Intelligence is rapidly transforming dentistry by improving diagnostic accuracy and supporting clinicians in the interpretation of radiographic and optical images. Machine learning and deep learning systems can identify pathological patterns and assist in the early detection of oral lesions.

Aim of study: This paper aims to present the current applications of AI in dentistry and its contribution to diagnostic improvement, with emphasis on radiographic analysis and fluorescence imaging for detecting oral abnormalities and potentially malignant lesions.

Materials and Methods: A narrative review of recent scientific literature was conducted, focusing on AI-assisted radiographic interpretation, fluorescence imaging systems and neural network algorithms used in the detection and classification of oral mucosal lesions.

Results and Discussion: Studies show that AI systems are effective in detecting oral pathological changes and improving lesion visualization through fluorescence analysis and image segmentation. These technologies may reduce diagnostic subjectivity and enhance early detection compared to conventional examination methods.

Conclusions: Artificial Intelligence shows strong potential for integration into future dental practice particularly in diagnostic procedures and image interpretation. However further clinical validation and standardized methodologies are still required for widespread implementation.

Keywords: artificial intelligence, oral id, cancer, hpv, dental diagnostics, radiographic interpretation, oral lesion detection, deep learning, digital imaging.

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The AI-Empowered Patient: A View for Citizens and Clinicians.

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Introduction. Generative AI chatbots (ChatGPT, Gemini, Claude) have fundamentally changed how citizens seek health information. Unlike the era of "Dr. Google", which returned fragmented links, today's AI provides coherent, persuasive narratives. Patients and healthy individuals now consult AI for symptom interpretation, medication advice, lifestyle management, and second opinions. This raises critical questions about accuracy, trust, and the medical community's response.

Objective and Methods: This paper provides an evidence-based overview of the AI-empowered patient/citizen for a heterogeneous audience (clinicians, policymakers, developers, and the public). We synthesize recent data on usage patterns, diagnostic accuracy, hallucinations, user trust, and future projections. We reviewed surveys and studies published between 2025–2026 from Pew Research Center, West Health-Gallup, Yale School of Medicine, Mass General Brigham and JAMA Internal Medicine.

Key findings: Approximately 32–36% of US adults have used AI for health information. Users fall into three behavioral types (anxious verifier, collaborator, self-diagnose) and four technological levels (general chatbot to autonomous agents). While AI achieves 85–92% diagnostic accuracy in controlled settings, it recommends unnecessary investigations in >90% of cases and potentially harmful treatments in 60–67%. Hallucinations occur in 53–83% of responses. Trust often exceeds accuracy: 45% of adults trust AI for health information; 25% have followed AI advice without seeing a clinician—of whom 23% reported harm. Predictions: By 2030, the global AI health market will grow to $1.6 trillion. Patients will become active health managers; clinicians will shift to strategic guides. AI will predict risks for >1,000 diseases.

Recommendations: Medical schools must integrate AI literacy into core curricula. Health authorities should enforce the EU AI Act, mandate transparent labelling, and launch digital health literacy campaigns. Clinicians should adopt a curious, non-defensive attitude ("What did the AI tell you?") and use shared triage to validate correct information while adding what AI cannot know (physical exam, context). Media should partner with experts to counter misinformation. Developers must implement safety warnings and submit to independent audits.

Conclusions: The AI-empowered patient is today's reality. AI is a valuable assistant but an unreliable independent diagnostician. Success depends on human adaptation—not technology alone—and on collaboration between citizens, clinicians, and well-designed AI systems.

Keywords: AI-empowered patient, health chatbots, hallucinations, trust in AI, medical education.

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3D Biomimetic piezoelectric scaffolds-based therapeutic approach for volumetric muscle loss repair

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Volumetric muscle loss (VML), a debilitating disease that poses a significant challenge to regenerative medicine. Current treatments, often relying on acellular scaffolds, frequently lead to fibrotic tissue formation, limiting functional recovery. We investigate into the exciting potential of bio-piezoelectric scaffolds, a novel class of biomaterials that mimic the natural electrical and mechanical properties of muscle tissue, to revolutionize VML repair. Muscle tissue is not a passive structure but a dynamic environment constantly responding to electrical and mechanical cues. These signals are crucial for regulating muscle growth, repair, and function, are often absent in conventional scaffolds.

Our research focuses on the development of 3D biomimetic piezoelectric scaffolds, employing the biodegradable and biocompatible polymer from the Polyhydroxyalkanoates (PHA) family. Electrospun fibers, incorporated into an extracellular matrix (ECM) hydrogel, provide a robust and biocompatible scaffold that mimics the mechanical properties of muscle tissue. Importantly, PHAs exhibit a piezoelectric effect, generating an electrical charge upon mechanical deformation. This intrinsic property allows the scaffold to respond dynamically to muscle contraction and relaxation, creating a bio-electric environment that closely resembles the native tissue.

In vitro studies using myoblast cells demonstrate enhanced cell adhesion, proliferation, and differentiation within the 3D bio-piezoelectric scaffolds. These cells exhibited increased expression of muscle-specific markers, such as MyoD, indicative of robust muscle regeneration. Preliminary in vivo studies using a mouse model of VML showcase the potential of bio-piezoelectric scaffolds for inducing functional muscle regeneration. The scaffolds promoted the formation of new muscle tissue, improving muscle function and reducing fibrosis. Bio-piezoelectric scaffolds offer a unique opportunity to overcome the limitations of current VML treatments, leading to improved functional recovery and a higher quality of life for patients. This presentation will discuss the ongoing research, including the exploration of bioprinting techniques to develop complex and customizable scaffolds, the investigation of the role of specific biomolecules in regulating muscle regeneration, and the potential application of this technology in treating diverse muscle injuries.

Visible Pain and Invisible Suffering. Smart Pain Care: Artificial Intelligence in Personalized Pain Medicine

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In pain management practice, the major challenge is not always controlling severe pain but rather managing patients in whom the underlying pain mechanism remains incompletely defined and whose response to treatment is difficult to predict. Cases of persistent postoperative pain, Failed Back Surgery Syndrome, Complex Regional Pain Syndrome, Chronic Pelvic Pain, or Fibromyalgia illustrate the complexity of modern pain medicine, where nociceptive, neuropathic, and nociplastic components frequently coexist. In such situations, artificial intelligence (AI) may serve as a complementary clinical tool for reducing diagnostic uncertainty and optimizing therapeutic decision-making. By simultaneously integrating clinical data, functional scores, medical imaging, neurophysiological parameters, autonomic biomarkers, and treatment history, machine learning algorithms can identify patterns that are difficult to recognize through conventional clinical assessment.

This presentation explores the practical applications of AI in pain management, with a focus on five challenging clinical scenarios. The role of AI in differentiating pain mechanisms, predicting pain chronification, selecting patients for interventional procedures such as nerve blocks, radiofrequency ablation, or neuromodulation, and early identification of non-responders will be discussed. Special attention will be given to the potential of AI to support precision medicine through individualized phenotyping and the selection of the most appropriate treatment for each patient.

Although promising, clinical implementation raises important challenges related to data quality, algorithmic bias, and model interpretability. In pain management, where the physician–patient relationship remains fundamental, AI does not replace clinical expertise but rather enhances it. The future belongs to a practice in which advanced technology helps clinicians look beyond expressed pain and gain a deeper understanding of patient suffering.

Interaction of Self-Assembled Amphiphiles with Circulatory System Esterases and Its Relevance to Drug Delivery

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Amphiphilic block copolymers containing hydrophilic polyethylene glycol attached to hydrophobic biodegradable polyester blocks, such as PEG-PLA or PEG-PCL, can act in self-assembled (micellar) form as drug delivery systems (DDSs) for the management of metastatic non-small-cell lung cancer, breast cancer and ovarian cancer with proved clinical efficiency (Genexol-PM approved in Korea and under advanced clinical trials in the U.S.). We engineered a set of PEG-PCL diblock copolymers through insertion of a PBO short block in between the hydrophilic and hydrophobic block and we characterized their self-assemblies in aqueous solutions and the ability of these supramolecular assemblies to load hydrophobic drugs [1-3]. We also developed methodology to test the stability of these assemblies against different esterases present in blood/tissues [4,5] and we evaluated the impact of the tuned interfaces on the micelle stability against these enzymes [2-4, 6]. We will present our newest results towards selective stabilization of the polymeric micelles in circulation/targeted tissues and their impact in drug delivery for the treatment of breast cancer.

Keywords: Medicine, Biochemistry, Breast Cancer, Block copolymers, Self-assembling, Drug encapsulation, Drug delivery, Esterases, Lipases, Kinetic parameters, Cellular and animal models

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Long-Term Circulatory Assistance with the HeartMate 3 Centrifugal Pump

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Advanced heart failure remains associated with high morbidity and mortality despite significant advances in medical therapy. Estimated survival for the patients is less than 5% at 5 years. Durable left ventricular assist devices (LVADs) have emerged as an established therapeutic option for patients with end-stage heart failure, ether as a bridge to transplantation or as destination therapy.

The HeartMate 3, a fulley magnetically levitated centrifugal-flow pump, has demonstrated favorable outcomes regarding survival, hemocompatibility and device durability.

Actual devices have a reduced risk of infection, bleeding, thrombosis, or stroke.

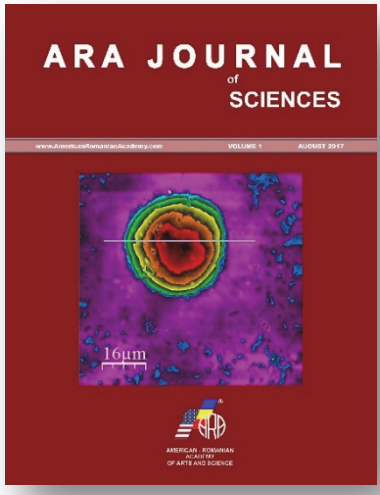
Survival at 5 years with LVAD devices is nearly 60%, comparable to the poor referral rate of patients into our medical centers and even due to limited knowledge of LVADs outcomes or quality of life.

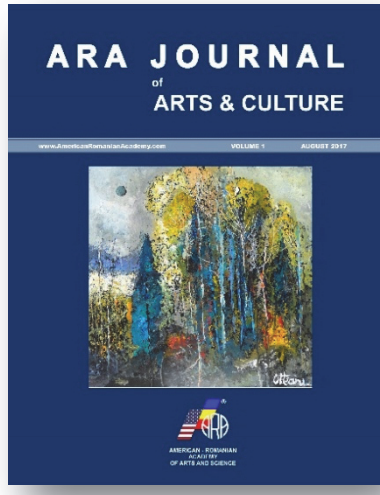
We present our experience with the HeartMate 3 LVAD implantations, one of them in a BIVAD configuration.

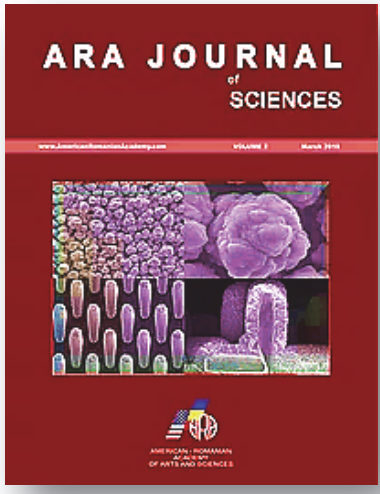
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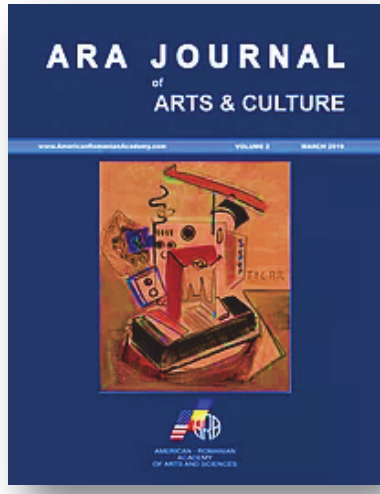
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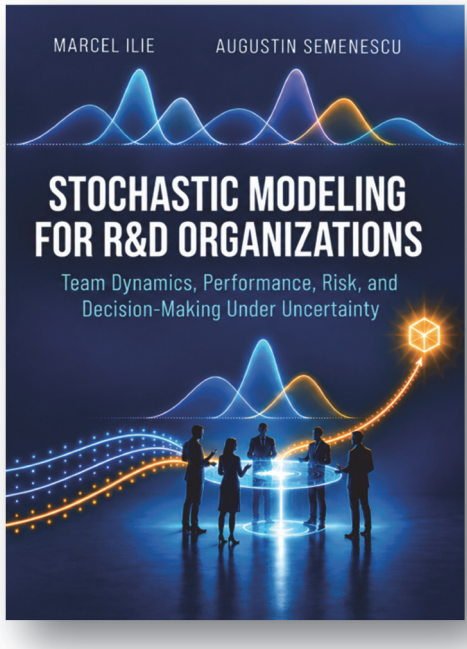


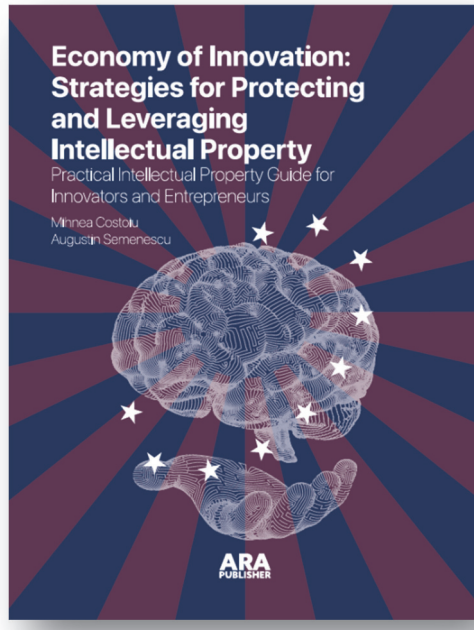


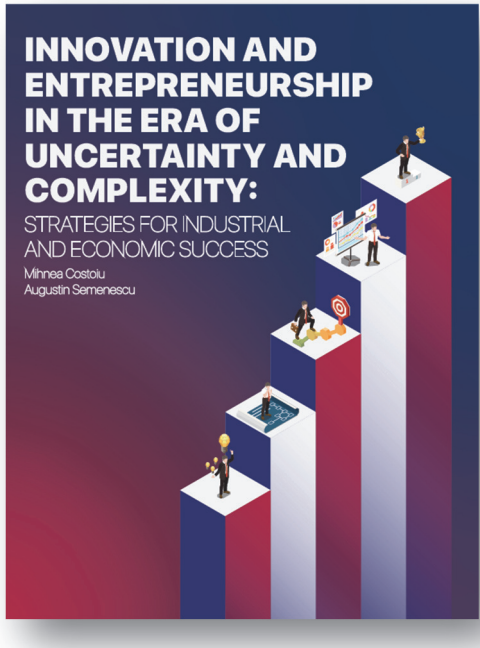


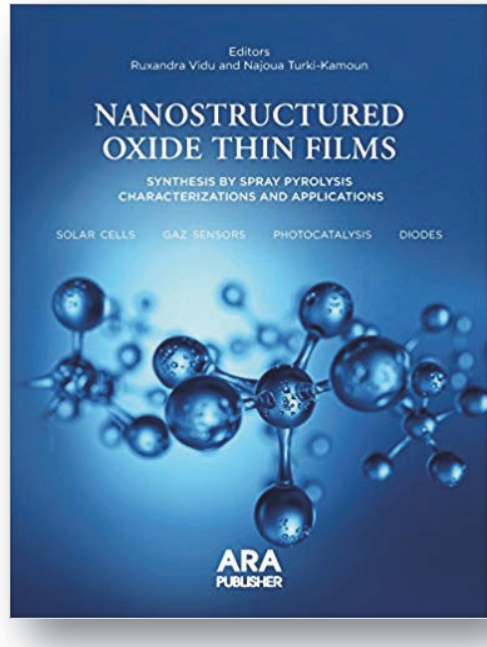
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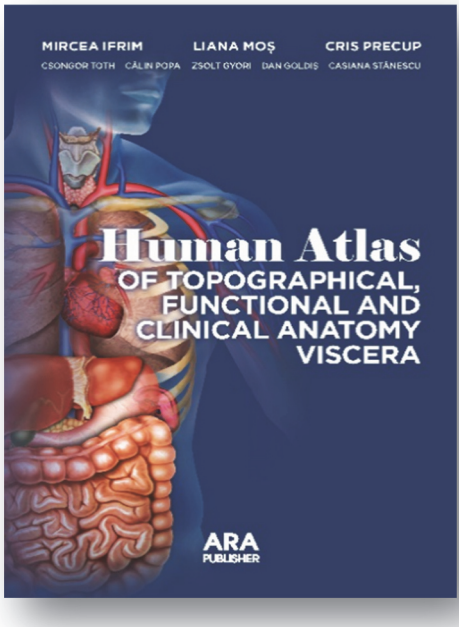
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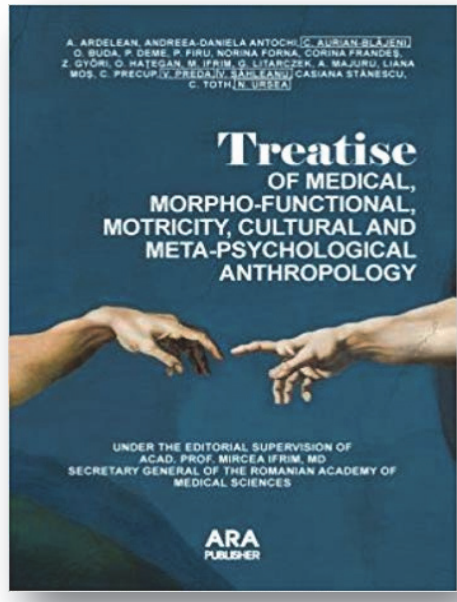


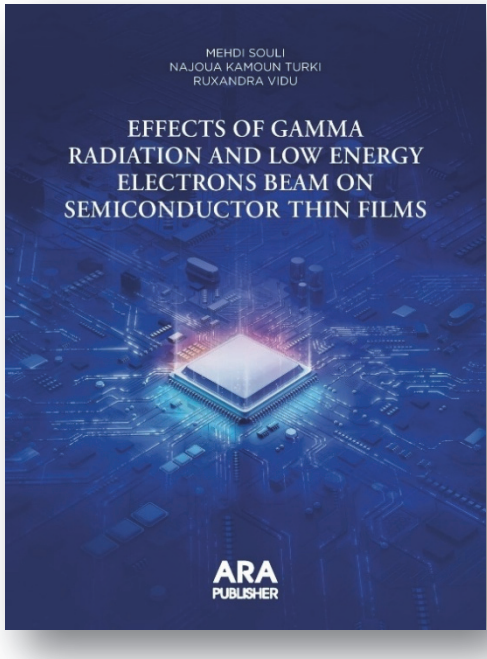


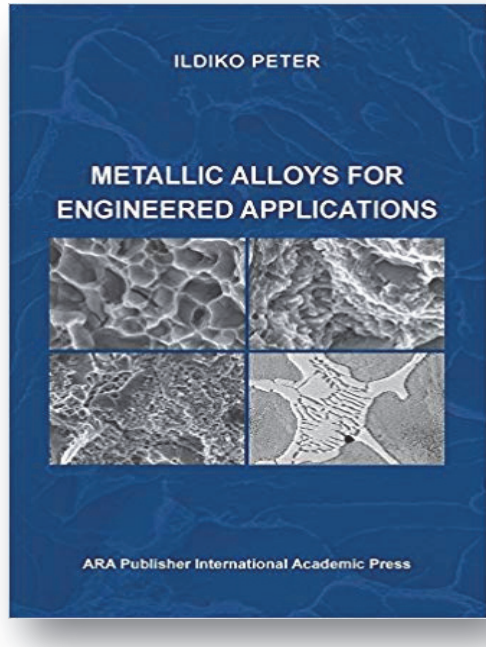


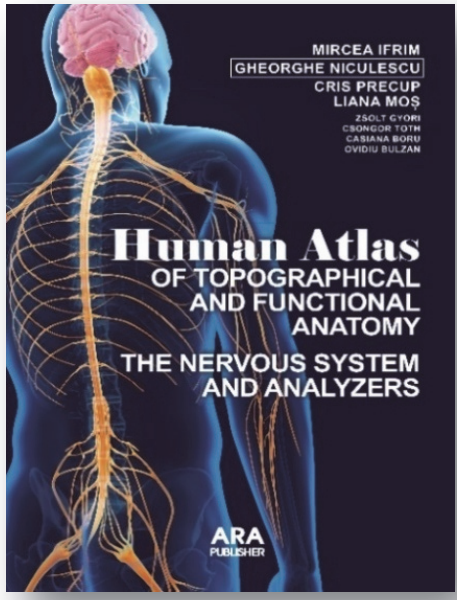


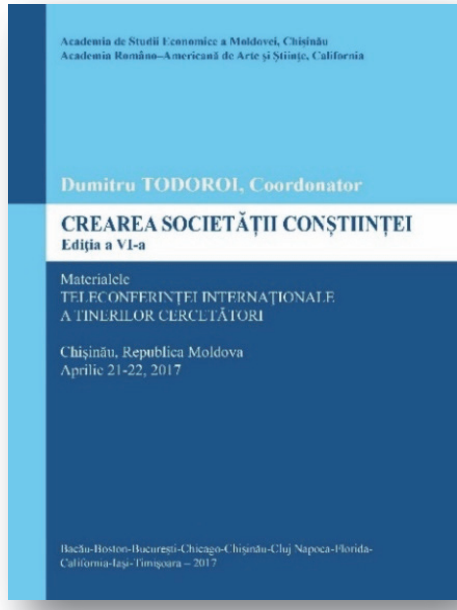

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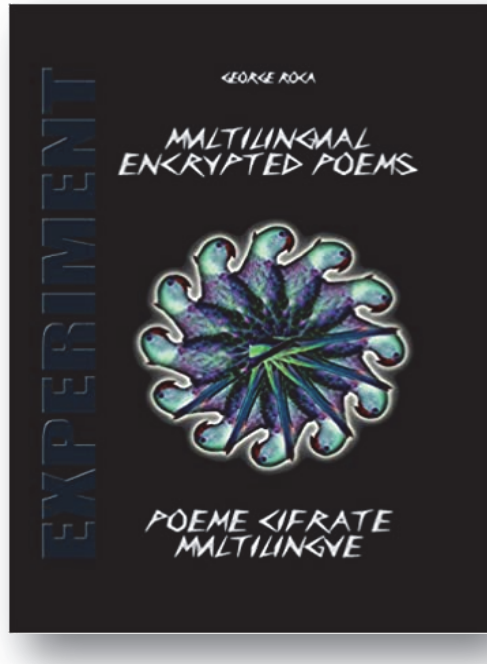

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