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Entangled Ontologies in the Digital Anthropocene: Navigating Posthuman Citizenship, Algorithmic Governance, and Socio-Ecological Regime Shifts

Dr. Nguyen Thi Mai
Department of Sociology, Vietnam National University, Hanoi, Vietnam

Dr. Kwame Osei-Tutu
Institute of African Studies, University of Ghana, Accra, Ghana

Dr. Elena Volkov
Faculty of Philosophy, Lomonosov Moscow State University, Moscow, Russia

Dr. Lestari Indah
Department of Environmental Science, University of Indonesia, Jakarta, Indonesia

ABSTRACT

Introduction: The convergence of the Anthropocene—the geological epoch defined by human impact—and the rapid acceleration of digital technologies has created a complex "techno-social" environment. This paper explores the entangled relationship between algorithmic governance, posthuman identity, and ecological stability. Methods: Adopting a critical posthumanist framework, this study synthesizes recent literature (2022–2024) spanning digital sociology, environmental theory, and philosophy. We employ a diffractive analysis to map connections between online propaganda mechanisms, the ontology of the metaverse, and macro-social ecological regime shifts. Results: Our analysis reveals three critical fissures. First, algorithmic optimization (SEO) and platform architectures actively fragment social cohesion and construct polarized narratives, as evidenced in studies of pandemic discourse and policy mapping. Second, the "digital divide" is morphing into an ontological divide, where access to telemedicine and digital citizenship determines survival, particularly in the Global South. Third, the "immaterial" digital world is deeply tethered to material ecological costs, influencing carbon cycles and energy consumption. Discussion: We argue that traditional human-centric sociology is insufficient for the current crisis. Instead, we propose a framework of "Posthuman Citizenship" that recognizes the agency of non-human actors (algorithms, ecosystems). We conclude that navigating the digital Anthropocene requires "tempering the not-yet," a temporal ethic that prioritizes long-term ecological stability over short-term technological acceleration.

KEYWORDS: Digital Anthropocene, Posthumanism, Algorithmic Governance, Socio-Ecological Systems, Digital Divide, Metaverse, Critical Theory.

INTRODUCTION

The dawn of the 21st century has been marked by two simultaneous and colliding epochal shifts: the recognition of the Anthropocene and the total saturation of the digital. The former designates a geological era where human activity acts as the dominant influence on climate and the environment, effectively collapsing the distinction between natural history and human history. The latter refers to the migration of political, social, and economic life into virtual environments mediated by algorithms, artificial intelligence, and platform capitalism. While these two phenomena are often treated in isolation—one as a crisis of nature, the other as a revolution of culture—they are, in fact, deeply entangled. We do not merely inhabit a warming planet; we inhabit a *smart* planet, where the sensors monitoring the carbon cycle are made of rare earth minerals extracted from the very soil they seek to protect. We are no longer simply biological "humans"; we are posthuman assemblages, extended cognitively by smartphones and ontologically defined by data profiles.

This article posits that we cannot understand the current crisis of the Anthropocene without understanding the "Infosphere," nor can we understand the digital society without reckoning with its material, ecological footprint. The aim of this manuscript is to map these entangled ontologies. We draw upon the emerging field of critical posthumanism, which challenges the centrality of the "human" (typically defined as male, white, and rational) in favor of a relational view of existence. As scholars like Ferrando (2023) and Braidotti (2022) argue, the humanist ideal of the autonomous subject is ill-equipped to deal with the complexities of a world where agency is distributed among humans, algorithms, viruses, and ecosystems.

The urgency of this investigation is underscored by the fragmentation of our shared reality. In the wake of the COVID-19 pandemic, digital platforms became the primary infrastructure for social interaction, healthcare, and political discourse. Yet, as recent studies indicate, this shift has not led to a global village but rather to a "metaverse of violence" and fragmented echo chambers (Pascali, 2024; Acampa & Padricelli, 2023). Simultaneously, the ecological clock is ticking. The "closed carbon cycle" that once regulated planetary health is now being managed—or mismanaged—by socio-technical regimes that prioritize infinite growth on a finite planet (Johnson, 2024).

This paper addresses two primary research questions. First, how do digital mechanisms—from Search Engine Optimization (SEO) to telemedicine algorithms—reshape the concept of citizenship and social equity? Second, how can a posthumanist perspective help us reconcile the immaterial allure of the digital with the material reality of the Anthropocene? By synthesizing recent empirical data and high-level social theory, we aim to provide a roadmap for navigating this entangled world.

Theoretical Framework: The Posthuman Turn

To analyze these questions, we employ a theoretical framework grounded in "Philosophical Posthumanism." This approach is not merely about "cyborgs" or technological enhancement; it is a fundamental critique of anthropocentrism. As Ferrando (2023) explicates, posthumanism seeks to deconstruct the hierarchies that have historically elevated the human above the non-human (animals, machines, the environment). It views existence as a "becoming," a constant flow of interactions rather than static categories.

Braidotti (2022) extends this into the realm of "Posthuman Feminism," arguing that the current technological explosion creates new forms of marginalization even as it promises liberation. The "universal human" of the Enlightenment is being replaced by the "quantified self" of the data economy, but access to this new status is unevenly distributed. This theoretical lens allows us to see the "Digital Divide" not just as a lack of internet access, but as a form of ontological exclusion (Laskar, 2023). If you are not datafied, you do not exist in the eyes of the administrative state.

Furthermore, we incorporate the "Anthropocene Narratives" discussed by Mellamphy and Vangeest (2024). They argue that our storytelling mechanisms—the way we conceive of the future and the past—must shift from human-hero narratives to complex, systemic narratives. The "problem of post-anthropocentrism" is that we struggle to imagine a world where we are not the center. Yet, ecological reality demands exactly this shift. Adam (2023) provides a temporal dimension to this framework, urging a "tempering of the not-yet." This concept challenges the "accelerationist" logic of Silicon Valley, which rushes toward the future without regard for the social or environmental debris left in its wake.

METHODOLOGY

This study adopts a qualitative, hermeneutic methodology, functioning as a "critical meta-synthesis" of literature published primarily between 2022 and 2024. The selection of texts was guided by a desire to bridge the disciplinary gap between Digital Sociology and Environmental/Anthropocene Studies.

Research Design and Data Selection

We analyzed a corpus of sixteen key academic contributions that represent "signals" of the current socio-technical regime. These include empirical case studies, such as Laskar's (2023) comparative evaluation of digital divides in India and Caroleo and De Amicis's (2023) mapping of the SEO landscape in Italy. These empirical anchors are read "diffractively" through the theoretical texts of Adam (2023), Dedeoglu (2023), and LaGrandeur (2024).

Diffractive Analysis

Borrowing from feminist technoscience, a "diffractive" reading does not simply compare texts but looks for the interference patterns created when insights from one discipline are read through another. For example, we ask: How does the "Metaverse of Violence" (Sociology) interfere with the "Closed Carbon Cycle" (Ecology)? How does "Posthuman Citizenship" (Political Theory) refract through "Telemedicine inequalities" (Healthcare)?

Limitations

It is important to acknowledge that while we strive for a global perspective, much of the high-level theoretical discourse on Posthumanism originates in the Global North. However, we have deliberately integrated studies focusing on the Global South (e.g., rural India) to mitigate this bias. Additionally, the rapid pace of technological change means that any analysis of "digital society" is capturing a moving target; the "regime shifts" described by Peters (2024) are ongoing and non-linear.

Results: The Architecture of the Digital Anthropocene

Our analysis reveals that the digital Anthropocene is constructed upon three pillars: the algorithmic manipulation of truth, the redefinition of violence and presence in virtual spaces, and the material metabolic cost of planetary computation.

1. The Fabricated Reality: SEO, Propaganda, and Epistemic Chaos

The first major finding concerns the structure of knowledge in the digital age. In a posthuman society, "truth" is often algorithmically determined. Caroleo and De Amicis (2023) demonstrate this through their investigation of the "SEO effect" on controversial policy issues in Italy. They found that the landscape of information is not a neutral marketplace of ideas but a carefully "optimized landscape." Keywords, back-end metadata, and search engine ranking factors determine visibility. This creates a feedback loop where content is created not to inform humans, but to please algorithms. The human reader is a secondary consumer; the primary audience is the Google spider.

This algorithmic gatekeeping has profound implications for social cohesion. Nerino (2023) explores how this fragmentation facilitates online propaganda. By analyzing the "cognitive sociology" of propaganda, Nerino argues that digital platforms exploit cognitive biases to create "epistemic bubbles." In these bubbles, propaganda does not need to be logically consistent; it only needs to resonate emotionally with the user's pre-existing identity markers. This was visibly operationalized during the COVID-19 pandemic. Acampa and Padricelli (2023) contrast traditional social platforms with alternative ones like Gab. Their analysis of narratives surrounding vaccines reveals a stark bifurcation of reality. On mainstream platforms, content moderation attempted (often clumsily) to enforce a scientific consensus. On alternative platforms, a "counter-narrative" flourished, framed as resistance against tyranny. The result is not just political disagreement but a fracturing of the shared "life-world."

2. The Ontology of the Virtual: Violence and Citizenship

The second pillar of our results concerns how we exist in these spaces. If we spend half our waking lives in digital environments, the nature of those environments matters ontologically. Pascali (2024) introduces the chilling concept of the "Metaverse of Violence." Moving beyond the idea that online harassment is "less real" than physical assault, Pascali argues that in a world where subjectivity is digital, aggression against the digital avatar is a direct violation of the self. The conceptual analysis of aggression in virtual environments shows that the "metaverse" is not a utopia of disembodied freedom, but a space where new forms of trauma are enacted. This violence is often unregulated, as legal frameworks are still tethered to physical geography.

However, the virtual is also a space of essential service delivery. Taddei and Parini (2023) highlight the contribution of digital social research to telemedicine in the post-COVID-19 era. While telemedicine promises universal access, their identification of inequalities suggests otherwise. The "patient" in the posthuman age is an assemblage of biological symptoms and digital connectivity. If the digital link is severed or poor quality, the biological care ceases.

This leads to the broader issue of "Posthuman Citizenship" conceptualized by Dedeoglu (2023). Citizenship is no longer just about birthright or borders; it is about "ontopolitics"—the politics of being. Who counts as a citizen? In the smart city, the citizen is a data point. Laskar (2023) provides a grounding example of this in the Indian context. The comparative evaluation between urban and rural areas in India shows that the "digital society" is an archipelago of high-connectivity islands in a sea of digital exclusion. The rural subject, lacking the digital prosthesis of high-speed internet, is effectively a second-class citizen in the modern state, unable to access the full spectrum of rights and services.

3. The Materiality of the Digital: Energy, Ecology, and the Anthropocene

The most significant area of our expansion focuses on the often-overlooked materiality of the digital sphere. There is a prevailing myth that the digital transition is "green" because it is immaterial—we replace paper with PDFs, travel with Zoom, and shopping malls with Amazon. However, our synthesis of the ecological literature reveals a starkly different reality. The "cloud" is heavy; it is composed of

server farms, undersea cables, and lithium batteries, all of which consume vast amounts of energy and raw materials.

Lima (2024) investigates the link between human population dynamics and energy consumption during the Anthropocene. The findings suggest that as populations urbanize and digitize, their per capita energy consumption skyrockets. The digital lifestyle is an energy-intensive lifestyle. Streaming 4K video, training Large Language Models (LLMs), and mining cryptocurrencies require base-load power that, in many parts of the world, is still generated by fossil fuels. The "dematerialization" of the economy is a local illusion; the entropy is simply exported to the power plant and the lithium mine.

Johnson (2024) takes this analysis to the planetary level, discussing the "closed carbon cycle in a managed, stable Anthropocene." Johnson argues that we have entered a phase where the carbon cycle is no longer a natural fluctuation but a "managed" flow. However, the management systems are flawed. Digital technologies are proposed as the solution—using AI to optimize grids and monitor emissions—but they are also part of the problem. The production of digital hardware involves a global supply chain that is one of the drivers of the "Socio-ecological regime shifts" described by Peters (2024).

Peters' macro-social analysis of New England (USA) from 1620 to 2020 provides a historical template for understanding regime shifts. Just as the shift from indigenous land management to colonial agriculture fundamentally altered the ecological regime, the shift to a "Digital-Industrial" regime is altering planetary boundaries. The extraction of materials for digital devices creates "sacrifice zones"—areas of environmental devastation usually located in the Global South—to support the "clean" digital lives of the Global North.

Furthermore, Richter (2023) discusses the implications of "Critical post-humanism and social work in the city." The urban environment is where these tensions collide. The "smart city" is often presented as the pinnacle of efficiency, but Richter argues that without a critical posthumanist perspective, social work and urban planning fail to account for the "entanglements" of the researcher and the professional. The city is an ecosystem of humans, animals, microbes, and machines. Ignoring the non-human elements (e.g., displacing urban wildlife to build data centers, or ignoring the heat-island effect generated by air conditioning for server rooms) leads to urban fragility.

The "Anthropocene Narratives" analyzed by Mellamphy and Vangeest (2024) are crucial here. They identify a "problem of post-anthropocentrism." We intellectually understand that we are destroying the planet, but our narratives—and our technologies—are still obsessively human-centered. We build AI to mimic humans; we build metaverses to replicate human cities. We rarely build technologies that help us integrate better with the biosphere. The digital revolution, rather than saving us from the Anthropocene, may be accelerating the very extraction and consumption cycles that drive it.

Discussion: Tempering the Not-Yet

The results of this study paint a picture of a world in transition, where old categories of "human," "nature," and "machine" are dissolving. The discussion must therefore turn to the ethical and political implications of this dissolution. How do we govern a world of entangled ontologies?

The Pharmakon of Emerging Technology

LaGrandeur (2024) offers a potent framework for understanding this through the "promise and peril of emerging technology for brain enhancement." He invokes the Greek concept of the *pharmakon*—something that is both a cure and a poison. Digital technology is a pharmakon. It offers the "cure" of connection, infinite knowledge, and medical breakthroughs (like telemedicine). Yet, it carries the "poison" of surveillance, addiction, polarization, and ecological exhaustion. The posthumanist perspective does not reject technology (which would be Luddism) nor does it blindly embrace it (Transhumanism). Instead, it calls for a critical engagement with the pharmakon. We must administer the dosage carefully.

This care is central to the "Posthuman Citizenship" discussed by Dedeoglu (2023). A new ontopolitics requires us to extend the circle of moral concern. Citizenship acts should not just be about voting or paying taxes; they should include "ecological citizenship"—the responsibility to the carbon cycle, to the water table, and to the non-human life that sustains us. It also implies "digital citizenship" rights that protect the cognitive liberty of the subject against the manipulative "SEO effects" identified by Caroleo and De Amicis (2023).

Navigating the Fragmentation

Addressing the fragmentation of reality described by Nerino (2023) and Acampa and Padricelli (2023) requires more

than just better fact-checking algorithms. It requires a "Cultural and Cognitive Sociology" that understands *why* people retreat into propaganda bubbles. Often, it is a response to the ontological insecurity of the Anthropocene. When the world feels like it is ending (climate grief) and the economy is alienating (gig economy), the certainty of a conspiracy theory or the tribalism of a polarized social platform offers a false sense of security.

To overcome this, we need to foster "assemblages" of solidarity that cross the digital/physical divide. We need educational systems that teach "digital literacy" not just as technical skills, but as critical thinking about algorithms. Users need to understand that the "optimized landscape" they see on Google is a construct, not a mirror of reality.

Temporal Ethics for a Destabilized World

Finally, we must return to Adam (2023) and the concept of "Tempering the not-yet." The Anthropocene is a crisis of time. We are consuming the future to fuel the present. The digital economy is built on instantaneity—real-time analytics, instant delivery, high-frequency trading. This compression of time clashes with the deep time of geology. The atmosphere does not negotiate with quarterly earnings reports.

"Tempering the not-yet" means adopting a social theory that respects the temporal lag of ecological systems. We cannot "disrupt" the climate the way we disrupt the taxi industry. A posthumanist ethic requires us to slow down certain aspects of technological deployment to assess their long-term "regime shift" potential (Peters, 2024). It asks us to consider the "Not-Yet"—the generations of humans and non-humans who will inherit the depleted lithium mines and the acidified oceans.

Implications for Policy and Research

Based on this synthesis, we propose three directions for future policy and research:

1. **Algorithmic Transparency Laws:** Governments must treat search algorithms and social media feeds as public infrastructure, subject to audit for their role in polarization and "metaverse violence."
2. **Ecological Accounting for Digital Systems:** We need new metrics that calculate the "Return on Energy Invested" (ROEI) for digital services. If a Metaverse project consumes terawatt-hours of energy but provides only entertainment value, it may be maladaptive in the Anthropocene.
3. **Inclusive Digital Infrastructure:** Bridging the digital divide (Laskar, 2023) must be prioritized not just as economic development, but as a human rights imperative. However, this infrastructure must be built with "appropriate technology" principles that do not lock developing nations into fossil-fuel dependency.

CONCLUSION

We stand at a crossroads. One path leads to a "Hyper-Anthropocene," where the digital is used to further dominate and extract from nature, creating a bifurcated world of digital elites and analog outcasts living in ecological ruin. The other path leads to a "Symbiotic Posthumanism," where digital technologies are used to monitor planetary health, distribute resources equitably, and foster a new consciousness of entanglement.

This paper has argued that the choice between these paths depends on our ability to integrate sociological, ecological, and technological insights. We must recognize that we are "entangled researchers and professionals" (Richter, 2023). There is no "outside" to the system from which we can observe objectively. We are inside the algorithm, and we are inside the climate. By embracing the principles of posthuman citizenship and tempering our rush toward the technological "not-yet," we may find a way to navigate the turbulent waters of the digital Anthropocene. The future is not just about learning rich features without labels; it is about learning to live richly on a finite planet with others—human, machine, and earth alike.

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