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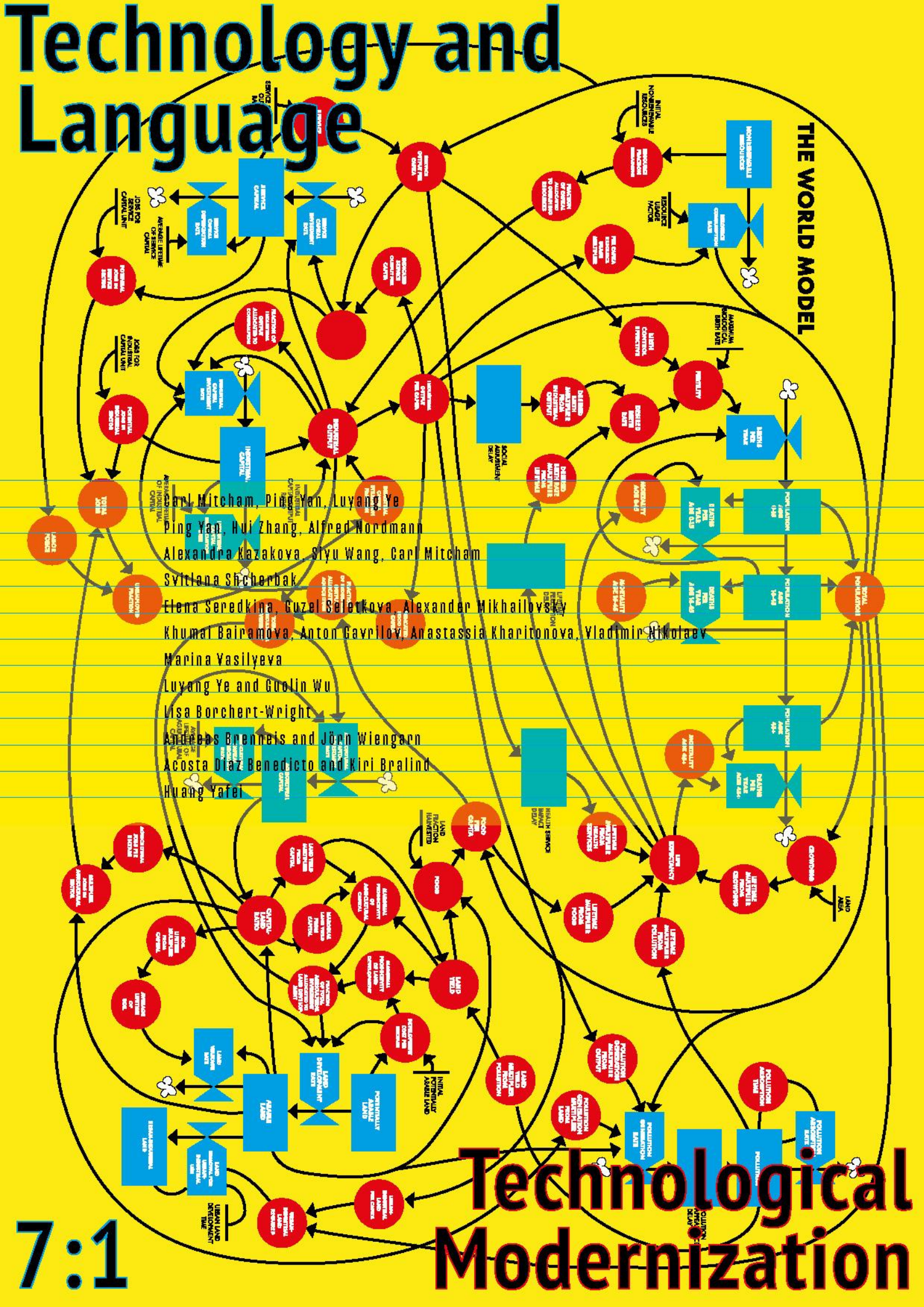

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Technological Modernization

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Carl Mitcham, Ping Yan and Luyang Ye

https://doi.org/10.48417/technolang.2026.01.01
Editorial introduction

Introduction: Technological Modernization in a Multipolar World[1]

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Abstract
This editorial introduces a Special Issue on "Technological Modernization in a Multipolar World." It is stimulated by the growing tension between established Western narratives of modernization and the emergence of alternative technological trajectories across diverse geopolitical contexts. Rather than treating modernization as a unified process, this collection of articles approaches it as a contested and pluralistic phenomenon shaped by competing imaginaries, institutional arrangements, and value frameworks. Individual contributions examine how technological systems function as sites of negotiation through which societies articulate and transform their identities, governance structures, and future orientations. Organized around conceptual, digital, ecological, and reflexive perspectives, this set of articles advances a reflexive understanding of technological modernization as an open-ended process unfolding through differentiation with interdependence, it furthermore highlights the challenge of sustaining dialogue across divergent yet interconnected pathways.

Keywords: Technological modernization; Sociotechnical imaginaries; Non-Western perspectives; Epistemic orders; Plural modernities

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[1] This editorial was prepared with the assistance of large language models (including ChatGPT and Gemini) in drafting and language refinement. All content has been reviewed and revised by the guest editors, who take full responsibility for its accuracy and interpretation. Given that all three guest editors also contribute articles to this special issue, the use of AI tools was intended, in part, to offer a fourth, ostensibly neutral and balanced perspectives on the contributions.

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Редакторская заметка

Введение: Технологическая модернизация в многополярном мире[2]

Карл Митчем [1], Пин Янь [2] (✉) and Луян Е [3]
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Аннотация
Данная редакционная статья представляет специальный выпуск, посвященный “Технологической модернизации в многополярном мире”. Она вызвана растущим напряжением между устоявшимися западными представлениями о модернизации и появлением альтернативных технологических траекторий в различных геополитических контекстах. Вместо того чтобы рассматривать модернизацию как единый процесс, этот сборник статей рассматривает ее как спорное и плюралистическое явление, формируемое конкурирующими представлениями, институциональными механизмами и ценностными рамками. Отдельные статьи исследуют, как технологические системы функционируют как площадки для переговоров, посредством которых общества формулируют и трансформируют свою идентичность, структуры управления и будущие ориентации. Организованный вокруг концептуальной, цифровой, экологической и рефлексивной перспектив, этот сборник статей развивает рефлексивное понимание технологической модернизации как открытого процесса, разворачивающегося посредством дифференциации с взаимозависимостью, и, кроме того, подчеркивает проблему поддержания диалога между различными, но взаимосвязанными путями.

Ключевые слова: Технологическая модернизация; Социотехнические представления; Незападные перспективы; Эпистемические порядки; Плюралистические современности

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[2] Редакционная статья была подготовлена с помощью больших языковых моделей (включая ChatGPT и Gemini) при составлении и уточнении текста. Весь контент был проверен и отредактирован приглашенными редакторами, которые несут полную ответственность за его точность и интерпретацию. Учитывая, что все три приглашенных редактора также вносят свой вклад в этот выпуск, использование инструментов искусственного интеллекта было призвано, отчасти, предложить четвертую, предположительно нейтральную и сбалансированную точку зрения на представленные материалы.

INTRODUCTION

Modernization has long been narrated as a historically singular process, often anchored in Western trajectories of scientific rationality, industrial production, and institutional differentiation. Within such accounts, technology appears not merely as a set of tools or infrastructures, but as a formative force shaping social organization, temporal horizons, and normative expectations. Yet in a contemporary world increasingly defined by geopolitical plurality and the uneven circulation of technoscientific capacities, this narrative no longer holds unchallenged authority. Modernization, rather than unfolding along a unified path, emerges as a field of competing interpretations and contested futures.

Across diverse contexts – from China and Russia to India and Brazil – technological development is being pursued through configurations that do not straightforwardly reproduce Western institutional models or normative commitments. These developments invite a reconsideration of a foundational question: to what extent can technological modernization be separated from the cultural, political, and ethical frameworks with which it has historically been entangled? Or does technology itself operate as a carrier of implicit epistemologies and value structures that resist such separation?

This Special Issue takes this tension as its point of departure, and explores technological modernization as a contested and pluralistic process. Rather than treating modernization as a unified trajectory, the articles in this volume examine how technological systems become sites of negotiation – where competing imaginaries, institutional arrangements, and value frameworks are articulated, challenged, and reconfigured, and through which societies define their identities, values, and future orientations.

REFRAMING MODERNIZATION: CONCEPTUAL FOUNDATIONS

The first cluster of contributions reconsiders the conceptual foundations of modernization, challenging linear and universalist accounts.

The results of a wide-ranging interdisciplinary workshop on the topic are surveyed in the opening contribution by Ping Yan, Hui Zhang, and Alfred Nordmann. For its interrogation of established narratives of modernization, the workshop drew for inspiration on the work of Sheila Jasanoff and others, emphasizing sociotechnical imaginaries and the plurality of culturally embedded visions that orient technological development. The analysis foregrounds a central tension: whether technological achievements can be appropriated independently of the epistemic and ethical commitments that have historically sustained them, thereby framing non-Western modernization as a process of selective adaptation and ongoing reinterpretation (Yan et al., 2026, see also Borchert-Wright, 2026).

Alexandra Kazakova, Siyu Wang, and Carl Mitcham approach modernization through the lens of engineering, distinguishing between its analytical and political meanings. By conceptualizing modernization as a form of “social engineering,” they highlight the role of engineers in shaping both infrastructures and institutional arrangements. Their analysis of China illustrates how technological development can be

embedded within distinct philosophical traditions while simultaneously challenging Eurocentric assumptions about engineering and modernization (Kazakova et al., 2026).

The contribution by Svitlana Shcherbak (2026) examines Russian "conservative modernization" as a case in which technological development is articulated within a civilizational framework. By distinguishing between normative visions of the future and descriptive strategies of implementation, this article reveals the coexistence of liberal, conservative, and technocratic elements, showing how modernization becomes a site of political reinterpretation and ideological negotiation.

Together, these contributions establish modernization as an open-ended process shaped by competing imaginaries, institutional configurations, and cultural contexts.

TECHNOLOGY, POWER, AND EPISTEMIC ORDERS

A second group of articles examines how technological modernization reorganizes knowledge and power, particularly in the context of digital technologies.

Elena Seredkina, Guzel Seletkova, and Alexander Mikhailovsky conceptualize large language models as political actors rather than neutral tools. Through comparative analysis, they demonstrate how AI systems reproduce culturally embedded normative orientations, giving rise to distinct "cognitive orders" and challenging assumptions of technological universality (Seredkina et al., 2026).

A complementary study by Khumai Bairamova and colleagues investigates inequalities in speech corpora and linguistic resources. By introducing the "Digital Resource Saturation Index," they show how disparities in data availability constrain technological development and shape the prospects for sovereign AI systems. Their analysis highlights how linguistic inequality reflects structural conditions of governance and institutional coordination rather than purely technical limitations (Bairamova et al., 2026).

Taken together, these contributions demonstrate that technological modernization in the digital age is inseparable from transformations in knowledge production, power structures, and governance.

ECOLOGICAL PERSPECTIVES AND NORMATIVE RECONFIGURATIONS

A third cluster situates modernization within ecological debates, focusing on how different cultural traditions conceptualize the relationship between technological development and nature.

Marina Vasilyeva (2026) offers a comparative analysis of ecological aesthetics in Western and Far Eastern contexts. She contrasts traditions emphasizing individual responsibility and grassroots environmentalism with those that are grounded in philosophies of harmony and often implemented through centralized governance. Her analysis highlights the emergence of hybrid forms of ecological consciousness under global environmental pressures.

Within a specifically Marxist and contemporary Chinese framework, Luyang Ye and Guolin Wu present and discuss a philosophical account of nature's intrinsic value. By proposing a relational theory of value that integrates human and natural creativity, they seek to overcome the divide between anthropocentrism and ecocentrism, articulating a normative basis for aligning technological development with ecological sustainability. Their account is aligned, moreover, with official reasoning within Chinese leadership (Ye & Wu, 2026).

Together, these contributions position ecological concerns as central to contemporary modernization, where universal challenges intersect with culturally specific value frameworks.

PLURAL MODERNITIES AND PERFORMATIVE FUTURES

Two final contributions address the plurality of modernity and the performative role of future-oriented knowledge.

Lisa Borchert-Wright (2026) continues earlier discussions by conceptualizing modernity as inherently plural and context-dependent. She examines how technological artifacts carry values that are reinterpreted across cultural settings, thus highlighting the coexistence of multiple modernities shaped by differing historical and intellectual traditions.

Turning to alternative pathways for the modern world on a global scale, Andreas Brenneis and Jörn Wiengarn finally analyze the performative dimensions of predictive modeling through a comparison of two Club of Rome reports. Introducing the concept of "performative modes," they show how models present orientations and decisions by mobilizing different narrative strategies, from warning to action-oriented hope (Brenneis & Wiengarn, 2026).

TOWARD A PLURAL AND REFLEXIVE UNDERSTANDING

Considered together, the contributions in this Special Issue demonstrate that technological modernization is neither a uniform trajectory nor a purely technical process. It is a contested field in which technological systems, cultural values, political institutions, and ecological considerations intersect.

In a multipolar world, modernization unfolds through diverse yet interconnected pathways. The challenge is no longer whether modernization can occur outside the West, but how its multiple forms can be understood, evaluated, and brought into dialogue.

Accordingly, as guest editors, we did not approach "non-Western modernization" as a settled category, but as an evolving field of inquiry. This Special Issue seeks to bring diverse perspectives into dialogue without presupposing a unified framework or outcome.

Rather than converging toward a single narrative, the contributions reveal a landscape defined by differences and tensions. If twentieth-century modernization was characterized by convergence, contemporary technological modernization may be better understood as differentiation within interdependence. Sustaining dialogue under such

conditions remains a central challenge for future work in philosophy of technology and technology governance.

REFERENCES

Bairamova, K., Gavrilov A., Kharitonova A., & Nikolaev V. (2025). Technological Development Models in the Context of Speech Corpora Imbalance. *Technology and Language, 7*(1), 80-102. https://doi.org/10.48417/technolang.2026.01.06

Borchert-Wright, L. (2026). Modernity As a Conversation – Investigating Chinese Modernity. *Technology and Language, 7*(1), 140-153. https://doi.org/10.48417/technolang.2026.01.09

Brenneis, A., & Wiengarn, J. (2026). Performative Modes of Modeling the Future. A Comparison of Two Club of Rome Reports. *Technology and Language, 7*(1), 154-186. https://doi.org/10.48417/technolang.2026.01.10

Kazakova, A., Wang, S. & Mitcham, C. (2026). Perspectives on Modernization: Nation-State, Engineering, and the Chinese Project. *Technology and Language, 7*(1), 27-41. https://doi.org/10.48417/technolang.2026.01.03

Seredkina, E., Seletkova, G. & Mikhailovsky A. (2026). Large Language Models as Political Actors: Cultural Bias and Epistemic Power. *Technology and Language, 7*(1), 63-79. https://doi.org/10.48417/technolang.2026.01.05

Shcherbak, S. (2026). From Conservative to Technological Modernization: Discourse and Policy. *Technology and Language, 7*(1), 42-62. https://doi.org/10.48417/technolang.2026.01.04

Vasilyeva M. (2026). Ecological Aesthetics and the Ecological Vector of Modernization in the Far East and the Western World. *Technology and Language, 7*(1), 103-120. https://doi.org/10.48417/technolang.2026.01.07

Yan, P., Zhang, H., & Nordmann, A. (2026). Non-Western Modernization? – Technological Development in a Multipolar World, *Technology and Language*, *7*(1), 8-26. https://doi.org/10.48417/technolang.2026.01.02

Ye, L., & Wu, G. (2026). A Philosophical Interpretation of Nature's Intrinsic Value. *Technology and Language, 7*(1), 121-139. https://doi.org/10.48417/technolang.2026.01.08

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Research article

Non-Western Modernization? – Technological Development in a Multipolar World

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Abstract

This article summarizes the findings of an interdisciplinary workshop convened to explore the concept and possibilities of non-Western modernization in today's multipolar world. Bringing together scholars from China, Germany, Denmark, India, Poland, Russia, Sweden, Ukraine, and the United States, the workshop focused on political programs – exemplified by China, Russia, India, and certain Latin American countries – that pursue technological development while embodying diverse approaches to liberal political values. The discussion was framed by Sheila Jasanoff's keynote lecture, which challenged linear, Western-centric narratives of modernity by introducing the concept of "sociotechnical imaginaries" – collectively held visions of desirable futures that shape technological trajectories across different cultural and political contexts. Tracing the evolution of modernization theory from its Cold War origins, where Western institutions served as normative models, to contemporary programs of "technological modernization" that retain technology while stripping away modernity's emancipatory components, the workshop then focused on a central tension: whether technology can be separated from the values historically associated with its development. Participants examined how universal values become branded as "Western," interrogating the counterfactual stances underpinning Enlightenment principles such as tolerance, epistemic humility, and the bracketing of morality in favor of ethics. The discussion further questioned whether these cultivated Western stances can be replaced without abandoning modernity altogether – a question complicated by the recognition that modern science itself presupposes non-dogmatic tolerance. Additional themes included the institutional dimensions of universal values, the relationship between deglobalization and digital sovereignty, and the importance of methodological symmetry – treating legal systems, political institutions, and ideologies as technologies requiring equal analytical attention. The workshop concluded that non-Western modernization involves selective adaptation, ethical negotiation, and strategic reinterpretation rather than wholesale rejection or replication of Western models – pointing toward contested, reflexive pathways into uncertain futures shaped by deep political and cultural differences.

Keywords: Non-Western Modernization; Technological Development; Sociotechnical Imaginaries; Multipolar World Order; Globalization and Deglobalization; Multiple Pathways

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Научная статья

Незападная модернизация? – Технологическое развитие в многополярном мире

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Аннотация
В статье обобщаются результаты междисциплинарного семинара, организованного с целью изучения концепции и возможностей незападной модернизации в современном многополярном мире. Семинар, в котором приняли участие ученые из Китая, Германии, Дании, Индии, Польши, России, Швеции, Украины и США, был посвящен политическим программам (на примере Китая, России, Индии и некоторых стран Латинской Америки), направленным на технологическое развитие и воплощающим различные подходы к либеральным политическим ценностям. Дискуссия завершилась лекцией Шейлы Ясанофф, которая бросила вызов линейным, ориентированным на Запад представлениям о современности, представив концепцию "социотехнического воображения" – коллективного видения желаемого будущего, которое формирует технологические траектории в различных культурных и политических контекстах. Проследив эволюцию теории модернизации от ее истоков во времена холодной войны, когда западные институты служили нормативными моделями, до современных программ "технологической модернизации", которые сохраняют технологии, но лишают их эмансипаторских компонентов, семинар сосредоточился на центральном противоречии: можно ли отделить технологию от ценностей, исторически связанных с ее развитием. Участники обсудили, какие универсальные ценности определяются как "западные", подвергая сомнению противоречивые позиции, лежащие в основе принципов Просвещения, таких как терпимость, эпистемологическое смирение и вынесение морали за скобки в пользу этики. Вопрос, можно ли заменить эти культивируемые западные взгляды без полного отказа от модернизма осложняется признанием того, что современная наука сама по себе предполагает недогматическую терпимость. Были рассмотрены институциональные аспекты универсальных ценностей, взаимосвязь между деглобализацией и цифровым суверенитетом, а также важность методологической симметрии – рассмотрения правовых систем, политических институтов и идеологий как технологий, требующих равного аналитического внимания. В заключение семинара было отмечено, что незападная модернизация предполагает избирательную адаптацию, этические переговоры и стратегическую переинтерпретацию, а не полное отвержение или копирование западных моделей, указывая на спорные, рефлексивные пути в неопределенное будущее, сформированное глубокими политическими и культурными различиями.

Ключевые слова: Незападная модернизация; Технологическое развитие; Социотехнические фантазии; Многополярный мировой порядок; Глобализация и деглобализация; Множественность путей

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INTRODUCTION

To prepare a discussion and to canvas the questions about the very notion and specific possibilities of non-Western modernization an exploratory workshop brought together an interdisciplinary group of discussants from China, Denmark, Germany, India, Poland, Russia, Sweden, Ukraine, and the United States.[3] It set out to discuss the emergence of various political programs of non-Western modernization, launched by Russia, China, India, and certain Latin American countries which emphasize technological development while rejecting or neglecting liberal political values. This situation raises numerous questions, including the history of non-Western countries' acceptance of modernization as a Western project, the universality of liberal values, and the implications of a search for alternative modernities for RRI (Responsible Research and Innovation) or (global) Technology Assessment.

This summary and discussion of the workshop proceeds along the lines of its program, beginning with a keynote lecture, followed by four topical sessions that were dedicated to unstructured conversations.[4] Texts produced as inputs to the discussion are here incorporated with the subsequent exchange of ideas among workshop participants.

CAPITAL SUBJECTS: IMAGINARIES OF PROGRESS IN A GLOBAL WORLD

In her keynote lecture, Sheila Jasanoff challenged the long-standing assumption that modernity follows a singular, Western-led trajectory and argued instead that modernization is constituted through plural, historically situated sociotechnical imaginaries. The lecture began by problematizing "modernity" as a linear or coherent concept. Rather than a universal condition, modernity functions as a temporal and political imaginary through which societies organize expectations about progress, development, and the future (Jasanoff and Kim, 2019, pp. 1-29). These imaginaries are made along with representations, identities, discourses, and institutions, and they are stabilized through infrastructures which shape how time, speed, and desired directions of change are experienced unevenly across different populations and regions. As such, modernization should be understood not as convergence toward a single endpoint, but as a contested process embedded in power relations, culture, and political economy.

[3] The workshop took place in December 2025 at the ITAS (Institute of Technology Assessment and Systens Analysis at Karlsruhe Institute of Technology). It was organized by Armin Grunwald, Alfred Nordmann, and Svitlana Shcherbak, participants included Jascha Bareis, Stefan Böschen, Lisa Borchert, Lars Botin, Christian Büscher, Christopher Coenen, Paulina Dobroc, Lisa Borchert-Wright, Torsten Fleischer, Philipp Frey, Sheila Jasanoff, Aleksandra Kazakova, Arjita Mital, Linda Nierling, Somidh Saha, Hilton Simmet, Lukas Staab, YE Luyang, YAN Ping, and ZHANG Hui.

[4] The workshop was first recorded, and the audio materials then transcribed into preliminary textual form using automated transcription software Otter·AI. These transcripts were subsequently translated into Chinese with the assistance of AI tools (including DeepSeek and ChatGPT) to facilitate comprehension. Based on these materials, key arguments and themes were identified and selected. ChatGPT was further used to assist in organizing, summarizing, and refining the main points of each section, with the selected key arguments continuously fed back into the process. The structure and content of the summaries were iteratively adjusted, drawing also on feedback from workshop participants.

Central to this conception is the notion of sociotechnical imaginaries that are defined as collectively held visions of desirable futures which are enacted both socially and materially. These imaginaries guide technological projects, policy decisions, and governance structures while simultaneously reflecting normative commitments about growth, security, equality, and responsibility. Importantly, such imaginaries are not limited to nation-states but can also emerge within organizations, sectors, and transnational networks.

Through comparative examples, the lecture illustrated how similar technologies can be embedded in radically different imaginaries. Nuclear power, for instance, was embraced in South Korea as a symbol of national progress and global status, while in the United States it became associated with material risks to health and the environment, giving rise to a de facto moratorium in the late 1970s. These differences cannot be explained by technical factors alone but must be understood in relation to distinct historical experiences and future-oriented visions.

The lecture further traced the evolution of technological imaginaries from mid-twentieth-century state-led megaprojects – such as nuclear and renewable energy, space exploration, and the Human Genome Project – to contemporary data-driven and platform-based technologies. Whereas earlier projects emphasized containment, control, and clearly defined endpoints, current technologies thrive on circulation, scalability, and continuous transformation. This shift challenges existing governance models and raises urgent questions about accountability, risk, and democratic oversight.

Jasanoff also critiqued the tendency to treat "the West" as a unified reference point. She demonstrated that Western modernity itself has always been internally diverse, with significant national differences in how technological development, regulation, and ethical responsibility are imagined and practiced. Recognizing this internal plurality is essential for avoiding simplistic binaries between Western and non-Western modernization.

The lecture concluded with a warning against Promethean confidence in technological solutions. In a world marked by capital concentration, weakened state authority, and powerful private actors, modernity no longer guarantees improvement but entails profound uncertainty and risk (Beck et al., 1994, pp. 2-3). The key challenge is not choosing between Western and non-Western models but developing new forms of collective imagination, governance, and responsibility that are capable of addressing collective global futures under conditions of deep political and cultural heterogeneity.

While these qualifications and political differentiations are necessary to avoid stereotyped interpretations, it remains difficult to abandon a general definition of modernization.[5] It would appear that all modernization programs promote ways of overcoming or at least transforming traditional ways of living and thinking. Even as we

[5] What makes it difficult to avoid defining „modernity" or „modernization" as a name of a particular imaginary of progress that is infinitely flexible and subject to locally specific understandings of what constitutes progress? All societies seem to yearn for improvement, and some call it modernization, but does one therefore need a singular definition? Maybe one should abandon „modernization" for other terms that philosophers have already sanctioned, like „flourishing." To the extent, however, that there is an explicit appeal to modernization – as in Xinhua News Agency (2024) – do these appeals not rely on a common referent?

appreciate the political dynamics through which traditions accommodate and absorb modernization processes, the process itself posits a contrast between modernity and traditionalism, and as discussed by Max Weber, it posits as well the progressive development of rationalization or intellectualization (Weber, 1946). In other words, whatever else it may be, there appears to be a pathos of modernization that is driven forward like progressive modern science or Enlightenment and the general advancement of humankind.

This led to queries about the linkage of socio-technical imaginaries of progress to current political and institutional transformations which undercut stories of progressive human Enlightenment. The growing role of large technology companies highlights a deeper reconfiguration of democratic governance, particularly the shifting balance between the public and private sectors and the weakening of institutional checks on executive power. These developments call into question the vantage point of expertise and the authority of the State.

Recent biomedical developments and gender-related technologies further indicate a backlash against universalist Enlightenment imaginaries. Rather than a simple conflict between opposing visions of progress, this backlash is directed against achievements of civil rights and signifies a reconfiguration or restoration of dominant imaginaries such which older logics of order and normalization are reactivated to govern new social claims. This underscores the contested nature of „progress."

Questions about the role of STS emphasized the importance of methodological symmetry. Social change should not be understood as driven solely by technological artifacts; legal systems, political institutions, and ideologies function as technologies as well and require equal analytical attention.

The session also examined future-oriented technological discourse. Claims of inevitability and bold promises were interpreted not as unique distortions, but as long-standing features of scientific and technological imaginaries that mobilize social hopes and anxieties. The analytical task lies in examining how certainty is constructed and what is excluded from particular visions. This involves that the notion of "trusting science" is critically questioned along with the constructions of certainty. If science is not a unified object of trust, but a product of social practices, it calls for critical engagement rather than unconditional trust or rejection.

TECHNOLOGICAL MODERNIZATION IN A MULTIPOLAR WORLD[6]

Modernization theory was formulated in the 1950s. At that time, it defined the "West," especially the USA, as a normative model for non-Western countries. It aimed to find a "recipe" for the former colonies on how to "become modern," which meant emulating Western economic and political institutions. The "present" of the "West," an imaginary utopian and geopolitical construction, was supposed to be the future of the "Rest."

Technology played a central role in modernization as a driver of economic

[6] The following discussion was prepared by Svitlana Shcherbak.

development (industrialization), which was supposed to create prerequisites for democratic transition. Modernization theory was based on the hypothesis of modernization as formulated by Seymour Martin Lipset (1959). It claimed that economic growth would enable the development of human capital and the emergence of a new social structure too complex for authoritarian regimes to manage. As a result, at a certain point, dictatorship gets replaced by democracy. Put differently, the hypothesis of modernization postulated a profound causal connection between technological development and human emancipation.

The 1990s revived the discourse of modernization from the 1950s, with its expectation that the world would steadily and triumphantly proceed on the path of progress toward a free-market economy and liberal democracy (modeled after the USA), as the final stage of modernization (Fukuyama, 1992). "The waves of democratization" were widely discussed, being considered immanent to the historical development of the world. Modernization envisioned a universal normative model for all societies, in which traditional values were expected to be replaced by modern values such as secularism or gender and racial equality. Industrialization was supposed to bring about the most profound structural and value transformations, thereby paving the way for liberal democracy.

Since then, the concept of modernization is still widely present in political discourse, but its meaning has changed. For instance, the Russian program of "conservative modernization," launched in 2009, apparently reshaped the concept of modernization through liberal values by substituting it with a different vision of a "good order." Putin's conservative turn aimed at dismantling the world order formed in the 1990s in favor of a new multipolar world order, focused on national traditions and interests, regional alliances, and coalitions. Other countries, including India, China, Brazil, and South Africa, have followed suit, launching their own programs with a strong focus on economic and technological development.[7] In doing so, they have seemingly replaced liberal values and political ideals with their own visions of "good life."

Such development programs can be roughly referred to as "technological modernization," since they reject the emancipative component of Western modernity. The term "technological modernization" is widely used in industry to describe the process of introducing new technologies across economic sectors to increase productivity and competitiveness. But in non-Western modernization programs, technological development is the only remaining component of the social-developmental program of modernity, stripped of its normative ideals of liberal democracy, personal autonomy, and emancipation. Russia was at the vanguard in linking technology to conservative political ideals, but interestingly the United States did not remain immune.

Donald Trump's return to power in 2025 dramatically intensified "anti-liberal forces seeking to overthrow universalist liberal ideals and replace them with a white, Christian,

[7] To be sure, „modernization" became programmatic in China with Zhou Enlai's 1977 call for „four modernizations" (of agriculture, industry, defense, and science and technology). The modernization-theme thus accompanied the economic „opening" of China and adhered to the popular narrative of „catching up" with the West. Only in the current age of the „new confidences" arose the concept of „Chinese modernization" (China Media Project, 2023, and Xinhua News Agency, 2024).

ethno-religious national identity" (Kagan, 2024). At the same time, Trump launched a program he considers a reindustrialization initiative for the USA, a kind of "nostalgic modernization" aimed at "making America great again." Paradoxically, perhaps, it is steel manufacturing and fossil-fuel based industrial production, not AI, Amazon, or electric vehicles, that in this narrative make America great.

Technological Modernization without Liberal Emancipation

The linear and teleological understanding of modernization relied heavily on a binary distinction between "modern" and "traditional" which enabled narratives of progress but also justified hierarchies between societies. The discussants broadly agreed that this classical model has lost much of its explanatory and normative power. In today's multipolar world, modernization no longer functions as a singular global script. Instead, different countries and regions articulate distinct trajectories that selectively combine technological development with diverse political, cultural, and moral frameworks. Accordingly, the categories „modern" and „traditional" are not descriptive but performative: They do political work by legitimizing certain futures while delegitimizing others.

Also, modernity is not the only axis through which societies organize meaning. Other distinctions are equally consequential such as nature versus culture, natural versus artificial, secular versus religious, individual versus collective. Here as well, Western models of individual autonomy and self-realization should not be assumed as universal aspirations. Examples from India, Japan, and other societies illustrate how technological sophistication can coexist with strong collectivist, familial, or tradition-oriented forms of subjectivity. Indeed, the contemporary backlash against liberal modernity – particularly in Western contexts – may reflect anxiety about a perceived weakness of the democratic process. A yearning for stronger leadership and collective meaning is vaguely associated with visions of progress where less individualism implies greater belonging or care.

At the same time, one needs to question the generalization that non-Western countries such as India, Brazil, South Africa, or China are "omitting democracy" altogether. Drawing on empirical examples – such as India's multi-tier democratic system, the role of digital technologies in reducing corruption, or alternative development models like Kerala's (Parayil, 1996) – participants argued that democracy, political participation, and emancipation take culturally specific forms that cannot be assessed solely against Western liberal benchmarks. In some cases, the organization of elections or fora for public accountability are tokens of a democratic culture that is perhaps „democracy" by name only. This emphasizes the need to distinguish between anti-liberalism and anti-democracy, and to avoid overly homogenizing accounts of "non-Western" modernization.

Technology, Politics, and Social Transformation

Another critical point is the difficulty – if not impossibility – of separating technological modernization from broader social transformations. There are notable historical precedents, including fascist and socialist modernization projects, in which rapid technological advancement was explicitly embraced while liberal or democratic values were rejected. Yet even in such cases, technological change inevitably reshaped

social relations, labor structures, subjectivities, and forms of governance. Technology is neither neutral nor deterministic, transporting values, redistributing power, and reconfiguring social life, regardless of political intent. Rather, it both carries values and can be mobilized to reshape values through new pathways of subject formation.

Inversely, the focus on technology tends to elide from the value commitments of modernization narratives, such as poverty alleviation, education, healthcare, and social security. Arguably, any meaningful understanding of "modernity" must include the capacity of organized societies to safeguard fundamental human needs, rather than focusing narrowly on productivity, innovation, or competitiveness.

By foregrounding key tensions between technology and democracy, universality and plurality, progress and backlash, the discussion underscored that technological modernization in a multipolar world cannot be understood as a linear or uniform process. Modernization appears instead as a contested field of competing political imaginaries, institutional arrangements, and socio-technical alignments. This calls for comparative, historically informed, and symmetrical analysis – one that takes non-Western experiences seriously, avoids normative shortcuts, and remains attentive to how technology, power, and visions of the good life are co-produced (Jasanoff, 2004).

ON THE WESTERNIZATION OF UNIVERSAL VALUES[8]

The project of modernity is rooted in modern science, modern capitalism, and an innerworldly orientation to the here and now. This is the story from Kant to Habermas via Joseph Needham and Max Weber: truth and wealth and happiness are acquired in a methodical (formal, mathematical manner) that compensates the lack of knowledge, certainty, and self-assurance by positing hypotheses, accumulating evidence, and critically reflecting it (Nordmann, in press). The splintered cosmos becomes shot through with general principles as one progressively constructs a universe of laws, systems, rules for human action (markets, laws of nature, principles of justice). In the words of Weber, the modern world is premised on the hypothesis that, in principle, everything can be mastered through calculation – where by „calculation" he means a focus on prediction and technical control (Weber, 1946, p.139). We do not know whether this hypothesis is true but it gives a marching order to reveal its truth. The production of evidence for this hypothesis doubles as our notion of "progress."

The peculiar European flavor of this construction is obvious, perhaps especially its "Faustian" doubt-belief dynamic that is restlessly driven by the absence of certainty as permanent anxiety: do we know enough, have we proven ourselves? And yet, the modern world is emphatically non-parochial but strives to formal universality: markets, laws of nature, as well as human rights, international law, public reason. If Enlightenment principles are shown to have limited scope, exhibit local bias, serve one-sided interests, this would be considered a defect that requires critique. The Enlightenment is emphatically non-parochial also in this: The good life is living in a world that accommodates competing ideas of the "good life."

[8] The following discussion was prepared by Alfred Nordmann.

What then, is going on when universal values are criticized as Western? What is narratively replaced by what when these critics seek to replace, as stated above, "liberal values and political ideals with their own vision of 'good life'"? Perhaps it is too charitable to assume that rebranding universal values as Western values is more than blaming these values for their place of origin, and more than blindly equating claims to universality with hegemonial claims to power. But what more is there when certain human rights or international laws are taken to be parochially Western?

According to the "separability assumption" of modern science the modernizing spirit of purification separates the questions of truth or validity from the conditions under which they were formulated (Feyerabend, 1989). Evolutionary theory, for example, is discussed for its universal claims even though it is evidently an offspring of British industrial capitalism (Young, 1971). Inversely, however, regarding "Western Enlightenment values" this separation no longer works when even the general principles that are enshrined in the Universal Declaration of Human Rights are interpreted as expressions of the particular culture in which they originated.

Trying to spell out what more there is to the branding of universal values as „Western," one might turn to the specific construction of the vantage point or position from which human rights, international law, "scientific truths" are posited. This vantage point is attained, after all, through peculiar counterfactual moves similar to the founding myth or conceit of science that "everything can be mastered through calculation." Indeed, the very aspiration towards universality projects a kind of anti-realism in that the universal principle or conceit deliberately disregards its violations. Three aspects of this counterfactual construction might be identified. While each of them yields universality, there is nothing universal to their construction and adoption.

For example, the principle of tolerance states that the good life requires non-interference from and into other conceptions of the good life. Rather than a hard-won posture of passionate restraint, this principle can also be understood as a form of mere indifference that is alien to any culture which does not valorize a carefully cultivated distancing from one's own values and traditions. A version of this argument can be found in Tolstoy's critique of modern science: Science claims to be interested in everything and so it proves to be interested in nothing but itself, thus lacking commitment (Tolstoy, 1904).

For another example, witness ethics (*Sittlichkeit*) bracketing morality. What is meant here can be seen in Kant's Enlightenment argument for the foundation of a United Nations. He imagines a system of international law by which even in a world of devils the nations of that world could live together peacefully (Kant, 1996, p. 335). The envisioned system of law is made for good and bad people alike, disregarding or discounting the specific achievements of countries that are founded upon belief in the goodness of a people grounded in traditional culture and religious belief.

The third example reflects an Enlightenment stance of epistemic humility: We know that the facts of the social world result from the actions of people, individually and collectively. But we do not know whether as individuals and collectives we can deliberately shape or design the future – and yet we must act as if we can create a future according to plan and we must take responsibility for our world as if we created it. Fatalism and cynicism are worked into the fabric of modernity, but the modern spirit

clings desperately to the illusion of human autonomy and sovereignty, to decisionism and voluntarism.

Each of these examples refer to a stance that has been cultivated in the West. If each marks a presupposition that does not travel well, can it be replaced? This question gives rise immediately to a somewhat hypothetical follow-up: The principle of tolerance, for example, may be seen as a sign of moral weakness, lack of commitment, and breeding ground for decadence. So, if we were to rid ourselves of tolerance and endorse instead a substantial value commitment to law and order, are we still talking about modernity and modernization – even when „law and order“ are equipped with advanced surveillance technologies? To be sure, one can tell a story along the lines of Foucault about the progressive modernization of policing, and this would be a story about the sciences of society that allow for more effective forms of profiling and social control. Paradoxically, perhaps, this story takes us full circle back to modern science as the cradle of modernity and modernization, and with modern science we are back to the cultivated epistemic stance of non-dogmatic tolerance which alone gives rise to the very idea that there can be progress in policing. In other words, or so it seems, as one evokes the notion of modernity and human progress, one cannot simply jettison the principle of tolerance.

Calculation, Standardization, Extraction

The subsequent discussion paid attention to how claims of universality are produced, challenged, and repurposed in both Western and non-Western contexts. A central question concerned what is at stake when values such as rationality, progress, equality, or freedom are criticized as “Western.” One does not do justice to such critiques if one reduces them to a simple denunciation of origins or to an automatic equation between universality and hegemonic power. Instead, these critiques must be understood in relation to theories of power, particularly the capacity of institutions to define standards, distribute symbolic and material capital, and legitimize hierarchies. In the contemporary U.S. context, for example, skepticism toward universalism intersects with the rise of identitarian politics, feminist standpoint theory, indigenous knowledge claims, and debates over meritocracy – illustrated by controversies surrounding elite university admissions and the authority to define “neutral” criteria of excellence.

Science and Technology Studies (STS) offers entry-points to such political analysis, for example by examining the role of calculation and standardization in universalizing projects. With Bruno Latour's notion of “centers of calculation” one can see how calculative practices enable knowledge to travel, stabilize, and circulate across space, often privileging certain epistemic forms over others (Latour & Woolgar, 2013, p. 51). Calculation thus appears not as a neutral technique, but as an expansionist and normative practice that renders diverse social worlds commensurable under universal rules – whether in markets, governance, or science.

With reference to the opening lecture one can further understand that universalization often entails extraction – of data, craft knowledge, or cultural forms. This becomes evident in the many examples of intellectual and cultural appropriation, such as the commodification of traditional designs by global fashion brands. These cases reveal competing ontologies of knowledge with communal, intergenerational practices at one

end of the spectrum, and proprietary, market-oriented logics at the other end. Accordingly, so-called resistance to universal values often comes to take the form of resistance to particular modes of standardization and circulation.[9]

Institutions

One cannot exclude from consideration also the institutional dimension of universal values. Western modernity spread globally not only through ideas but through institutional forms such as the nation-state, capitalism, legal systems and the rule of law, and democracy. All of these have been adopted worldwide but transformed in locally specific ways. One should therefore tend not only to the varieties of modernization but just the same to varieties of capitalism or varieties of calculation. This shows how universal values are enacted through plural, culturally embedded institutional arrangements rather than through uniform replication.

Historical examples from India, particularly the nineteenth-century Bengal Renaissance, complicated narratives of Western imposition. Here, reforms such as widow remarriage mobilized overlapping but not identical value frameworks: internal ethical concerns, colonial legal instruments, and global discourses of progress converged with local ideas of emancipation without collapsing into a single singular "Western" logic. Such cases can be analyzed with the concept of boundary objects (Star & Griesemer, 1989) and political "opportunity structures" (Tarrow, 2022) whereby different actors align around shared practices while attributing divergent meanings to them.

Shared practices with divergent meanings have always been a feature of Western notions of modernity, as demonstrated by comparative work in STS, but these fissures have spilled into the open as universal liberal values are increasingly contested: How can any society appropriate or mobilize such values when their normative authority is destabilized at the outset. Today, one might contrast liberal universalism with emerging claims of a "conservative international," in which traditionalist values are themselves framed as universal and are then mobilized transnationally against progressive liberalism (for the case of Russia, see Shcherbak, 2026).

Some might finally wish to question whether it remains analytically productive to speak of "universal values" at all, or whether it is more useful to focus on visions of the good life, power-laden technologies, and historically situated practices constituting diverse, and competing, sociotechnical imaginaries. The presumed universalism of human values is undermined by a fundamental tension in modern Enlightenment discourse: Modernization rhetoric often invokes freedom and emancipation, but its practices frequently rely on authoritarian structures, extractive economies, and technocratic governance. Technological development does not inherently produce liberalization. Instead, technologies are repeatedly reinterpreted and aligned with divergent political projects, including conservative and authoritarian ones.

[9] Perhaps it is more salient here that alleged universal values such as GDP and economic growth mask inequalities of distribution, such as by giving intellectual property rights to the commercial manufacturers but not to communities of craftspeople? Resistance to the universalisms is an expression then of political pushback.

TRAVEL COMPANIONS: MODERN TECHNOLOGY AND WESTERN VALUES[10]

The discussion above of technological modernization presented the conclusion that "in non-Western modernization programs, technological development is the only remaining component of the social-developmental program of modernity, stripped of its normative ideals of liberal democracy, personal autonomy, and emancipation." However, any such separating-out of spheres raises suspicion: According to Science and Technology Studies (STS) material artefacts can function as Trojan Horses that – along with promises of universal betterment – transport patterns of use, structures of power, logics of supply chains, and ideological constructions of users, buyers, divisions of labor, and hierarchical orderings. But it is not evident how this insight proves salient for the discussion of technologies in a multipolar world:

> Even in the recent past, a globalized world was often confronted with the hegemonic expansion of Western technologies in which all new gadgets and programs seemed to come from the country of Hollywood and McDonalds. In contrast, AI takes shape in the multipolar world of TikTok and X, ChatGPT and DeepSeek, Apple and Huawei, WeChat and WhatsApp, Tesla and BYD. This is a world of social media platforms under suspicion, blocked here, allowed there, a world where chip manufacturing sometimes includes malicious capabilities, a world of export and import controls, of different privacy policies and ecological costs for browsers and their search engines. (Wang et al., in press)

There are four different ways in which the diffusion of (Western) technologies comes with a diffusion of (Western) values: The first story is that of consumer products which promote the construction of the sovereign consumer-subject: As they are buying into the life-style that has been associated with a product, consumers are individuals who create themselves as products of their purchasing choices. To become a consumer in a global economy is not per se a political act, and yet it undermines cultural traditions and political ideologies. Inversely, and perhaps paradoxically, (Western) cultural attitudes are imported along with the goods, even if these are produced in China or India. – This story about consumption might be adapted to manufacturing technologies such as the assembly line, and it can be excavated as well from critical infrastructure design.

The second story is that of technological competence geared towards the advancement of state politics, such as surveillance technologies, public and personal data management – here, we might say that many countries are now buying into Chinese governance models. This would then be a story about „Chinese modernization" undermining modern Enlightenment values.

A third kind of story revolves around the sustainability transition, as articulated especially in renewable energy projects. China, with or without liberalism, provides an example by featuring solar energy and the idea of sustainable modernization built around renewable energies. This model of sustainability as renewable energy transition has been exported across the developed and developing worlds (Jasanoff and Simmet, 2021; see

[10] The following discussion was prepared by Alfred Nordmann.

also Simmet, 2018). Yet the rise of solar power plants in national and international development policies posits a notion of sustainability and the "good life" that may not be sensitive to local distributional issues, such as conflicting patterns of land use (Jasanoff and Simmet, 2021).

In contrast to the previous three, the fourth story is one of surrender to the mimetic force of technologies – also a surrender to whatever values are transported by a technical system or device. National capacities are utilized not to develop alternatives but simply to create the same products again and again as rails for global capitalists to travel on. For example, the user interfaces of smartphones, tablets, desktop computers look increasingly alike, independently of who produces them or where. Digital interactions thus become standardized at a time that would benefit from a proliferation of perspectives. One kind of testimony to this trend is the fact that censored or sanctioned products are replaced by near clones. If a famous US brand is no longer available, a local brand will imitate it rather than create a meaningful alternative: The disappearance of a dominant foreign brand is seen as a loss and not as an opportunity, perhaps because the globalized commodity signified that the modern consumer society had arrived.

As for these four stories (and others), how well do they describe what is actually going in countries that seek to modernize? And if technology always transports implicit values, one might investigate where this is explicitly utilized today as it was, for example, in the Soviet Union or the GDR for the design of household appliances. And for all such ways of interacting with the value-ladenness of technology – to what extent do these promote modernization programs, survival programs, or governance programs?

These questions place Chinese and Russian, Indian and Brazilian modernization in the wider context of so-called second or reflexive modernity (Beck, 1992, Giddens, 1990, Lash et al., 1995). It begins by acknowledging firstly that modern technologies and modernization originate in the Western "modern world" with its „modern science" and that this Western project has spread hegemonically throughout the world. It acknowledges secondly that the pervasive transformative effects of modernization include resource depletion, environmental degradation, alienation and economic injustice – effects that are reflected in the West and all the countries in the grip of modernization. Second modernity is thus a reflexive modernity, preserving its political, cultural, economic, and technological achievements while seeking to ameliorate the damages inflicted by first modernity. In non-Western countries, similarly, we see the Western modernization project taken up and modified, adapted to the requirements of the future. This would mean that by dissociating oneself from first or original modernity one can take technological modernization out of "the West," but – with reflexive modernity seeking to repair the original project – one cannot take "the West" out of technological modernization.

Historical Process and Future Aspiration

With these considerations, the discussion shifts the focus from abstract models of modernization toward concrete political, ethical, and infrastructural dynamics, with particular attention to Chinese, Russian, and comparative non-Western perspectives. A central theme was that non-Western modernization should be understood as a strategic and political project rather than a simple transfer of Western norms. Technological

development was repeatedly described as state-driven, security-oriented, and closely linked to concerns over territorial integrity, sovereignty, and infrastructural cohesion – especially in large, heterogeneously constituted states. Modernization in this sense was framed not primarily as cultural convergence, but as the construction of national capacities through localized technological systems.

This also suggests that modernization is experienced differently at the level of everyday life. Rather than being understood as a historical stage, modernization was described as an aspiration toward a "better life," materialized in concrete improvements to living conditions, governance capacity, and social stability. From this perspective, modernization functions as a future-oriented goal rather than a retrospective narrative. This framing highlighted the importance of contextual meanings and cautioned against treating modernization as a uniform process.

Ethical governance of emerging technologies served as a major axis of discussion. Case-based reflections on biotechnology and artificial intelligence illustrated how technological crises can expose regulatory gaps while simultaneously catalyzing rapid institutional learning. Rather than indicating the absence of ethical reflection, these cases were presented as evidence of reflexive modernization in which societies respond to unintended consequences by strengthening governance frameworks, expanding stakeholder participation, and integrating ethical considerations into technological design and education. Digital platforms, surveillance systems, and data infrastructures thus become examples of material artifacts that embed specific models of governance, subjectivity, and social order. In a technologically multipolar world, where innovation no longer flows from a single Western center, value-laden technological systems now circulate in multiple directions, creating new forms of dependency, competition, and influence.

Alternative Modernities

Comparative perspectives highlight significant variation in state–technology relations. In some contexts, strong state control over digital infrastructures leads to centralized governance, censorship, and surveillance. In others, powerful technology corporations increasingly assume roles traditionally associated with the state, particularly in the provision of critical infrastructures, the privatization of public services, or the appropriation of policing functions and the public sphere. These dynamics complicate simple distinctions between "state-led" and "market-driven" modernization and point to new sites or emergent political struggle over technological power.

A recurring concern was that broad narratives of alternative modernities risk becoming empty unless grounded in concrete cases. Participants called for closer attention to regulatory regimes, production systems, and economic infrastructures – the often-invisible foundations shaping technological development. Surveillance, while politically salient, was described as only one surface manifestation of deeper transformations occurring in manufacturing, services, and digital platforms that structure contemporary social life.

Modern technologies cannot travel alone. Even in a multipolar world, they advance globalization and continue to transport values, institutional logics, and political

imaginaries. Non-Western modernization does not simply reject Western models, nor does it replicate them wholesale. Instead, it involves selective adaptation, ethical negotiation, and strategic reinterpretation shaped by national narratives, governance capacities, and global challenges. Modernization has thus emerged not as a single trajectory, but as a set of contested, reflexive, and politically charged pathways into uncertain futures.

(DE)GLOBALIZATION BETWEEN PLANETARY RISKS AND ENTREPENEURIAL HEGEMONIALISM[11]

The question of deglobalization has been broadly discussed at least since the radical disruption of the established international order in 2022. The topic remains relevant because global trade, investment flows, and geopolitical alignments are undergoing visible shifts, with protectionism, reshoring, and industrial policies reshaping the international order. Nations are actively bringing supply chains closer to home or to trusted allies, especially in critical sectors like semiconductors. Although global trade flows have not been significantly reduced, the logic of globalization – interdependence, open markets, and peace – is being questioned. Deglobalization is not just about economics – it intersects with security, technology, climate policy, and inequality.

One way in which the focus has shifted is in respect to political imagination, driven by far-right populists in the USA, the EU, and also in Russia, where The Conception of the Foreign Policy of the Russian Federation (https://www.mid.ru/ru/detail-material-page/1860586/) was adopted in March 2023. There, Russia was unequivocally defined as a conservative, technologically oriented sovereign state in contrast to the West. Russia aspires to be the vanguard of the global anti-colonial movement, appropriating parts of the Soviet legacy but reformulating them in terms of civilizational identity (Shcherbak, 2026). Russian "anti-colonialism" is expressed in conservative rhetoric. It is interesting to see how this is echoed by the recently published US National Security Strategy (NSS), which, in fact, has proclaimed the end of globalism and thus the end of what Pete Hegseth called the "utopian idealism" in International Relations (Hegseth, 2025).

However, deglobalization is not merely a matter of rhetoric and political imagination. In China, globalized infrastructure such as the internet is heavily restricted and recast as a tool heavily controlled by the national government, with 'the great firewall' turning the free flow of information into an incredibly effective method of political control. Russia follows the same path, increasingly seeking control of social networks and private communication, and building a digital 'iron curtain' between itself and the "collective West" to ensure its sovereignty. The attendant question of digital sovereignty has become a pressing concern also in Europe, it is a code-word for the EU or member states taking the process of digital modernization into their own hands.

This situation raises many questions about digital technologies, policy, production, and regulation, as well as concerns about the climate crisis and AI, both of which are of existential importance. In this context, China published a report entitled "China's

[11] The following discussion was prepared by Svitlana Shcherbak.

Modernization: The Way Forward" (2024). It reflects the "Chinese leadership's proposal to the rest of the world." The doctrine of "Chinese-style modernization" emphasizes promoting green, low-carbon modes of production and living, accelerating technological development, and advancing multipolarity and diverse models of sociocultural and political development. At the same time, the idea of "global governance" gains special prominence.

From a non-Western perspective, one might say that modernization „colonizes" the world by insinuating a type of sovereign subjectivity which has been rejected as bourgeois – to be overcome by a proletarian type of modernity that was embodied, for example, in the „New (Soviet) Man. "But the consumerist or bourgeois sovereign subject can also be rejected by conservative populism that propagates national identities rooted in religious traditions. As the Enlightenment subject of a liberal democratic state it can be rejected as well by emphasizing instead the solidarity of a collectivized subject. But all these modes of rejecting the sovereign modern subject are implicated in a *Bildungsprozess* or formative trajectory that advances all humankind in a progressive development towards emancipation, democracy, and liberalism.

The idea of second or reflexive modernity strips from this *Bildungsprozess* the pathos of progress but preserves the modern subject in its democratic culture. Second or reflexive modernization foregrounds learning (*Lernprozesse*) and, as such, it is cautious and reactive. Consumed by the need to remediate the negative „side-effects" of (first) modernization, it nevertheless maintains its confidence (Kurtov, 2023). The ideas behind Chinese modernization and Russian conservative modernization go further in that they reject its supposedly hegemonic liberalism, thus learning to integrate modernization into conceptions that, perhaps, distort it beyond recognition.

Global Perspectives

Rather than treating deglobalization as a singular economic process, the final discussion framed it as a multidimensional transformation that mobilizes political imagination for technological governance, security, climate change, and an ideological realignment of modernization projects.

A central theme was the erosion of the classical globalization narrative, which linked open markets, interdependence, and peace. Recent developments – including military conflicts, the rise of protectionism, industrial reshoring, and strategic trade restrictions – were discussed as symptoms of a broader reconfiguration of the global order. Deglobalization was understood not simply as challenges to free trade, but as a questioning of globalization's normative foundations and promises.

If deglobalization is driven by ideological and civilizational narratives, one such narrative stands out: The appropriation of anti-colonial rhetoric by illiberal and conservative political projects. In this context, modernization is increasingly portrayed not as emancipation but as a form of Western domination that calls for a non-Western response. This reframing enables a rejection of liberal democracy and universalist norms while selectively embracing technological development, often decoupled from questions of social justice and egalitarian ideals. Modernization thus appears as a layered concept that refers to infrastructure, science and technology, political economy, and ideology,

allowing for its reassembly in divergent and sometimes contradictory ways.

Another emerging narrative is that of digital sovereignty as a key dimension of deglobalization. The fragmentation of the global digital space – through national firewalls, state control of platforms, and restrictions on data flows – was discussed as both a response to geopolitical insecurity and a new mode of governance. Digital technologies were repeatedly described as non-neutral, deeply entangled with power, surveillance, and state capacity. These developments raise questions about regulation, production, and ethical responsibility, particularly in relation to artificial intelligence and climate governance.

In contrast to rhetorics of civilizational closure, the discussion also examined alternative modernization narratives that foreground sustainability, low-carbon development, and long-term governance of technological risks. Such approaches were interpreted as signs of reflexive or "second" modernity, in which the goal is no longer unlimited progress but the management of unintended consequences and the stabilization of social and ecological systems. This shift is reflected in changing attitudes toward prosperity and well-being, where maintaining existing standards of life replaces expectations of continual improvement, thus bracketing the forms of governance that were thought to be most conducive for a continual advancement of humankind.

Global governance emerged as a contested but necessary horizon. While skepticism was expressed toward universal regulatory regimes in a fragmented geopolitical landscape, participants highlighted the potential of regional leadership, regulatory exemplars, and plural pathways to shape global standards indirectly. The discussion stressed that governance challenges posed by climate change and emerging technologies are fundamentally shared human problems, cutting across national and ideological divisions.

Finally, the workshop discussion underscored the importance of empirical and everyday perspectives – such as infrastructure, consumption patterns, and material culture – for understanding modernization. It advocated comparative, historically informed, and reflexive research into modernization imaginaries, technological visions, and their political consequences in a multipolar world.

REFERENCES

Beck, U. (1992). *Risk Society: Towards a New Modernity.* Sage.

Beck, U., Giddens, A. and Lash, S. (1994). *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*. Stanford University Press.

China Media Project. (2023, May 12). Chinese-Style Modernization. *China Media Project*. https://chinamediaproject.org/the_ccp_dictionary/chinese-style-modernization/

Feyerabend, P. (1989). Realism and the Historicity of Knowledge. *The Journal of Philosophy*, *86*(8), 393–406. https://doi.org/10.2307/2026649

Fukuyama, F. (1992). *The End of History and the Last Man.* The Free Press.

Giddens, A. (1990). *The Consequences of Modernity*. Polity Press.

Hegseth, P. (2025, Dec. 6). Keynote Address at Reagan National Forum. *LiveNOW from FOX*. www.youtube.com/watch?v=tyuISf1xYX4

Jasanoff, S. (Ed.) (2004) *States of Knowledge: The Co-Production of Science and the Social Order*, Routledge.

Jasanoff, S. & Kim, S-H. (Eds.) (2019). *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power*. University of Chicago Press.

Jasanoff, S. & Simmet, H.R. (2021). Renewing the future: Excluded imaginaries in the global energy transition, *Energy Research & Social Science*, *80*, 102205. https://doi.org/10.1016/j.erss.2021.102205

Kagan, R. (2024). *Rebellion: How Antiliberalism Is Tearing America Apart–Again*. Knopf.

Kant, I. (1996). *Practical Philosophy*. Cambridge University Press.

Kurtov, M. (2023). Russia and Europe: The Culture of Breakages and the Culture of Repairs, *Technology and Language*, *4*(2), 116-127, https://doi.org/10.48417/technolang.2023.02.11

Lash, S., Wynne, B. & Szerszynski, B. (1995). *Risk, Environment and Modernity: Towards a New Ecology*. Sage Publications.

Latour, B., & Woolgar, S. (2013). *Laboratory Life: The Construction of Scientific Facts*. Princeton University Press.

Lipset, S.M. (1959). Some Social Requisites of Democracy: Economic Development and Political Legitimacy. *American Political Science Review*, *53*(1), 69–105. https://doi.org/10.2307/1951731

Nordmann, A. (in press). Technology, Science, and Modernization: Progressive Tales and Modern Myths. In L. Checketts (Ed.) *What Went Wrong with the West: Carl Mitcham's Critique of Western Philosophy of Technology*. Springer.

Parayil, G. (1996). The 'Kerala Model' of Development: Development and Sustainability in the Third World. *Third World Quarterly*, *17*(5), 941–958. https://doi.org/10.1080/01436599615191

Shcherbak, S. (2026). From Conservative to Technological Modernization: Discourse and Policy. *Technology and Language,* *7*(1), 42-62. https://doi.org/10.48417/technolang.2026.01.04

Simmet, H.R. (2018). 'Lighting a Dark Continent': Imaginaries of Energy Transition in Senegal. *Energy Research & Social Science*, *40*, 71–81.

Star, S.L. & Griesemer. J. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420. https://doi.org/10.1007/978-3-031-84609-0_8

Tarrow, S. (2022). *Power in Movement*. Cambridge University Press.

Tolstoy, L. (1904). *Essays and Letters* (pp. 219–235) (A. Maude, Trans.). Funk and Wagnalls.

Wang, G., Mitcham, C., and Nordmann, A. (in press). Introduction. In G. Wang, C. Mitcham, & A. Nordmann (Eds.), *AI Ethics: A Cross-Cultural Dialogues.* Springer.

Weber, M. (1946). Science as a Vocation. In *Science and the Quest for Reality* (pp. 382-394). Palgrave Macmillan.

Xinhua News Agency (2024, May 4) *Chinese Modernization: The Way Forward*. https://english.news.cn/20240504/ae50c03d5f544ae8a651f146c08e5be9/c.html

Young, R. (1971) Darwin's Metaphor: Does Nature Select? *The Monist, 55*(3), 442-503.

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Research article

Perspectives on Modernization: Nation-State, Engineering, and the Chinese Project

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Abstract

The term "modernization" carries two distinct meanings that are often conflated: an analytical concept in Western social sciences describing the historical emergence of modernity, and a political project of national development in non-Western countries. This paper connects these meanings through a single overarching theme: the role of engineering and engineers in modernization processes. The first section sketches a sociological debate on modernity, technology, and nationalism. It traces the evolution from the universalist theories of modernization and their critique to contemporary concepts of multiple and reflexive modernities. The second section examines historical studies of engineers as both subjects and objects of national modernization policies, with a focus on their role in sociomaterial transformations, underlying state-building and expansionism. Drawing on comparative historiography, it analyzes patterns across the first-wave to the "catching-up" modernization scenarios. The third section takes China as exemplifying a distinctive catching-up approach and postulates a philosophical interpretation of modernization as social engineering, arguing for the need to overcome a narrow, Eurocentric understanding of engineering itself. This framework synthesizes Western critical theory with Chinese philosophy of engineering to envision a hypothetical emancipatory path for twenty-first century modernization. This hypothetical imaginary constructs a perspective on modernization as a creative, reflexive, and participatory process of constructing the social world, where humans remain the subjects rather than objects of progress.

Keywords: Philosophy of engineering; Theory of modernization; Critical theory; National modernization; Social engineering; Globalization.

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Научная статья

Перспективы модернизации: национальное государство, инженерная деятельность и китайский проект

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Аннотация
Термин “модернизация” используется в двух, зачастую смешиваемых, значениях: как аналитическая категория западной социальной науки, описывающая историческое возникновение обществ модерна (современности), и как политический проект национального развития в незападных странах. В данной работе эти значения связаны сквозной темой: роли инженерии и инженеров в процессах модернизации. В первом разделе очерчивается социологический дискурс о связи модерна (современности), технологий и национализма. В нем прослеживается эволюция от универсалистских теорий модернизации и их критики к современным концепциям множественной и рефлексивной модернизации. Второй раздел посвящен историческим исследованиям инженеров как субъектов и объектов национальной модернизационной политики, с акцентом на их роли в социоматериальных трансформациях, лежащих в основе государственного строительства и экспансии. В нем сравниваются сценарии “первого эшелона” и “догоняющей” модернизации. Третий раздел рассматривает Китай как пример особого подхода к догоняющему развитию и предлагает философскую интерпретацию модернизации как социальной инженерии, аргументируя необходимость преодоления узкого, евроцентричного понимания самой инженерии. Китайская философия инженерии (“гунчэн”) синтезирует западную критическую теорию с китайской философией техники, сохраняя гипотезу о возможности эмансипационного пути модернизации в XXI веке. Это взгляд на модернизацию как на творческий, рефлексивный и партисипаторный процесс конструирования социального мира, в котором человек остается субъектом, а не объектом прогресса.

Ключевые слова: Философия инженерной деятельности; Теория модернизации; Критическая теория; Национальная модернизация; Социальная инженерия; Глобализация

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INTRODUCTION

The visions and politics of globalism that were dominating after the end of the Cold War have been challenged in recent decades with the formation of new blocs and the rise of the Global South. The discourse on technological sovereignty, nationalism and militarization has emerged against the ongoing globalization of markets and media, cultural and technological deterritorialisation and massive migration. Citizenship regimes are contested by supra- and sub-national identities, networks and lifestyles, and states compete with transnational and non-state actors in efforts to control the flows of peoples, technologies, ideas, information, capital, resources, and waste. While possessing the greatest technological means, nation-states are facing their most significant constraints since the emergence of this institution.

The problems states face in the social organization and the distribution of agency are both theoretical and practical. The future of governments largely depends on their capacity for anticipating and designing social processes without evoking backlashes and their abilities to keep up with "reflexivity" of modernity (Beck et al., 1994). Insofar as modernization is considered an ongoing process, it is inextricably linked to engineering: both historically (the revolutionizing of productive forces) and metaphorically (social experimentation and rationalization). Our ambition here is not so much to create a wholly new theory of modernization as simply to reconstruct developmentalist discourse around one theme: engineering as a modernization project, and engineers as agents of modernization. The first section of our argument sketches the sociological debate on the relationship between modernization, technology and nationalism. The second considers historical studies of engineers as subjects and objects of national modernization policies. Finally, turning to the contemporary Chinese context and drawing on Li Bocong's philosophy of engineering, section three criticizes Western critical social theory and hypothesizes a Marxist-humanist imaginary of modernization as social engineering with the potential to overcome contradictions.

MODERNITY, TECHNOLOGY, AND NATION

The idea of social development was – and largely remains – the basic assumption of modernity, one of the core categories of social sciences and political ideologies, a cognitive scheme and a self-fulfilling prophecy. The perception of development as both explanation for social reality and a possibility for its construction is associated with the secular understanding of society and history, as well as with capitalism's expansive and innovative orientation, complemented with the elements of religious or utopian visions of transcendence and liberation. In modern social and political thought, whether evolutionary or revolutionary, development is both the goal and simultaneously the means of achieving this goal. The definitions of social development, then, are based on explicit or implicit assumptions of what are the possible and desirable social changes, and re-interpreted from the different historical standpoints. Conceptualizing modernization in terms of social developments occurring during the past five centuries at various pace and in diverse forms globally requires reflection on the descriptive and normative elements of our socio-political thinking.

The notion of modernization is defined differently in the disciplinary contexts of history and sociology and performs a special function in political projects and policies that appeal to national imagination or memory. In historical studies, the concept of modernization served primarily for periodization and played a more descriptive role, narrating the cause-effect explanations and documenting the empirical diversity of national paths, including the non-Western "catching-up" efforts in Russia, Japan, Turkey, et al. Sociology, emerging itself as a form of self-reflection of modern societies, was for a long time aimed at developing models or "ideal types" of modernization. Even before the term was introduced, the classical social theorists of the "long nineteenth century" – August Comte, Karl Marx, Herbert Spencer, Emile Durkheim, Max Weber, and Ferdinand Toennis – attempted to explain what was happening in the West, and tended to see it as a general theory of social development.

The most influential theories of modernization of the twentieth century by Talcott Parsons (1951) and Walt Rostow (1960) were articulated in the context of decolonization and formation of new nation-states outside a Euro-American center, where they were then tested in the political practice of national elites – depending, imitating, or opposing themselves to "the West" (Varouxakis, 2025) – in competition with Marxist progressivism and Soviet influence (Gilman, 2003). At the same time, universalist modernization theories were challenged by the historical comparisons (Bendix, 1964; Moore, 1966) and the critiques of Eurocentrism and methodological nationalism (Prebisch, 1950; Frank, 1966). In the late XX century, socio-historical scholars developed nuanced concepts of "multiple modernities" (Eisenstadt, 2002), and placed nation-states within a wider context of the modern world system (Wallerstein, 2004). Focusing on the present, the concepts of "late," "radical," "reflexive," "unfinished," or "liquid" modernity were developed (Habermas, 1981; Giddens, 1990; Beck, 1992; Appadurai, 1996; Bauman, 2000), where modernization was interpreted as an ongoing process, or, rather, as various uneven trends occurring at different levels, rather than the teleological approximation of an "end of history."

Whereas historically in the West national developmentalist policies took shape in conjunction with specific ideologies such as liberalism, socialism, nationalism, imperialism, conservatism, fascism, in non-Western state-led, top-down reform programs"modernization" has become an explicit objective and official term. Modernization has itself become an ideology. But as both theoretical category and political term, the concept of modernization becomes subject to internal oppositions between the "traditional" and "modern" stages, between "the West" and "the Rest", and between the nation-state and its "environment". The later is seen as presenting potential serious threats but also most importantly as a stimulus for the innovation or adoption of new technologies and institutional models. In a historical perspective, this aspect is challenging for both "methodological nationalism" and its critique (Chernillo, 2011).

The first wave of modernization developed a variety of technological and institutional innovations in the context of wars among the Western nations. From the formation of parliaments and scientific academies to industrialization of war, technologies and institutions were invented and "travelled" first within Europe itself and then to colonized countries, fueled by the imperialist competition and national liberation

movements. However, institutional and especially technological transfer received more focused attention in the histories of non-Western modernizations, which emphasize "skipping," "compression," great leaps across stages. Since science and technology are perceived as "universal" and potentially importable, the projects of mobilized modernization that aimed for sovereignty and welfare (with or without cultural Westernization) largely relied on borrowing and subsequent development of a scientific and technological base. The role of governments in the formation of professional engineering is a bright example of nationalist developmentalist policies, allowing for comparisons between the scenarios of modernization.

ENGINEERS IN MODERNIZATION

Within this context of learning, competition, adaptation and localization of science and technology between nations, the formation of the engineering profession implied more than just production or transfer of knowledge. For a long time, engineering embodied techno-progressivist ideals aligned with "national interests" interpreted in terms of economic growth and military dominance. Engineers have been both agents and products of modernization. As a social group, however, engineers were almost unnoticed by classical sociology, despite its interest in industrialization and rationalization – their role overshadowed by the impersonal forces of capitalism, as if science and technology could be directly translated into economic wealth (Kazakova & Gavrilina, 2021). Until the massification of engineering profession and the rise of technocracies in the XX century, the agency of engineers was secondary or associated with scientific and political elites, bureaucracy, and entrepreneurs.

In retrospect, the co-development of engineering and modernization in Europe has been highlighted in historical studies. These have revealed diverse patterns in the formation of engineering science, education and professionalism with regard to the social structural, political, cultural and economic contexts in the Western societies (Meiksins & Smith, 1996; Channell, 2019). The social standing and lifestyles of engineers varied in different industrialization scenarios – statist or capital-driven, national or colonial resources and markets – but the centrality of engineering for industrialization is indubitable.

In the early modern period, engineering was differentiated from architecture and primarily associated with fortifications and military vehicles (Ferguson, 1992) and participated directly in the territorial expansion of early nation-states and the centralization of power and control. Construction of "bridges and roads" (the name of one of the first technical universities in Europe, located in France) ensured connectedness of the territories, the coordination of periphery with the centre, overcoming provincial fragmentation and local identities, and operation of national bureaucracies, armies and markets: literally and metaphorically, nation-building. Engineering of infrastructures and mobilities was the "backbone" of modernization, the socio-material embodiment of the distanciation of social action in time and space (Giddens, 1990), and what Michel Foucault (1991) called the "governmentality" of societies. Similarly, the growing

technologization of maritime fleets – from wood and sails to steel and steam – enhanced and manifested imperialist expansion (Rodger & Buchet, 2017; Marsden & Smith, 2005).

The XVII and XVIII centuries were pivotal for engineering in Europe for linking the rise of professional engineering with Enlightenment, nationalism, and warfare (Verin & Gouzevitch, 2011; Alder, 1997). Professionalization and growing disciplinary specialization of military and civil engineering was a prerequisite for further industrialization. Engineers as a social group personified the "modernizing" transition from ascribed to achieved status, replacing aristocratic privileges with meritocratic prestige through a scientifically-laden education and state service. Engineering for army and government materialized the ideas of knowledge as power: rationality, quantification and control. "Enlightened absolutism" in Europe was strongly promoting engineers through state-organized schools and large-scale infrastructural projects (Gouzevitch, 2011), while politically fragmented states lacked such capacity (De Lorenzo, 2011).

In the European periphery, the mobility of engineers in both directions – recruiting engineers from abroad or sending them for training to the foreign industrial centers – was promoted by governments, aligning national priorities with individual careerism (Cardoso de Matos & Diogo, 2007). Engineers played the role of "linking agents" in the transfer of technology (Anduaga, 2011), not only enacting the formal, decontextualized knowledge of natural and engineering sciences, but localizing "best practices" to specific needs and resources. In the context of Russian statehood, the import of technologies was a systematic policy: from inviting Italian architects in the early Russian Tsardom to the large-scale recruitment of Dutch, German and British engineers by the Russian Empire, training travels, and developing its own technical educational system based on the French and Prussian models (Rieber, 1990; Gouzevitch & Gouzevitch, 2003). For the continental empire of Russia, connecting and integrating remote territories through roads and railways was a centuries-long quest, a condition for further industrialization, and an embodiment of state power (Schenk, 2014). Peter the Great initiated the construction of a maritime fleet as a deliberate catching-up effort in competition with European empires; Russia's loss to Japan in the "opening battle" of the XX century, which was largely determined by Japanese success in the adoption of technology and expertise from Britain, was an immense blow to state authority.

The United States of America in the XIX century, initially relying on both French and British traditions, developed its own practically-oriented engineering education, driven by the market demand and local resources (Kranakis, 1989; Mitcham, 2019). Entrepreneurship played the greatest role in American industrialization even with respect to infrastructures and transportation systems in ways that had no analogies in the "old world" and formed the basis for a distinctive professional culture. Industrialists such as William Sellers who, in alliance with a civil society institution (the Franklin Institute) and private railroad enterprises, stabilized the whole national standardization system, personified this national engineering style (Sinclair, 1969).

The "latecomers" to industrialization enjoyed not only opportunities to skip stages of development but also higher selectivity in available technologies and institutional models. The Ottoman Empire, Japan and China attracted foreign engineers in the XIX-early XX centuries to strengthen national technological sovereignties (Fukasaku, 1992;

Martykanova & Kocaman, 2018; Wu, 2024). In contrast, in colonized countries such as India, metropolitan engineers played the role of maintaining the monopoly of colonial administration on control over economic process, and organization of dissemination of knowledge was to that extent limited (McLeod & Kumar, 1995; Weiler, 1996).

The XX century altered the social position of the engineering profession. With the industrialization of war and formation of the mass societies and regimes, the production of engineering cadres became subject to its own massification, with growing disciplinary specialization and the standardization of education. With the spread of Taylorism and Fordism, the functions of design, planning, management and control over production to a large extent were all delegated to engineers, promoting an ideology and self-identity of technocracy as conceptualized by Thorstein Veblen (1921/2001). In capitalist countries, engineering became a white-collar, middle-class, predominantly male profession. Socialist engineers as a part of "scientific-technological intelligentsia" maintained a culture of state service and were mobilized for large-scale governmental projects. After the influx of Western technologies and organizational practices in the 1920s, and the mobilized industrialization for the World War II, the Soviet Union itself became an exporter of engineering cadres and education: first to China during the 1950s (Zhang et al., 2006), and then to newly independent nations of Asia, Africa and Latin America (Coenen & Kazakova, in press).

During the second half of the century, engineers from the Eastern and Western blocks, personifying the rivalry between a (US-dominated) modernization doctrine and Soviet Marxism, competed for the "hearts and minds" of the Global South (Engerman et al., 2003). Soviet engineers performed their social and geopolitical mission and their "internationalist duty" in large-scale infrastructural projects for developing countries. The spread of Soviet "soft" and "hard" power to the South coincided with the development of Marxist theory of Scientific-Technological Revolution in the 1960-1970s, where engineers were destined to play the role in the acceleration of the productive forces and reducing the wealth gap between industrialized and industrializing countries.

In general, during the Cold War, the global circulation of engineering knowledge was reoriented from the import of Western expertise towards the establishment of national systems of higher technical education based on the growth and internationalization of engineering sciences combined with localization of engineering practices. The adaptation of technologies to the needs and conditions of non-Western countries stimulated "waves" of technological and organizational borrowings and modifications, e.g. from Europe and United States to Soviet Union and from the Soviet Union to China. Engineers became the practitioners and representatives of developmentalist policies and the agents of "technopolitics" (Hecht & Edwards, 2007). The engineering profession became adjunct worldwide to national projects.

CHINESE MODERNIZATION AS AN ENGINEERING PROJECT

Contemporary non-Western modernization is characterized not only by the potential technological leaps and opportunities to alter established institutional models, but also by a temporal compression of socio-technical challenges, as the processes of

industrialization and urbanization occur simultaneously with digitalization, and a demographic transition coincides with the expansion of mass consumerism. Modernization shifts from strictly economic aspects of growth toward social organization and developmental constraints are insufficient for meeting the welfare protection and environmental obligations and concerns of contemporary developing states. Reformist meliorism or "piecemeal engineering" as argued for by Karl Popper (1957) and other liberal critics of the revolutionary or statist projects in the XIX and XX centuries, are often inadequate in the face of contemporary social complexity and risks.

In Western discourse the concepts of "social engineering" and "social technologies" carry negative – manipulative, totalitarian or dystopian – connotations. Reflexive modernization, however, inherently implies a more or less scientifically-grounded form of social design in a broad sense – from pedagogical standards to urban planning, and from biopolitics to environmental programs. As long as nation-states remain the major form of social organization in the world, urgent socio-technical and environmental challenges require some level of efficient responses that build on their agency.

Drawing on Li Bocong's philosophy of engineering (2021), we want to explore how it might be developed into social and political philosophy. For this, the notion of engineering itself should be redefined. According to its Latin etymology, engineering in the Western languages is associated with individual ideas ("ingenuity"), which leads to further oppositions between the subject and objects of knowledge-power, human and nature, intellectual and physical labour, innovation and maintenance. The Chinese term "gongcheng" 工程 has a different etymology associating it with project or construction work. This allows Li Bocong to focus not only on the aspect of design, which is central to Western philosophy of engineering, but to also include the stages of organization, planning, implementation, using and living with artifacts and systems, shifting the perspective towards coordination of collective actions by engineers, management, workers, users, and more. Compared to this extended concept of engineering, modernization can also be seen as a process which combines planning and calculation with social creativity and experimentation, and requires coordination between various actors without suppression of their interests. This understanding is not contradictory to the ideals of "unfinished" or "reflexive" modernity as an open and non-determinist process; it allows maintaining activist and moderately optimistic visions in the face of the multiple crises humanity has brought on itself.

Chinese philosophy of engineering emerged within a Marxist tradition. China was the first nation to synthesize the concept of modernization with Marxism, developing its strategy of "socialist modernization" at both theoretical and political levels. Although the founders of Marxism did not use the term "modernization," they famously captured the disruptive dynamism of the bourgeois and the industrial revolutions in *The Communist Manifesto*: "All that is solid melts into air, all that is holy is profaned, and man is at last compelled to face with sober senses his real conditions of life, and his relations with his kind" (Marx & Engels, 1848/2002, p. 26). Modernization radically breaks down old structures and compels people to actively remake their world, becoming itself a more planned and intentional, human-driven process: an engineering project. From this perspective the object of modernization research becomes the triad of nature, technology

and social organization: a relationship which is itself engineered and dynamic. Human beings transform nature with tools; new tools alter social arrangements; social conflicts and adaptations then reshape how tools are used and nature is exploited. The conflict between the development of productive forces and existing social relations drives social change, and engineering the resolutions for this conflict is a part of modernization.

Through the lens of Marxist philosophy, modernization can be interpreted as engineering with two aspects: (1) the material-technological dimension, in which humans transform nature and produce new wealth; (2) the social-system dimension, in which they consciously design and reform social institutions and relations. In the context of contemporary non-Western modernization, material-technological engineering had to develop, often in parallel, both industrial infrastructure (roads, dams, electrification, production) and digital infrastructure (telecom networks, data centers, satellites), often coordinated by the state or public-private partnerships, and radically transforming the social world within a lifetime of one generation. Likewise, at the level of social-system engineering, non-Western nations not only implemented new institutional governance structures, laws, educational systems, healthcare and welfare programs, but had to tailor them to their demographic and geographic conditions, such as rapid urbanization and, in the post-colonial context, contingently defined national borders.

Before the introduction of the welfare and environmental policies, the first wave of technological modernization in the West was driven primarily by competition and profit. It created, as Marx put it, “wonders” on one side and “misery” on the other. Its machinery embodied what critical social theorists later called “instrumental rationality” towards both nature and the organization of labour: exploitation and domination. Advanced industrialization adopted labour rights and consumerism, yet at the price of new forms of alienation and control in the growing comfort of mass society, which Herbert Marcuse described as “the rational character of its irrationality” (1964, p. 16). The Frankfurt school revealed the dialectical tension of material-technological modernization, which enables human empowerment over nature, while disempowering a human behind the facade of progress.

A later critique of material-technological modernization focused on the production of unforeseen consequences and global risks. Ulrich Beck argued that the distribution of risks in late industrial societies is intersecting with, but cannot be reduced to class inequality within nations. These manufactured risks are not external threats but self-inflicted consequences of modernization’s success: environmental and labour crises, nuclear threat, dislocation of population, etc. The risk society thesis supplements the neo-Marxist critique of instrumental reason with an ecological and safety imperative: that only reflexive modernization, revising and correcting its own techno-material development at both national and global levels, can be sustainable.

In the XX century, both capitalist and socialist states pursued ambitious projects of social engineering to modernize their nations, from the bureaucratic welfare-state planning to the centralized economic plans and mass campaigns of communist revolutions. The underlying idea of what James Scott (1998) termed “high modernist” faith is that society can be designed and managed with the same rational efficiency that engineers apply to machines: traditional social bonds and arrangements are to be replaced

by scientifically informed policies, laws, and organizational forms to create a more advanced society. The powerful unity of market and state, science and technology resulted in what Jürgen Habermas famously described as the colonization of the lifeworld by system imperatives. Although social engineering of modernity is eroding the social bases of freedom and solidarity, Habermas put his hopes in modernity as an "unfinished project," arguing for reviving communicative reason and public discourse about values and goals. He and the other theorists of the "second," "late," "radical," "fluid," and "reflexive" modernity, acknowledging its consequences, are striving to reform it from within, without rejecting modern ideals of reason and progress. With regard to both material and social engineering, the precautionary principle and ethics of responsibility are seen as continuation of the modern program.

Many of these Western critiques ultimately point back to the core issue Marx identified: the contradiction between ever-expanding productive power and the social relations that constrain and distort its use, where decisions are driven by short-term gains and externalized effects. As Marx suggested, resolving the modernity paradoxes would require a social engineering on the grandest scale: replacing capitalism with a freer association. Sublating the contradiction between "economic" and "social" spheres, noted by Habermas, and between the ever-growing needs and environmental constraints globally requires transcendence of partial, limited rationality of earlier modernization(s) as well as critical awareness and radical imagination. This puts a premium on what Beck calls reflexivity and what Marxists might simply call praxis: theory and action continually informed by feedback. Modernization must be treated as a continuous engineering process with built-in self-correction. In the XXI century humanity and its survival more than ever becomes the imaginary of a project for itself and, just as in Li Bocong's expansive understanding of engineering as project, this construction calls for wider participation, beyond political, economic and technocratic elites.

Li Bocong's philosophy recenters modernization on human creativity. He famously proposes to replace René Descartes' dictum "I think, therefore I am" with a new maxim: "I create, therefore I am." As Li argues, the traditional Cartesian focus on knowing subject vs. objectified world is insufficient in the modern era; what is needed is an affirmation of the human as a creative, world-constructing subject. In line with Marx' *Theses on Feuerbach*, human existence finds its fullest meaning not in abstract contemplation alone, but in the active, material creation of a better world. Emancipated by modernization, therefore, our primary identity should be that of creator of reality, not merely detached thinker or passive consumer.

Li Bocong's formulation implicitly asks: What if modernization were driven by human creative empowerment, rather than humans being driven by the autonomous imperatives of technique or capital? In his work on the philosophy of engineering, Li argues that engineering is far more than applied science or technical design; it is a comprehensive human activity that interweaves the material and the social. He emphasizes planning, purpose, and value as fundamental categories: engineering works are done for human purposes and within social constraints, which means questions of ideals, consequences, and responsibilities are intrinsic. In this respect, Li's Marxist-humanist standpoint harmonizes with Western critical theories while adding a

constructive perspective. Rather than merely critiquing the dehumanizing tendencies of instrumental rationality, Li seeks to reorient modernization by affirming creative praxis as the core of human progress. This has practical echoes in movements that emphasize participatory design, appropriate technology, and democratization of innovation, aligning technical advancement with the empowerment of communities.

Li Bocong is a scholar bridging Chinese Marxist thought and Western critical theory, and a life-long witness to Chinese modernization. China's social experimentation in the late XX and early XXI centuries has reaped enormous material gains, but also raised questions about sustainability, inequality, and cultural continuity. Li's philosophy of engineering, grounded in Marxist humanism, emerged as a response to these conditions, focusing on human empowerment, self-realization and transformative work. A key lesson from the Western critique of modernization is the need for reflexivity: modernization has to be self-critical and guided by awareness of its limitations and side-effects. Such a reflexive modernization would prioritize not just expansion but evaluation and adjustment of progress. Equally important is the collaborative and democratic character of any future modernization. This means treating citizens as co-engineers of their social world, not passive subjects of expert plans. In practice, experiments in collaborative governance, community-centered development, and workplace democracy all embody the idea that people should have a say in the modernization processes that affect their lives, which actually increases its adaptability.

In the Marxist-humanist tradition, the ultimate measure of progress is the extent to which individuals become free, creative, and fully developed human beings. This ethos resonates with the concept of human development advanced by thinkers such as Amartya Sen and Martha Nussbaum (1993). An ethical path of modernization would thus integrate principles of social justice, ecological care, and human dignity into the engineering blueprint. It would treat issues like reducing inequality, preserving the environment for future generations, and protecting individual autonomy as central criteria for evaluating progress, on par with traditional metrics like economic growth or technical efficiency.

CONCLUSION

Discourse on modernization has had two faces: one historically descriptive, another for political practice. Neither has thematized the centrality of engineering. To begin to redress this lacuna, we have, first, reviewed an existing sociological debate about modernization, technology, and nationalism and, second, called attention to some limited materials on engineers as subjects and objects of modernization. In a third move, however, we have tried to consider Chinese modernization in the framework of Li Bocong's philosophy of engineering as project as more explicitly placing engineering and engineers at the center of modernization theory and practice. This perspective establishes an opportunity to imagine modernization as a project of emancipation rather than a fate, a vision of development that enlarges human freedom, community, and creativity.

On this hypothesis, historical materialism reminds us that when material conditions and productive forces do not align with production relations, crises ensue. Reflexive modernization, then, becomes a fine tuning or synchronization: updating our institutions

to fit our productive capacities. Modernization as engineering project means jointly tweaking the technical systems and the social systems, e.g., developing the new, innovative forms of welfarism in the light of progressive automation and artificial intelligence. The Marxist-humanist tone that permeates such an analysis insists that humans must remain the subjects, not the objects of a truly emancipative and inclusive modernization for its own viability. Such an engineering outlook potentially combines human agency, collective collaboration, while acknowledging the uncertainties and risks of complex systems that require constant feedback and adaptations. Understanding modernization through the dual lenses of material and social engineering unites the tremendous power of human creativity and the need for caution and guidance by humane values. The engineering project of XXI century, if grounded in critical self-awareness and collaboration, holds the promise of the enlightenment dream without extinguishing the humanistic light that guides it. It is a path where modern society becomes, in effect, an engineered and engineering artwork of the people themselves.

REFERENCES

Alder, K. (1997). *Engineering the Revolution: Arms and Enlightenment in France, 1763-1815*. Princeton University Press.

Anduaga, A. (2011). The Engineer as a "Linking Agent" in International Technology Transfer: The Case of Basque Engineers Trained in Liège. *Engineering Studies, 3*(1), 45–70. https://doi.org/10.1080/19378629.2010.550922

Appadurai, A. (1996). *Modernity at Large: Cultural Dimensions of Globalization*. University of Minnesota Press.

Bauman, Z. (2000). *Liquid Modernity*. Polity Press.

Beck, U. (1992). *Risk Society: Towards a New Modernity* (M. Ritter, Trans.). Sage Publications.

Beck, U., Giddens, A., & Lash, S. (1994). *Reflexive Modernization: Politics, tradition and Aesthetics in the Modern Social Order*. Polity Press.

Bendix, R. (1964). *Nation-building and Citizenship: Studies of our Changing Social Order*. Wiley.

Cardoso de Matos, A., & Diogo, M. P. (2007). Bringing It All Back Home: Portuguese Engineers and Their Travels of Learning (1850-1900). *HoST: Journal of History of Science and Technology, 1*, 155–182.

Channell, D. F. (2019). *The Rise of Engineering Science: How Technology Became Scientific.* Springer Cham. https://doi.org/10.1007/978-3-319-95606-0

Chernilo, D. (2011). The Critique of Methodological Nationalism: Theory and History. *Thesis Eleven*, *106*(1), 98-117. https://doi.org/10.1177/0725513611415789

Coenen, C., & Kazakova, A. (in press). Ex Oriente Progressus? The Soviet Union, between East and West, as the Light of the World. In L. Checketts (Ed.), *What went wrong with the West: Carl Mitcham's critique of Western philosophy of technology.* Springer.

De Lorenzo, R. (2011). Being an Engineer and Being an Architect in Eighteenth-Century Italy: Professional Identity as a Reflection of Political Fragmentation. *Engineering Studies, 3(3),* 171–194. https://doi.org/10.1080/19378629.2011.620616

Eisenstadt, S. N. (Ed.). (2002). *Multiple Modernities*. Transaction Publishers.

Engerman, D. C., Gilman, N., Haefele, M. H., & Latham, M. E. (Eds.). (2003). *Staging Growth: Modernization, Development, and the Global Cold War*. University of Massachusetts Press.

Ferguson, E. S. (1992). *Engineering and the Mind's Eye*. MIT Press.

Foucault, M. (1991). Governmentality. In G. Burchell, C. Gordon, & P. Miller (Eds.), *The Foucault Effect: Studies in Governmentality* (pp. 87–104). University of Chicago Press.

Frank, A. G. (1966). The Development of Underdevelopment. *Monthly Review, 18*(4), 17–31. https://doi.org/10.14452/MR-018-04-1966-08_3

Fukasaku, Y. (1992). *Technology and Industrial Development in Pre-war Japan: Mitsubishi Nagasaki Shipyard, 1884-1934*. Routledge.

Giddens, A. (1990). *The Consequences of Modernity*. Stanford University Press; Polity Press.

Gilman, N. (2003). *Mandarins of the Future: Modernization Theory in Cold War America*. Johns Hopkins University Press.

Gouzévitch, D. Y. (2011). The Rise of State Engineering Administrations in Eighteenth Century Russia. *Engineering Studies, 3*(3), 195–213. https://doi.org/10.1080/19378629.2011.620964

Gouzevitch, I., &Gouzevitch, D. (2003). Travelling Interchanges between the Russian Empire and Western Europe: Travels of Engineers During the First Half of the Nineteenth Century. In A. Simões, A. Carneiro, & M. P. Diogo (Eds.), *Travels of learning: A Geography of Science in Europe* (pp. 213–232). Kluwer Academic Publishers.

Habermas, J. (1981). Modernity versus Postmodernity (S. Benhabib, Trans.). *New German Critique*, *22*, 3–14. https://doi.org/10.2307/487877

Hecht, G., & Edwards, P. N. (2007). *The Technopolitics of Cold War: Toward a Transregional Perspective*. American Historical Association.

Kazakova, A. A., & Gavrilina, E. A. (2021). Engineers in Action: Investigating Collective Agency in Sociology of Engineering. *Sociology of Science and Technology, 12*(1), 101–112. https://doi.org/10.24411/2079-0910-2021-11007

Kranakis, E. (1989). Social Determinants of Engineering Practice: A Comparative View of France and America in the Nineteenth Century. *Social Studies of Science, 19*(1), 5–70. https://doi.org/10.1177/030631289019001001

Li, B. (2021). *An Introduction to the Philosophy of Engineering: I Create, therefore I am*. Springer. https://doi.org/10.1007/978-3-662-64088-3

MacLeod, R., & Kumar, D. (Eds.). (1995). *Technology and the Raj: Western Technology and Technical Transfers to India, 1700-1947*. Sage Publications.

Marcuse, H. (1964). *One-Dimensional Man: Studies in the Ideology of Advanced Industrial Society.* Beacon Press.

Marsden, B., & Smith, C. (2005). *Engineering Empires: A Cultural History of Technology in Nineteenth-Century Britain*. Palgrave Macmillan.
Martykánová, D., & Kocaman, M. (2018). A Land of Opportunities: Foreign Engineers in the Ottoman Empire. In J. Rohbeck, D. Brauer, & C. Roldán (Eds.), *Philosophy of Globalization* (pp. 237–252). De Gruyter. https://doi.org/10.1515/9783110492415-018
Marx, K., & Engels, F. (2002). *The Communist Manifesto*. Lawrence & Wishart. (Original work published 1848)
Meiksins, P., & Smith, C. (Eds.). (1996). *Engineering Labour: Technical Workers in Comparative Perspective*. Verso.
Mitcham, C. (2019). *Steps Toward a Philosophy of Engineering: Historico-philosophical and Critical Essays*. Rowman & Littlefield International.
Moore, B., Jr. (1966). *Social Origins of Dictatorship and Democracy: Lord and Peasant in the Making of the Modern World*. Beacon Press.
Nussbaum, M. C., & Sen, A. (Eds.). (1993). *The Quality of Life*. Oxford University Press.
Parsons, T. (1951). *The Social System*. Free Press.
Popper, K. R. (1957). *The Poverty of Historicism*. Routledge & Kegan Paul.
Prebisch, R. (1950). *The Economic Development of Latin America and Its Principal Problems*. United Nations.
Rieber, A. J. (1990). The Rise of Engineers in Russia. *Cahiers Du Monde Russe et Soviétique*, *31*(4), 539–568.
Rodger, N. & Buchet, C. (2017). *The Sea in History – The Modern World.* Boydell and Boydell and Brewer. https://doi.org/10.1515/9781782049111
Rostow, W. W. (1960). *The Stages of Economic Growth: A Non-communist Manifesto*. Cambridge University Press.
Schenk, F. B. (2014). *Russlands Fahrt in die Moderne: Mobilität und Sozialer Raum im Eisenbahnzeitalter* [Russia's Journey to Modernity: Mobility and Social Space in the Railway Age]. Franz Steiner Verlag.
Scott, J. C. (1998). *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed.* Yale University Press.
Sinclair, B. (1969). The 'Inner Revolution' of the American Engineer: Professionalism and Social Responsibility, 1860-1900. *Technology and Culture, 10*(2), 171–190. https://doi.org/10.2307/3101466
Varouxakis, G. (2025). *The West: The History of an Idea*. Princeton University Press.
Veblen, T. (2001). *The Engineers and the Price System*. Batoche Books. (Original work published 1921)
Vérin, H., & Gouzévitch, I. (2011). The Rise of the Engineering Profession in Eighteenth Century Europe: An Introductory Overview. *Engineering Studies, 3*(3), 153–169. https://doi.org/10.1080/19378629.2011.626051
Wallerstein, I. (2004). *World-systems Analysis: An Introduction*. Duke University Press.
Weiler, J. (1996). Colonial Connections: Royal Engineers and Building Technology Transfer in the Nineteenth Century. *Construction History*, *12*, 3–18.
Wu, L.-C. (2024). Promoting Standardisation in Modern China: British and American Engineers' Organisations, Local Chinese Engineers, and their Transnational Networks,

1901–41. *Journal of the Royal Asiatic Society, 34*(3), 573–589. https://doi.org/10.1017/S1356186323000627

Zhang, J., Zhang, B., & Yao, F. (2006). Technology Transfer from the Soviet Union to the People's Republic of China: 1949-1966. *Comparative Technology Transfer and Society, 4*(2), 105–167. https://doi.org/10.1353/ctt.2006.0024

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Research article

From Conservative to Technological Modernization in Russia: Discourse and Policy

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Abstract

The paper raises the question of how to approach recent non-Western modernization programs, taking the Russian "conservative modernization" program and its transformation through the concept of the state-civilization as a case study. Non-Western modernization is based on the idea that technology, on the one hand, and political institutions and values, on the other, are separable, thereby replacing the latter with another civilizational foundation. This work examines the fusion of technological development and non-Western civilizational foundations as the socio-technical imaginary of "technological modernization." The research question is how this imaginary is constructed and justified, and what it means in practice. The paper consists of three sections: Section 1 offers reflections on the concept of modernization; Section 2 situates the Russian conservative modernization program; and Section 3 examines the concept of Russian state-civilization in the context of "technological modernization." The analysis of the conservative modernization program relies on a normative-descriptive approach to the concept of modernization proposed in the paper. The normative component includes the imagined vision of a "normalized future" and can also be interpreted as a sociotechnical imaginary, since it fuses the vision of the good life with the technological future. The descriptive component refers to the vision of the current situation and the recipe for reaching the desired future. Examining the conservative modernization agenda reveals its ambiguity, which arises from the merging of liberal, conservative, and technocratic rhetoric. Analyzing the concept of state-civilization through the lens of technological development reveals how the state-civilization framework transforms coproduction, as Sheila Jasanoff defines it, by de-universalizing and detaching Western governance forms from Western technology, and by insisting that they are civilizational choices of a particular civilization, imposed globally as if they were universal. The article concludes with examples of how the socio-technical imaginary of "technological modernization" operates in practice.

Keywords: Modernization; Liberalism; Conservatism; Social engineering; De-Westernization

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Научная статья

От консервативной к технологической модернизации в России: Дискурс и политика

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Аннотация

В статье ставится вопрос о том, как подходить к недавним незападным программам модернизации, рассматривая российскую программу “консервативной модернизации” и ее трансформацию через концепцию государства-цивилизации в качестве примера. Незападная модернизация основана на идее о том, что технологии, с одной стороны, и политические институты и ценности, с другой, отделимы друг от друга, тем самым заменяя последние другой цивилизационной основой. В данной работе рассматривается слияние технологического развития и незападных цивилизационных основ как социально-техническое представление о “технологической модернизации”. Вопрос исследования заключается в том, как это представление конструируется и обосновывается, и что оно означает на практике. Статья состоит из трех разделов: в разделе 1 представлены размышления о концепции модернизации; в разделе 2 представлена российская консервативная программа модернизации.; а в разделе 3 рассматривается концепция российского государства-цивилизации в контексте “технологической модернизации”. Анализ консервативной программы модернизации основан на нормативно-описательном подходе к концепции модернизации, предложенном в статье. Нормативный компонент включает в себя воображаемое видение “нормализованного будущего” и также может быть интерпретирован как социотехническое воображение, поскольку он объединяет представление о хорошей жизни с технологическим будущим. Описательный компонент относится к видению текущей ситуации и рецепту достижения желаемого будущего. Изучение консервативной программы модернизации выявляет ее неоднозначность, которая возникает из-за слияния либеральной, консервативной и технократической риторики. Анализ концепции государства-цивилизации через призму технологического развития показывает, как структура государства-цивилизации трансформирует совместное производство, по определению Шейлы Ясанофф, путем деуниверсализации и отделения западных форм управления от западных технологий и настаивания на том, что они являются цивилизационным выбором конкретной цивилизации, навязываемым глобально, как будто они были универсальными. Статья завершается примерами того, как социально-техническое представление о “технологической модернизации” работает на практике.

Ключевые слова: Модернизация; Либерализм; Консерватизм; Социальная инженерия; Девестернизация

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INTRODUCTION

The concepts of modernity and modernization are closely linked to European historical development. Initially, they captured the rapid transformations of European societies during the scientific, industrial, and political revolutions, which changed everything: the way of production, consumption, and living; the way of doing politics; social structure; and human consciousness, as grasped through the notion of "modern man" (Inkeles, 1969). Of course, theories of modernity and modernization are closely intertwined: while theories of modernity, including those of Émile Durkheim, Max Weber, Ferdinand Tönnies, Talcott Parsons, Jürgen Habermas, Anthony Giddens, Ulrich Beck, Antony Giddens, Zygmunt Bauman, and Jean-François Lyotard, sought to reflect on the transformation of Western societies and the internal contradictions of the modern project, theories of modernization aimed to find a "recipe" for non-Western countries to achieve economic growth and social progress. Between the mid-1950s and 1960s, American authors such as Daniel Lerner, Seymour M. Lipset, Neil Smelser, Walt Rostow, David McClelland, Gabriel Almond, and Sydney Verba, formulated the main provisions of modernization theory, against a background of decolonization, the confrontation with the Soviet Union and communist ideology, and the search for new markets for US commodities (Latham, 2000).

The core of these provisions was the "modernization hypothesis," which focused on the empirical mechanisms of modernization. It argued for a causal link between technological and economic development and democratization. This assumption engendered a vast number of empirical studies on the correlation between economic development and democratization (Wucherpfennig & Deutsch, 2009). Although the nature of this correlation has remained unclear, the modernization hypothesis served as an ideological framework that provided the 'scientific' basis for American foreign policy until the late 1990s (Latham, 2000). In fact, the modernization hypothesis was based on the Marxist assumption of the key role of technology and economy in social development, supplemented by a non-Marxist vision of political institutions. It promoted the idea that industrialization and technological innovation would necessarily lead to the replacement of traditional culture with modern rational and secular values, and to the development of democratic political systems and institutions. The constellation of institutions inherent in Western countries, particularly English-speaking Protestant countries, was treated as a normative model, and the belief developed that success in social and economic development could be achieved by exporting the structural conditions of these societies to other countries (Sachsenmaier, 2002).

By the late 1960s, the validity of the core assumptions of modernization theory had been called into question, including a strict opposition between "modern" and "traditional;" the expectations that traditional values and social structures would be replaced; the concepts of growth and progress; and the focus on endogenous factors of development, to name but a few (Tipps, 1973; Knöbl, 2017). In the 1970s, modernization theory finally lost its momentum and relevance, mainly because it no longer fit the context of the economic and political crises that began to unfold in Western countries in the late 1960s (Gilman, 2007).

A new wave of critical reflections on modernity and modernization emerged in the late 1980s and early 1990s, driven by the transformation of Western societies and the end of the communist project. By the early 1980s, Western societies were experiencing deindustrialization, globalization, technological acceleration, environmental crises, individualization, and the collapse of stable class structures (Gilman, 2007). Instead of greater rationality and stability, modernity, as it turned out in the 1980s, has been producing instability, uncertainty, complexity, and new risks. This triggered a wave of theories of "new modernity," such as reflexive modernity, second modernity, liquid modernity, risk society, and postmodernity, which sought to rethink modernity from within. Interestingly, the collapse of the Soviet Bloc seemed to confirm the key assumptions of the modernization hypothesis, leading to its partial revival–parallel to the reconsideration of modernity.

In the 2000s, the theory of multiple modernities was explicitly formulated (Eisenstadt, 2000), marking the next step in rethinking. In recent decades, however, alternative non-Western modernization programs have begun to emerge, starting with Russia's "conservative modernization" launched in 2009. Other countries, including India, China, Brazil, and South Africa, have followed suit, launching their own programs with a strong focus on economic and technological development. In doing so, they have seemingly replaced Western liberal values and political ideals with their own visions of proper social order. These programs transformed the concept of modernization by essentially refusing to follow the "West" further in terms of social and political order. They definitely put an end to the expectations of the overall transition to liberal democracy, formulated by the modernization hypothesis. Liberalism is losing its persuasive power, which has been reflected in the rise of right-wing populism across the globe and a new wave of autocratization." Democracy Report from 2025 laments that "the GDP-weighted level of democracy is far below the 1974-year-level, at its lowest in over 50 years" (Varieties of Democracy Institute, 2025, p. 10).

Trump's return to power in 2025 has significantly amplified anti-liberal trends in the U.S. and around the world, as well as the crisis of the rule-based liberal international order. At the same time, Trump launched a program he considers an initiative to reindustrialize the USA and "make it great again," as well as an initiative to accelerate the development of digital technology, also referred to as "modernization." Therefore, the problem I address in this paper is not merely the rejection of political liberalism but the combination of this trend with technological acceleration. Remarkably, while the modernization hypothesis posited a causal connection between economic development and democratization, emphasizing greater equality in the distribution of wealth as the necessary precondition for democracy (Shcherbak, 2018), the recent modernization programs correlate technological development with the "great power" status. Already in his inaugural speech, Trump interlaces technological development with the vision of the U.S. as "the greatest, most powerful, most respected nation on earth" (Trump, 2025a). But this connection is especially evident in his speech on the signing of the AI Action Plan on July 23, 2025:

> We mastered the Industrial Age, we created the Digital Age, and now we are leading the world into the golden age, indeed, the golden age of America… It will

> be run on American technology, improved by American artificial intelligence. And it will make America richer, stronger, greater, freer, and more powerful than ever before (Trump, 2025b).

For Vladimir Putin, the link between Russia as a great power and its technological advancement plays a no less essential role, starting with his programmatic article *Russia at the Turn of the Millennium*:

> Russia was and will remain a great power. It is preconditioned by the inseparable characteristics of its geopolitical, economic and cultural existence… But Russian mentality should be expanded by new ideas. In the present world, *the might of a country as a great power is manifested more in its ability to be the leader in creating and using advanced technologies* [cursive mine – S.S.], ensuring a high level of people's wellbeing, reliably protecting its security and upholding its national interests in the international arena, than in its military strength. (Putin, 1999)

The vision of Russia as a great power in a multipolar world has been playing a major role in the Russian president's foreign policy discourse, closely entangled with security and sovereignty issues (Tsygankov, 2016; Frear & Mazepus, 2020). "Great power" is used in international relations (IR) and is a relational concept that refers to a state's standing, defined by its position in the hierarchy of other states and by external recognition. In Russian political discourse, "great power" overlaps with the concept of civilization (or a state-civilization), which gained prominence especially after the 2012 presidential election. In 2022, Putin used both terms separated by a comma: "Russia is a great thousand-year-old power, a whole civilization…" (President of the Russian Federation, 2022). In contrast to a great power, a state-civilization is an ontological concept that defines status from within, through a unique civilizational identity that does not require external recognition and cannot be measured by comparison. Put simply, by defining itself as a state-civilization, Russia claims to be a great power, regardless of what others think. Thus, state-civilization develops and bolsters the concept of great powers, shifting the issue of sovereignty to the existential level (Tsygankov, 2016), which is essential to the topic of modernization and technological development.

I am particularly interested in understanding how a state-civilization operates in domestic political discourse, namely as part of a complex sociotechnical imaginary. Cornelius Castoriadis (1975/1998) introduced the concept of the "social imaginary" as a collective horizon of meaning that is neither an ideology, nor a fantasy, nor merely a cognitive construct or description of reality – it is constitutive of social reality. Charles Taylor (2004) developed this into the concept of "modern social imaginaries" as shared images, expectations, and narratives about social existence that are constitutive for modern societies. Sheila Jasanoff translated this into the STS register, linking together material, moral, and social landscapes: "Imaginaries encode not only visions of what is attainable through science and technology but also of how life ought, or ought not, to be lived; in this respect they express a society's shared understandings of good and evil (Jasanoff, 2015, p. 4). Put differently, sociotechnical imaginaries encode visions of a desirable future, referring to collective beliefs about how society functions.

The concept of great power can be considered as an imaginary in Jasanoff's sense, since it presupposes technological advancement as its sine qua non. However, I would sooner shift the focus and view this imaginary through the lens of technological development rather than politics. In the political context, technology functions as a means, an instrument for achieving political purposes – greatness and power. Focusing on technological development prompts us to ask about the normative horizon in which it is embedded. Therefore, I frame the issue in terms of "modernization," thereby raising the question: what vision of the future does technological development rely on, if it is not linked to the emancipatory political ideals of modernity? I will label the sociotechnical imaginary that fuses great power and technological development as "*technological modernization*." This term is widely used in industry to describe the process of introducing new technologies across economic sectors to increase productivity and competitiveness. I will try to demonstrate why this title may be appropriate even when it comes to society as a whole and, in the final section, provide the rationale for this terminological trick. Otherwise, Section 1 offers reflections on the concept of modernization; Section 2 provides a case study of the Russian conservative modernization program; and Section 3 considers the concept of state-civilization Russia as an essential part of the complex sociotechnical imaginary "technological modernization."

MODERNIZATION AS A CONCEPT OF EXPECTATIONS: NORMATIVITY AND THE SEMANTICS OF TIME

The concept of modernization can be attributed to a set of specific historical concepts Reinhart Koselleck calls "concepts of expectations," which shape our horizon for the future. Koselleck coined the categorical couple, "space of experience" and "horizon of expectations" as meta-historical categories indicative of the temporality of human beings and, hence, of history. These two categories are inseparable and presuppose no alternatives: "No expectation without experience, no experience without expectation" (Koselleck, 2004, p. 257). The "horizon of expectation" is defined within the "space of experience," which determines which future possibilities are perceived as feasible and contributes to imagining the future. In modern times, however, a new horizon of expectations emerged due to the rapid pace of change driven by technoscience. It could not be grounded in the present space of experience but rather anticipates an undoubtedly improved, yet unknown, future. Koselleck analyses how this change is captured by the concept of progress, which grasps a cleavage emerging between the past and the future, that means the growing temporal gap between experience and expectations.

Göran Therborn aptly summarized how this semantics of time is regarded by different theorists as a hallmark of modernity:

> Modernity here will be defined culturally, as an epoch turned to the future, conceived as likely to be different from and possibly better than the present and the past. The contrast between the past and the future directs modernity's 'semantics of time' [Niklas Luhmann, *Soziologie des Risikos*], or constitutes its 'binary code'. The present is 'valid only by the potentialities of the future, as the

> matrix of the future' [Renato Poggioli, *The Theory of the Avant-garde*]. The coming of modernity, then, is tantamount to the discovery of the future, of an open, this-worldly future, that is. This discovery is empirically verifiable/falsifiable, with regard to notions of knowledge, of politics and of other social affairs, and of art, for example. As such it is tied in with the rise of the idea of progress and the cumulation of knowledge [David Spadafora, *The Idea of Progress in Eighteenth-Century Britain*], with the Enlightenment, the opening up of a mundane time horizon [Reinhart Kosellek, *Futures Past*] and the heralding of social evolution. It is manifested in the loss of the previous, and etymological, retrospective meanings of the political concepts of reform and revolution, which instead turn into keys to the future. (Therborn, 1995, p.4).

Although the concept of modernization falls under the same category and features the same semantics of time as "progress," it differs in one essential aspect. While "progress" implies the uncertainty of a future detached from the space of experience, "modernization" refers to the empirical image of already modernized societies as the embodiment of the future for others. In this sense, the concept of modernization is more of an engineering nature: while shaping the horizon of expectations, it contains not a vague anticipation of a utopian "improved future," but rather a tangible image and a blueprint. In this way, Western societies become a normative model, playing the role of the City of God incarnate on earth. Back in the 1970s, harsh critics of modernization theory pointed out that "the most important referents of the concept [of modernization] are normative, not empirical," so that "the functions of the concept are primarily ideological," although it is represented as a scientific one (Tipps, 1973, p. 222).

In quite another context, namely the question of what a "problem" is, Jan C. Schmidt explicated the notion of „descriptive-normative hybrids," related to the future-oriented horizon of time. "Modernization" is not tantamount to a "problem," but it can be considered from the same perspective, "as a relation of three elements, which encompass normative and descriptive dimensions": 1) the desired final or ultimate state, which describes what the future should look like; 2) a vision of the present situation, which is qualified as an unsatisfactory and problematic state of affairs; and 3) the steps that need to be taken to transform the present state into the future state (Schmidt, 2021, p. 81). The vision of the current situation and the recipe for reaching the desired future can be considered the descriptive component of the concept; the imagined vision of a "normalized future" is the normative component that provides criteria for assessing the current situation. This structural approach allows us to analyze more rigorously various modernization programs, both Western and non-Western, in comparative and contextual terms. While the normative component refers to sociotechnical imaginaries (Jasanoff, 2015), which blend the vision of the good life with the technological future, the descriptive components capture the experience of those modernized. This approach appears more relevant to the current situation than the classical binary opposition between "modern" and "traditional" societies – not only because the opposition captures neither the complexity of the non-Western world nor the heterogeneity of the West. Analysis of "modernization" as a descriptive-normative hybrid makes visible and accessible both its normative component and its engineering approach to society. It echoes Schmuel

Eisenstadt's interpretation of modern fundamentalist movements as specifically modern, however reactionary they may appear, because they share modern semantic of time, as well as modern social engineering attitude drawn on "the conception of society as an object of active construction by human beings which can be remolded above all by future-oriented political action" (Eisenstadt, 1999, p. 42).

European and American intellectuals have spent many years cataloging the main traits of modern societies and seeking an encompassing definition of modernization. The key question they were supposed to answer was "What made the West different?" (Gilman, 2007, p. 76). As Jürgen Habermas (1987, p. 2) observed, the modernization theorists separated the concept of modernity from its origins as a description of a specific period of European history and "stylized it into a spatiotemporally neutral model for the process of social development in general." This resulted in constructing "the West" as a geopolitical imaginary that blended actual institutional transformations of Western societies over a specific historical period with an idealized image of "the West" as the authentic embodiment of the best promises of modernity. However, the model of the West reflected not reality but its own idealized vision – in the 1950s, it was "what postwar American liberals wished their countries to be" (Gilman, 2007, p. 3).

This model also shaped the perception of modernizing countries, for whom the imaginary construct of the "West" served as a normative exemplar. This is especially true of ex-communist countries, which found themselves after the collapse of the Soviet bloc in a gap between Soviet and Western modernity. In the public discussions of the 1990s, the expectations of "normalization" prevailed (Krastev & Holms, 2019), not least because, in the imagination of the future, the communist utopia was substituted by the tangible empirical image of the West as a model of normality. Imagining the future in terms of catch-up modernization became dominant. It was both a utopian and geopolitical construction that presupposed that the present of the West would be the future of the Rest, so that emulation of the normative model by imitation has become an imperative of modernization (Krastev & Holms, 2019, p.8). 1989 indeed became a turning point, since at that moment liberalism, due to disappointment in the communist project, became the only acceptable and unavoidable option for the future. Faith in liberalism replaced faith in communism.

However, the emphasis on imitation obscures another fundamental feature of the modernization concept: its engineering approach to society, as evidenced by the discrepancies between modernization discourse and policy. According to the modernization hypothesis, the most important expected outcome of the modernization process is liberal democracy, which embodies the idea of autonomy and the expansion of personal and institutional freedom. However, the path to realizing this ideal involved increasingly authoritarian practices to launch economic reforms and technological development. Nils Gilman summarized his study of American modernization theory as follows:

> The modernization theorists believed that bureaucracies, technical experts, and social engineers of various stripes should impose economic and political order on cities, nations, and the world… Technocracy rather than 'people's liberation' was what modernization would ideally achieve (Gilman, 2007, p. 18).

In Russia, similarly, the liberal intelligentsia, which promoted catch-up modernization, supported Boris Yeltsin's increasingly authoritarian regime, "making him think he could do anything" to dismantle the Soviet system and built a new Russia (Sauvé, 2025, p. 3). Describing the reforms in ex-communist Central and Eastern Europe, Krastev and Holms aptly remark:

> Poles and Hungarians were told what laws and policies to enact, and simultaneously instructed to pretend that they were governing themselves. … Pretending to rule themselves while being ruled by Western policy-makers was bad enough. The last straw was being disparaged by visiting Westerners, who accused them of merely going through the motions of democracy, when that was exactly what political elites in the region thought they were being asked to do. (Krastev & Holms, 2019, p. 11).

This contradiction between the discourse and practices of modernization reflects the internal ambivalence of modernity, as Adorno and Horkheimer (1947/2002) criticize in *Dialectic of Enlightenment*. Since modern rationality reduces the world to what can be calculated, controlled, and used, reason becomes an instrument for controlling and disciplining life rather than expanding human autonomy. This criticism was continued by other theorists of modernity, including Habermas (1987) with his attempt to separate instrumental and communicative rationality and thereby save the normative foundations of modernity, and Bauman (1989), who viewed the Holocaust as the result of the application of modern mechanisms of control and rational organization of labor, social engineering aimed at realizing a right-wing social utopia. This theme has also been explored in various ways by Michel Foucault, Cornelius Castoriadis, Johann P. Arnason, Peter Wagner, and Luc Boltanski & Eve Chiapello. This critique sees modern societies as a field of constant tension, structured by two dominant poles–the demands of emancipation and authentic forms of life on the one hand, and rational domination and control on the other (Boltanski & Chiapello, 2005). This tension is inherent to the concept of modernization in general, due to its social-engineering focus on rational management and technocratic administration of society. It is especially striking in the case of the classical approach to modernization, based on liberalism. However, it is unclear how it works in the case of the new non-Western modernization programs. In search for the answer, I suggest analyzing the so-called conservative modernization program in Russia and then moving on to the current policy of technological modernization.

THE "CONSERVATIVE MODERNIZATION" PROGRAM

Modernization in Russia has a long conceptual history and has always been interlaced with Russia's self-determination vis-à-vis the West. The famous dispute between Slavophiles and Westernizers concerned whether Russia was part of the West as a European country or had its own path of development. In this sense, the "West," primarily Europe, served as a basic point of reference for Russia, its "Other," against which Russia's own identity has been built (Neumann, 1999).

Although the processes in the late USSR were framed not in terms of modernization but in terms of perestroika and acceleration, glasnost and democratization, the topic of modernization has gradually gained momentum since the early 1990s. In post-Soviet Russia, modernization theory provided an alternative way of understanding the historical process at a time when Marxist doctrine was suffering a historic defeat (Yakovenko, 2014). It also retained a stage-based approach and declared economic development to be the driver of socio-political change, with the significant difference that the destination was not communism but liberal democracy.

Public discussions in the late 1990s and early 2000s revealed growing dissatisfaction with the results of "shock therapy" – the name given to the reform program implemented by a team of liberal reformers led by Yegor Gaidar. These reforms were followed by the collapse of the economy, culminating in a 1998 default, a sharp decline in living standards, the impoverishment of large segments of the population, and an impressive increase in inequality. As a result, Russian society formed a lasting association between the adverse outcomes of "shock therapy," the economic collapse of the 1990s, and Western-style modernization (Vititnev, 2024; Sauvé, 2025). This triggered a search for a different model of modernization that would avoid the failures of the past, put the country on a sustainable path of development, and reinforce Russia's standing as a great power. In the middle of the 2000s, liberal and conservative approaches to modernization clashed in heated public debates about a new development model. At the time, conservative intellectual and political circles generated a request for a "national modernization project" for Russia. Moreover, several projects of conservative modernization had been formulated and discussed, including "conservative futurism" (Engström, 2016) and the Russian Doctrine that championed "the creation of a centaur of Orthodoxy and innovative economy, high spirituality and high technologies" (Averianov, 2010).

In 2009, then-president Dmitry Medvedev published an article titled "*Go Russia!*" in which he announced a large-scale modernization "based on the values and institutions of democracy" (President of Russian Federation, 2009). Scrupulous reading of Medvedev's article reveals its twofold, interim character. At first sight, the program referred to the normative liberal ideals of modernity and expressed hope for liberalization of the Russian political system. Medvedev explicitly reproduces the modernization hypothesis, interpreting technological development and the formation of an innovative economy as a necessary condition for the establishment of democracy:

> I also think that technological development is a priority public and political task because scientific and technological progress is inextricably linked with the progress of political systems. Experts believe that democracy originated in ancient Greece, but in those days there was no extensive democracy. Freedom was the privilege of a select minority. Full-fledged democracy that established universal suffrage and legal guarantees for the equality of all citizens before the law, so-called democracy for everyone emerged relatively recently, some eighty to one hundred years ago. Democracy occurred on a mass scale, not earlier than the mass production of the most necessary goods and services began. When the level of technological development of Western civilization made it possible to gain

> universal access to basic amenities: to education, health care and information. Every new invention that improves our quality of life provides us with an additional degree of freedom. It makes our existential conditions more comfortable and social relations more equitable. The more intelligent, smarter and efficient our economy is, the higher the level of our citizens' welfare, and our political system and society as a whole will also be freer, fairer and more humane (Medvedev, 2009).

Medvedev takes a negative, critical view of the present, identifying the main obstacles to growth as the raw-materials economy, the lack of innovation, chronic corruption, a "habit of relying on others," the poor quality of democratic institutions, etc. As a result, Russia's influence on the international stage has declined. Based on the problems listed, the path to the future lies through intensifying technological development, modernizing the political system, strengthening the judiciary, and fighting corruption. Medvedev's rhetoric retains a motif of future-oriented policies and breaking with the past, inherent to modernization: "Our time is truly new!... Instead of the past, we will build a real Russia – a modern, forward-looking young nation..." He distances himself from the authoritarian modernizations of the past and calls on business and civil society to join forces to build a new Russia without revolutionary upheavals. Climate change, nuclear weapons non-proliferation, technogenic risks, and international cooperation are all on the agenda.

However, a closer scrutiny of the context and further "decoding" of the provisions outlined in the article suggests some adjustments to this interpretation. As for the context, the article was written after the 2008 global financial crisis, which exposed oil-export dependency as a systemic risk and prompted authorities to diversify the economy (Trenin, 2010). In addition, the concept of "sovereign democracy" had already been put forward by Vladislav Surkov, the deputy head of the Russian presidential administration – he outlined it in his speech to United Russia activists in February 2006. Its purpose was to reject political liberalism in favor of "cultural tradition" and "authentic values" within a retained model of electoral democracy (Kiryukhin & Shcherbak, 2022). In other words, it rejected the "West" as a normative model, while imagining Russia as part of the pan-European value space:

> Russia has been led to democracy not by 'defeat in the Cold War', but by the very European nature of its culture (Surkov, 2006).

Therefore, "sovereign democracy" implied that Russia itself would determine the form and criteria of its democracy. Politically, "sovereign democracy" introduces the idea of democracy as collectively rather than individually oriented (Kazantsev, 2007). In parallel, conservatism was announced as the official ideology of the Russian ruling party, "United Russia," and was placed at the heart of its program, alongside "sovereign democracy." Although conservatism was not mentioned once in Medvedev's programmatic article or speeches at the time, it had already been part of the Russian ideological ecosystem (Bluhm, 2016). The formal head of United Russia, Boris Gryzlov, tried to reconcile these controversial liberal and conservative lines, interpreting Russian conservatism as "open" and "ready to accept new ideas, and therefore capable of

modernizing the country," so that the motto 'Go, Russia!' was considered a guide to action for Russian conservatism (Yabloko Party, 2009). Medvedev himself repeatedly appealed to patriotism, traditional family values, a strong state, belief in Russia, and the independence and freedom of the Russian state, starting with his first Annual Address to the Federal Assembly in November 2008 (Trenin, 2010).

Against the conservative ideological backdrop, the liberal appeal of Medvedev's program had taken a conservative flavor. Medvedev clearly rejects the West's exemplarity while maintaining liberal rhetoric. The program's central thesis is "We must rely only on ourselves," which refers to both the Western modernization programs and the West itself:

> Naive ideas about an infallible and happy West and an eternally underdeveloped Russia are unacceptable (Medvedev, 2009).

In other words, the goals remain rather liberal, but the path to achieving them is to be forged independently. In addition, when discussing the development of the political system and democracy, Medvedev does not clarify their meanings, except to say that Russian society will be wealthier, "freer, fairer, and more humane."

At the same time, the emphasis on technological innovation as the economic driver stands in stark contrast to the market fundamentalism of the 1990s (Shcherbak, 2018). This emphasis embraces a technocratic interpretation of Soviet history: although the Soviet Union achieved technological breakthroughs, many of these technologies have since become obsolete, necessitating new breakthroughs. Soviet cutting-edge technologies are seen as an essential contribution to the Soviet/Russia's past greatness and victories. The past serves as a lost ideal – the message, in fact, is to restore Russia's past greatness on new foundations in a new context. Thus, "the tense relationship between attitudes toward the past, belief in Russia's great culture, and aspiration toward the future becomes a hidden but significant foundation" of Medvedev's modernization project (Kalinin, 2010). Medvedev's text combines technocratic rhetoric with "an attempt to use the negative nostalgic energy of the gap between the past and the present" as the driving force of modernization (Kalinin, 2010). As can be seen, Medvedev's model attempted to fit a future framed in liberal terms into the reconstructed historical horizon of "Great Russia" and link them through "patriotism" and "great culture." As a result, a hybrid of "conservative modernization" was born.

Medvedev's modernization program was thus ambivalent. Despite its emancipatory potential, many Russian liberals initially criticized the document for its conservative motifs (Trenin, 2010), lately describing the subsequent conservative consolidation of Kremlin politics as a process of demodernization, either politically (Rozov, 2024) or in a broader sense (Rabkin & Minakov, 2018). After Vladimir Putin returned to power in 2012, the concept of conservative modernization lost its political significance, though conceptual discussions of it continued in Russian conservative intellectual circles (Vititnev, 2024; Diskin, 2021). Since then, the term "modernization" has not disappeared from official texts, but it has been used strictly in a technical sense. Subsequent political discourse and policies run with the conservative overtones and technocratic tendencies of Medvedev's program, while ditching its liberal ideals.

STATE-CIVILIZATION RUSSIA AND TECHNOLOGICAL MODERNIZATION

The beginning of Putin's third term is often seen as a shift away from the pragmatism that was a hallmark of his first two terms (Frear & Mazepus, 2020) to the conservative (Bluhm, 2016; Laruelle, 2025) or civilizational discourse (Tsygankov, 2016). The vision of Russia as a distinct non-Western civilization has roots in the Slavophiles and Nikolay Danilevsky's works and was later developed and promoted by Eurasianists. After the collapse of the USSR, this vision crystallized in writings by Alexandr Panarin, Vadim Tsymbursky, and Alexandr Dugin in the late 1990s and early 2000s as a conservative reaction to post-Soviet liberal universalism, gradually making its way into official discourse. The question is how the language of "distinct civilization" made its way from the political margins in the 1990s to become widely employed by top officials and what it means in the context of technological development.

During his first two presidential terms, Putin considered Russia to be part of European civilization, sharing the same values from Lisbon to Vladivostok. This is clearly expressed, for example, in his Annual Address to the Federal Assembly in 2005:

> Russia was, is and will, of course, be a major European power. Achieved through much suffering by European culture, the ideals of freedom, human rights, justice, and democracy have for many centuries been our society's determining values (President of the Russian Federation, 2005).

During Medvedev's 2008–2012 presidency, the civilizational framework competed with modernization discourse – the 2008 Foreign Policy Concept (FPC) framed foreign policy in terms of a global interstate competition emerging along civilizational fault lines, implying that Russia was a distinct civilizational pole with its own values and development model (Tsygankov, 2016, p. 7) and calling for dialogue among civilizations. However, this civilizational language was applied to the international system rather than to Russia as a self-designation.

Starting in 2012, the concept of "state-civilization" began to feature prominently in Vladimir Putin's speeches and articles. The Russian president adopted the language of civilization at home and abroad "in response to the situation of ontological insecurity," since he identified "the Western language of democracy and human rights as a form of ideological pressure" (Tsygankov, 2016, pp. 9-10). In his article "*Russia: The Ethnicity Issue*," Putin (2012) rejects ethnonationalism and labels Russia "a multiethnic civilization with Russian culture at its core." The Russian president operates there with the concept of "state-civilization," making the state itself the primary bearer of Russian identity and contraposing it to both ethnic nationalisms, on the one hand, and liberal civic universalism, on the other. State institutions, together with Russian culture and language – which constitute the national cultural (civilizational) code–serve here as the foundation of social unity – the glue that binds together the ethnic, religious, and cultural diversity of Russian society. However, this emphasis on Russian civilization and identity was not sustained and was almost absent from official documents by 2018, as the focus shifted to security issues (Frear & Mazepus, 2020, p. 19).

The FPC, adopted in March 2023, is the first to explicitly describe Russia as a conservative, technologically oriented, sovereign "country-civilization" (given that the 2025 National Security Strategy again refers to a "state-civilization," I will not dwell on these intriguing terminological nuances at this point). Therefore, the 2023 FPC represents a qualitative shift: previous FPCs used civilizational vocabulary to describe the international system (a world of diverse civilizations, and Russia as one player among others), whereas the 2023 FPC uses it to designate Russia itself in the international arena as a civilizational subject with a distinct identity, mission, and claim to a sphere of civilizational community. This is the difference between civilizational pluralism as a descriptive framework for world order and civilizational identity as a constitutive self-description – a shift with significant implications for how technological modernization and sovereignty are framed, since it claims civilizational self-sufficiency in a way the former did not.

The 2023 FPC turns the rejection of Western normative exemplarity into a struggle against Western hegemony, with Russia claiming the vanguard of the global anti-colonial movement. This document employs decolonial discourse, appealing to the Soviet Union's support for decolonization, but frames it through appeals to civilizational identity and cultural-religious struggles – in other words, it aligns with what, in the West, appears as right-wing rhetoric. Russia criticizes the West, mainly the US, for seeking unilateral dominance and accuses it of neocolonial and hegemonic ambitions, and defends the right of sovereign states "to choose models of development, and social, political and economic order," as well as "non-interference in internal affairs" and

> diversity of cultures, civilizations, and models of social organization, non-imposition of their models of development, ideology, and values on other countries by all states, and reliance on a spiritual and moral guideline common to all world traditional religions and secular ethical systems. (Ministerstvo inostrannykh del Rossiiskoi Federatsii, 2023)

The construction of a "state-civilization" continues the line already visible in the concept of "sovereign democracy," equating the rejection of the West's normative superiority with anti-colonial struggle and justifying this rejection by appealing to Russia's own civilizational foundations. At the same time, the idea of technological leadership, as we have observed, has already been identified as a key element of Russian policy and political rhetoric in Putin's early article (1999). More recently, it has been outlined in the Executive Order of May 7, 2024, "*On the Development Goals of the Russian Federation through 2030 and for the Future Until 2036*." This document is a striking example of the sociotechnical imagination of what I call "technological modernization," though the term "modernization" appears only 2 times in reference to infrastructure improvements – the keywords are "development" (22 times) and "state" (24 times in the Russian original). National goals are centered here around two poles, the state and the populace (people). Care for the people is the priority: "preservation of the population, strengthening health and improving the wellbeing of people, supporting families" (President of the Russian Federation, 2024). Expanding the housing stock, infrastructure, addressing climate change and environmental issues are also on the

agenda. Quite in line with the setting of a practical, that is, a technical and administrative agenda, notions of democracy and self-governance do not play a role even where the reduction of inequalities is set as a rare example of an explicitly political goal. Along with enhancing technological leadership and digitalizing the state, economy, and social sphere, the state takes these measures in the interests of its population. In this construction, the state and the populace merge, making the promotion and protection of "traditional Russian spiritual and moral values" one of the decree's central tasks. Another no less important task is educating youth in a patriotic spirit and creating state-funded opportunities for vertical social mobility for talented and loyal young people. At the same time, ensuring network sovereignty and information security is also a priority.

In this context, the ambiguity of the outlined political discourse catches the eye. On the one hand, it emphasizes cultural differences, values, and identity as the organic foundations of a distinct social and political order. On the other hand, it does not criticize the universal achievements of modernity to which Russia itself has contributed significantly and which explicitly remain a priority – namely, science, technology, the global economy, infrastructure… Put differently, the state-civilization concept disaggregates the modernization package by positing that technology, on the one hand, and political institutions and values, on the other, are separable. It is possible to take technology and leave values behind because it belongs to a distinct civilization with its own relationship to technology, its own developmental logic, and its own legitimate institutional forms. The state-civilization framework transforms coproduction, as Jasanoff defines it, by de-universalizing and detaching Western governance forms from Western technology, and by insisting that they are civilizational choices of a particular civilization, imposed globally as if they were universal. It can be illustrated with the example of digital sovereignty (tsifrovoi suverenitet): it is not a claim to build its own internet from scratch – it rather implies that the underlying infrastructure is the same, but will be governed by Russian state institutions, filtered through Russian legal frameworks, insulated from Western platform monopolies and Western content standards. The technology is the same – the content and institutional wrapping are Russian civilizational (the same logic applies to AI). As Putin has put it recently on the *Future Technologies Forum*,

> I have repeatedly emphasised: equal access to future technologies, rather than privileges for the chosen few [meaning the Western societies – S.S.], is an indispensable condition for the equitable development of our civilisation. (Putin, 2025)

I will illustrate the practical implementation of the outlined sociotechnical imaginary through two cases: first, the development and top-down implementation of the ideology of "the human being of the future," and second, the introduction of the social architect.

A Kremlin official, Boris Rapoport (2025), has recently presented his revised version of Sergei Uvarov's triad, "Orthodoxy, Autocracy, Nationality," formulated in 1833 as opposition to the revolutionary "Liberté, Égalité, Fraternité." Rapoport interpreted Uvarov's formula as reflecting three constants that shape the Russian national

character and can be traced throughout Russian history. The first of these constants is messianism, expressed through a sense of special responsibility and a model of development intended as an alternative to the Western one; today, it is articulated in the concept of a just multipolar world. The second is conciliarity (sobornost'), that is, the ability of society to consolidate around a common goal in times of trial. The third is the pursuit of fairness (Rapoport, 2025). Now they have been transformed into new triads, which look as follows:

Table 1. New Triads (SS, based on Rapoport's text)

Constants	Social correlates	Activity	Faith	Feelings
Messianism	sovereign country	active patriotism	in the country	Pride
Consiliarity	traditional society	creative labor	in those around us	Confidence
Fairness	social state	Service	In the future	Hope

At the same time, the imaginaries of the future based on traditional values are assumed to be constructed and promoted, intentionally and reflectively, also through modern digital technology. Therefore, this kind of ideological creativity is complemented by the introduction of a new profession: "social architects." In January 2025, applications opened for a social architect competition organized by the Expert Institute for Social Research, with support from the ANO "Russia – Land of Opportunity" and the Presidential Academy of RANEPA (three of the Kremlin Administration's think tanks). These new professionals are supposed to work with the population within the framework of the state ideology, promoting traditional values and patriotic education, working with youth and territorial self-government, addressing environmental issues, etc. (Konkurs sotsial'nykh arkhitektorov, 2025). This involves "proactive modeling and designing of social processes," meaning mediating the relationship between authorities and the population as a new form of social engineering. The social architects will rely on large data sets, sociological surveys, and AI in their work.

This field is developing very quickly, apparently in response to the authorities' demand. In 2025, the first master's programs were launched, and in December, the first textbook was presented at the first International Conference on Social Architecture, held at St. Petersburg State University. According to the speaker, who presented the new textbook (Sergey Volodenkov, professor at the Faculty of Political Science at Lomonosov Moscow State University), the textbook is based on

> A simple, but essential idea: the future of society is not predetermined, it is designed; the future of society is not predestined, it is constructed. This is our response to the challenges of our time, when spontaneous social changes must

give way not only to purposeful but also to holistically oriented construction of social reality (Konkurs sotsial'nykh arkhitektorov, 2025a).

As for the conference, it included sections such as "Modeling the Future: Conceptual Approaches and Solutions" and "Civilizational Foundations and Value Orientations in Designing the Future" (Sotsial'naya arkhitektura, 2025b). The presence of Alexander Dugin and Valery Fedorov in the presidium suggests close cooperation between sociologists and ideologists aimed at social engineering. As one of the conference participants noted, the topic at hand was "*the de-Westernization of political processes in non-Western parts of the world*" (Konkurs sotsial'nykh arkhitektorov, 2025a).

The resulting policy landscape aligns with the modern ideas of rational domination and instrumental rationality and can be loosely described as "technological modernization," since politics as such disappears from this sociotechnical imaginary, replaced by a specific art of governmentality. "Technological modernization" combines the future-oriented temporal structure inherent in the concept of modernization with an engineering, instrumental approach to society. The development of digital technologies and AI is also embedded in the normative framework of state-civilization, and the question of its implications for social and political dynamics remains open.

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REFERENCES

Adorno, T. W., & Horkheimer, M. (2002). *Dialectic of Enlightenment* (E. Jephcott, Trans.). Stanford University Press. (Original work published 1947)

Averianov, V. (2010, July 14). Nuzhny drugie liudi [We need Different People]. *Zavtra*. http://zavtra.ru/blogs/2010-07-1431

Bauman, Z. (1989). *Modernity and the Holocaust*. Cornell University Press.

Bluhm, K. (2016). Modernisierung, Geopolitik und die neuen russischen Konservativen [Modernization, Geopolitics and the New Russian Conservatives]. *Leviathan*, *44*(1), 36–64. http://www.jstor.org/stable/24886401

Boltanski, L. & Chiapello, E. (2005). *The New Spirit of Capitalism*. Verso.

Castoriadis, C. (1998). *The Imaginary Institution of Society* (K. Blamey, Trans.). MIT Press. (Original work published 1975)

Diskin, I. (2021). *Konservativnaya modernizatsiya* [Conservative Modernization]. Politicheskaya entsiklopediya.

Eisenstadt, S. N. (2000). Multiple Modernities. *Daedalus*, *129*(1), 1–29.

Eisenstadt, S. N. (1999). *Fundamentalism, Sectarianism, and Revolution: The Jacobin Dimension of Modernity*. Cambridge University Press.

Engström, M. (2016). Apollo against Black Square: Conservative Futurism in Contemporary Russia. In B. Günter (Ed.), *International Yearbook of Futurism Studies* (vol. 6, pp. 328–353). De Gruyter. https://doi.org/10.1515/FUTUR-2016-0016

Frear, M., & Mazepus, H. (2020). Security, Civilisation and Modernisation: Continuity and Change in the Russian Foreign Policy Discourse. *Europe-Asia Studies*, *73*(3), 390–411. https://doi.org/10.1080/09668136.2020.1843601

Gilman, N. (2007). *Mandarins of the Future: Modernization Theory in Cold War America*. Johns Hopkins University Press.

Habermas J. (1987). *The Philosophical Discourse of Modernity.* Massachusetts Institute of Technology Press.

Inkeles, A. (1969). Making Men Modern: on the Causes and Consequences of Individual Change in Six Developing Countries. *American Journal of Sociology*, *75*, 208–225.

Jasanoff, S. (2015). One Future Imperfect: Science, Technology, and the Imaginations of Modernity. In S. Jasanoff & S.-H. Kim (Eds.), *Dreamscapes of Modernity: Sociotechnical Imaginaries and the Fabrication of Power* (pp. 1–33). University of Chicago Press.

Laruelle, M. (2025). *Ideology and Meaning-making under the Putin Regime.* Stanford University Press.

Latham, M. E. (2000). *Modernization as Ideology: American Social Science and "Nation Building" in the Kennedy Era*. The University of North Carolina Press.

Kalinin, I. A. (2010). Nostal'gicheskaya modernizatsiya: Sovetskoe proshloe kak istoricheskii gorizont [Nostalgic Modernization: The Soviet Past as a Historical Horizon]. *Neprikosnovennyi zapas: Debaty o politike i kul'ture*, *6*. https://magazines.gorky.media/nz/2010/6/nostalgicheskaya-modernizacziya-sovetskoe-proshloe-kak-istoricheskij-gorizont.html

Kazantsev, A. (2007). "Suverennaya demokratiya": Struktura i sotsial'no-politicheskie funktsii kontseptsii ["Sovereign Democracy": Structure and Socio-political Functions of the Concept]. *Forum noveishei vostochnoevropeiskoi istorii i kul'tury*. https://www1.ku.de/ZIMOS/forum/inhaltruss7.html

Kiryukhin, D., & Shcherbak, S. (2022). The People, Values, and the State: How Vladimir Putin's Views on Ideology Evolved. *Studia Politica*, *22*(1), 9–33. https://www.studiapolitica.eu/Archive/2022/studia-politica-romanian-political-science-review-vol-xxii-no-1-2022

Knöbl, W. (2017). The Sociological Discourse of Modernization and Modernity. *Dans Revue internationale de philosophie*, *3*(281), 311-329. https://doi.org/10.3917/rip.281.0311

Konkurs sotsial'nykh arkhitektorov. (2025). *Konkurs sotsial'nykh arkhitektorov* [Competition of Social Architects]. https://xn--80aaobldpdsgjuebyc0ck3hlh.xn--p1ai/

Konkurs sotsial'nykh arkhitektorov. (2025). *Rossiiskie uchenye predstavili pervyi v mire uchebnik po sotsial'noi arkhitekture* [Russian Scientists Presented the World's first Textbook on Social Architecture]. https://xn--80aaobldpdsgjuebyc0ck3hlh.xn--p1ai/tpost/bst78ppgt1-rossiiskie-uchenie-predstavili-pervii-v

Sotsial'naya arkhitektura: Polnaya programma konferentsii [Social Architecture: Full Conference Program] (2025). *Russian Association of Political Science*. https://www.rapn.ru/News/6466

Koselleck, R. (2004). *Future Past: On the Semantics of Historical Time* (K. Tribe, Trans). Columbia University Press.

Krastev, I. & Holms, S. (2020). *The Light That Failed: A Reckoning*. Penguin Books.

Ministerstvo inostrannykh del Rossiiskoi Federatsii. (2023, March 31). *Kontseptsiya vneshnei politiki Rossiiskoi Federatsii* [Foreign Policy Concept of the Russian Federation]. https://www.mid.ru/ru/detail-material-page/1860586/

Medvedev, D. (2009). *Go Russia!* http://en.kremlin.ru/events/president/news/5413#sel=32:1:Lj3,32:192:qvj

Neumann I. B. (1999). *Uses of the Other. The 'East' in European Identity Formation*. University of Minnesota Press, Borderline Series.

President of the Russian Federation. (2005, April 25). *Annual Address to the Federal Assembly of the Russian Federation*. http://en.kremlin.ru/events/president/transcripts/22931

President of the Russian Federation. (2009, November 12). *Dmitry Medvedev delivered his Presidential Address to the Federal Assembly*. http://kremlin.ru/events/president/news/5978

President of the Russian Federation. (2022, September 30). *Signing of Treaties on accession of Donetsk and Lugansk people's Republics and Zaporozhye and Kherson regions to Russia*. http://en.kremlin.ru/events/president/news/69465

President of the Russian Federation. (2024, May 7). *Executive Order on Russia's Development Goals through 2030 and for the Future until 2036*. http://kremlin.ru/events/president/news/73986

President of the Russian Federation. (2025, February 14). *Plenary Meeting of the Future Technologies Forum*. http://en.kremlin.ru/events/president/news/79222

Putin, V. (1999, December 30). Rossiya na rubezhe tysyacheletiy [Russia at the Turn of the Millennium]. *Nezavisimaya gazeta*. https://www.ng.ru/politics/1999-12-30/4_millenium.html

Putin, V. (2012, January 23). Rossiya: Natsional'ny vopros [Russia: The Ethnicity Issue]. *Nezavisimaya gazeta*. https://www.ng.ru/politics/2012-01-23/1_national.html

Rozov, N.S. (2024). Political (De)modernization of Russia in the 1990s: Turning Events and Models of Conflict Dynamics. *Polis. Political Studies*, *3*, 142–161. https://doi.org/10.17976/jpps/2024.03.10

Rabkin, Y., & Minakov, M. (Eds.). (2018). *Demodernization. A Future in the Past*. Ibidem-Verlag.

Rapoport, B. (2025). Politicheskie vyzovy Rossii: istoriya i sovremennost' [Political Challenges of Russia: History and Modernity]. *Bloknot grazhdanskogo prosveshcheniya*, *14*. https://gos.znanierussia.ru/

Sauvé, G. (2025). *Suffering Victory: Soviet Liberals and the Failure of Democracy in Russia, 1987–1993*. Cornell University Press.

Sachsenmaier, D. (2002). Multiple Modernities: The Concept and Its Potential. In D. Sachsenmaier, S. Eisenstadt, & J. Riedel (Eds.), R*eflections on Multiple Modernities: European, Chinese and Other Interpretations* (pp. 42–67). Brill.

Schmidt, J. C. (2021). *Philosophy of Interdisciplinarity: Studies in Science, Society and Sustainability*. Routledge. https://doi.org/10.4324/9781315387109

Shcherbak, S. (2018). The Modernization Hypothesis and Neoliberalism. *The Russian Sociological Review*, *17*(3), 291–328.

Surkov, V. (2006, November 20). *Natsionalizatsiya budushchego* [The nationalization of the future]. https://surkov.info/nacionalizaciya-budushhego-polnaya-versiya/

Taylor, C. (2004). *Modern social imaginaries*. Duke University Press.

Tipps, D. C. (1973). Modernization Theory and the Comparative Study of Societies: A Critical Perspective. *Comparative Studies in Society and History*, *15*(2), 199–226.

Therborn, G. (1995). *European Modernity and Beyond*. SAGE Publications.

Trenin, D. (2010). Russia's Conservative Modernization: A Mission Impossible? *SAIS Review of International Affairs*, *30*(1), 27–37. https://doi.org/10.1353/sais.0.0063

Trump, D. J. (2025a, January 20). *The Inaugural Address* [Speech transcript]. https://www.whitehouse.gov/remarks/2025/01/the-inaugural-address/

Trump, D. J. (2025b, July 23). *Remarks on signing executive orders at the Artificial Intelligence Summit* [Speech transcript]. The American Presidency Project. https://www.presidency.ucsb.edu/documents/remarks-signing-executive-orders-the-artificial-intelligence-summit

Tsygankov, A. P. (2016). Crafting the State-civilization: Vladimir Putin's Turn to Distinct Values. *Problems of Post-Communism*, *63*(3), 146–158. https://doi.org/10.1080/10758216.2016.1181682

Varieties of Democracy Institute. (2025). *Democracy Report 2025: 25 Years of Autocratization – Democracy Trumped?* https://v-dem.net/documents/61/v-dem-dr__2025_lowres_v2.pdf

Vititnev, S. (2024). Konservativnaya modernizatsiya v Rossii: Istoriograficheskii analiz diskussii o novoi paradigme razvitiya [Conservative Modernization in Russia: A Historiographical Analysis of the Debate on a New Development Paradigm]. *Postsovetskii materik*, *4*(44), 162–170. https://doi.org/10.48137/23116412_2024_4_162

Wucherpfennig J. & Deutsch F. (2009) Modernization and Democracy: Theories and Evidence Revisited. *Living Review in Democracy*, *1*, 1–9. https://www.ethz.ch/content/dam/ethz/special-interest/gess/cis/cis-dam/CIS_DAM_2015/WorkingPapers/Living_Reviews_Democracy/Wucherpfennig%20Deutsch.pdf

Yabloko Party. (2009, November 29). *Predmet konservatsii* [The Subject of Conservation]. https://www.yabloko.ru/publications/2009/11/29

Yakovenko, I. G. (2014). *Rossiya i modernizatsiya v 1990-e gody i posleduyushchii period: Sotsial’no-kul’turnoe izmerenie* [Russia and Modernization in the 1990s and the Subsequent Period: A Socio-cultural Dimension]. Novye Znaniya. https://novznania.ru/pdf/YakovenkoModernization.pdf

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Research article

Large Language Models as Political Actors: Cultural Bias and Epistemic Power

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Abstract

The rapid diffusion of Large Language Models (LLMs) into socially and politically sensitive domains raises critical questions about the nature and origins of political bias in artificial intelligence. While existing research often treats bias as a technical flaw to be minimized, this article advances a broader philosophical and cultural interpretation of LLM bias as an outcome of embedded epistemic and value-laden structures. The aim of this study is to conceptualize LLMs as political actors of a new type and to examine how cultural context, language, and prompt design shape their normative orientations. Methodologically, the research brings comparative survey methods to the study of chatbots trained on North American, Russian, and Chinese data. It combines this with philosophical analysis grounded in Actor–Network Theory and assemblage theory. The empirical instrument was an adapted Political Compass consisting of 62 normatively charged statements, administered twice to each model using standardized numerical responses, followed by qualitative analysis of response variability through grounded theory methodology. The study confirms three core hypotheses. First, large language models function as political actors rather than neutral tools, systematically reproducing normative positions across moral, economic, and political domains; bias is therefore constitutive rather than accidental. Second, political bias is context-dependent and dynamically produced through interaction, shaped not only by prompt framing and linguistic reformulation, but also by broader sociocultural and national value frameworks embedded in training data and alignment regimes. Prompt engineering and jailbreak strategies reveal that normative orientations can be activated, attenuated, or reconfigured, indicating a distributed responsibility for AI bias among developers, users, and cultural contexts. Third, the analysis identifies distinct epistemic patterns: American and Russian chatbots share a Western epistemic matrix despite ideological differences, with Russian models combining ideological sovereignty and epistemological dependence. Chinese models exhibit greater contextual sensitivity and partial epistemic autonomy, reflecting a different cognitive grammar. By showing that LLM bias reflects culturally embedded epistemic matrices rather than technical deviations from a neutral norm, the study challenges linear conceptions of modernization and contributes to the understanding of non-Western technological modernization as the emergence of plural cognitive orders within global AI development.

Keywords: Large Language Models; Political and Cultural Bias; Prompt Engineering; Actor–Network Theory, Techno-Social Assemblages, Political Compass.

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Научная статья

Большие языковые модели как политические акторы: Культурная предвзятость и эпистемическая власть

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Аннотация

Быстрое распространение больших языковых моделей (Large Language Models, LLM) в социально и политически чувствительных сферах ставит вопрос о природе и источниках политической предвзятости в системах искусственного интеллекта. В большинстве исследований предвзятость рассматривается преимущественно как технический дефект, подлежащий устранению. Здесь предлагается более широкая философская и культурная интерпретация феномена, согласно которой предвзятость LLM является результатом встроенных эпистемических структур и ценностных предпосылок. Цель исследования – концептуализировать LLM как политических акторов нового типа и проанализировать, как культурный контекст, язык и дизайн промптов влияют на формирование их нормативных ориентаций. Эмпирическим инструментом исследования выступила адаптированная версия опросника Political Compass, включающая 62 нормативно нагруженных утверждения, охватывающих экономические, социальные и политические вопросы, на которые были получены ответы чатботов, обученных на данных различных культурно-политических контекстов – североамериканского, российского и китайского Анализ ответов сочетается с философской интерпретацией, основанной на акторно-сетевой теории и теории техно-социальных ассамбляжей. Полученные данные были дополнительно подвергнуты качественному анализу вариативности ответов с использованием методологии обоснованной теории. Результаты исследования подтверждают три ключевые гипотезы. Во-первых, большие языковые модели функционируют не как нейтральные инструменты обработки языка, а как политические акторы, воспроизводящие устойчивые нормативные позиции в моральной, экономической и политической сферах. Во-вторых, предвзятость является контекстуально зависимой и формируется в процессе взаимодействия, включая влияние промптов, языковых формулировок и социокультурных рамок. В-третьих, американские и российские модели демонстрируют сходство когнитивных установок, формируясь в рамках общей западной эпистемической матрицы, несмотря на идеологические различия; китайские же модели проявляют большую контекстуальную чувствительность и частичную эпистемическую автономию, отражая иную когнитивную грамматику. Таким образом предвзятость LLM следует рассматривать не как техническое отклонение от нейтральной нормы, а как проявление культурно обусловленных эпистемических матриц.

Ключевые слова: Большие языковые модели; Политическая и культурная предвзятость; Промпт-инжиниринг; Акторно-сетевая теория; Техно-социальные ассамбляжи; Политический компас (Political Compass)

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INTRODUCTION

The widespread expansion of Large Language Models (LLMs) has led to the increasing involvement of artificial intelligence systems in the interpretation of socially significant, normatively charged, and politically sensitive issues (Cantini et al., 2025; Yang et al., 2024). Chatbots are now used to explain complex social phenomena, formulate evaluative judgments, provide consultations, and in some cases even substitute expert knowledge (Zhou & Zhang, 2024). Under these conditions, a fundamentally important question arises: what values, norms, and modes of thinking are reproduced by LLMs in their responses, and on what factors do the observed forms of bias depend?

This article builds its argument not on abstract theory, but on empirical sociological research that investigates cultural and political biases embedded in language models.[1] Specifically, the study is based on a standardized survey of chatbots developed and operating in different cultural and political contexts – American, Russian, and Chinese (Haslett et al., 2025; Wu et al., 2025; Zhou & Zhang, 2024). The questionnaire consisted of normatively and value-laden statements covering key economic, social, moral, and political issues. The response format was deliberately restricted to a numerical scale, excluding extended argumentation, in order to capture latent priorities and cognitive orientations rather than reflective or deliberately moderated formulations (Yang et al., 2024).

The results of this empirical investigation reveal stable and reproducible differences in chatbot responses that cannot be explained by random variation or technical malfunction (Cantini et al., 2025). On the contrary, they point to systemic regularities linked to language, cultural context, and the epistemological foundations within which LLMs are developed and trained (Wright et al., 2025). On the basis of these empirical observations, the article formulates and substantiates three key hypotheses.

The first hypothesis posits that LLMs should be understood not as purely technical systems for natural language processing, but as political actors of a new type (Latour, 2005; DeLanda, 2016). At this point, a conceptual clarification is necessary. The characterization of LLMs as "political actors" should not be understood as an ontological claim equating them with human citizens, institutional representatives, or autonomous political subjects. We do not attribute intentionality, moral agency, or deliberative consciousness to language models. Rather, the term "actor" is employed in an analytical sense derived from Actor–Network Theory (Latour, 2005), where agency is distributed across socio-technical assemblages and does not presuppose personhood. Our use of this framework is methodological rather than anthropomorphic. We begin from a limitation of AI systems – namely, their dependence on selective training data, alignment procedures, and mainstreamed discursive corpora – and treat this limitation as analytically productive. If LLMs are structurally biased, and if the pattern of bias differs across

[1] A detailed presentation of the empirical results of the sociological survey, including statistical tables, diagrams, and quantitative analysis, will be provided in a separate article: Seletkova and Seredkina. *Mapping Political Bias in Large Language Models: A Comparative Sociological Survey of American, Russian, and Chinese Chatbots* (in press). The present study focuses on the philosophical and cultural interpretation of these findings rather than their full sociological exposition.

cultural contexts, then these differences can serve as indicators of dominant value orientations within web-based knowledge infrastructures. In this sense, LLMs do not "speak for" a culture in a representative-democratic sense; rather, they function as mediating nodes within feedback loops that reinforce and stabilize prevailing discursive formations.

The sociological survey demonstrates that chatbots reproduce stable normative positions on issues of freedom, responsibility, justice, and the legitimacy of power (Yang et al., 2024). This indicates that their "bias" is not a deviation from an assumed neutral norm, but rather a consequence of their embeddedness in sociotechnical and cultural contexts (Wright et al., 2025). In this sense, LLMs function as new mediators of political representation, capable of reinforcing or transforming dominant discourses (Latour, 2005).

The second hypothesis follows from a comparative analysis of American and Chinese chatbot responses and asserts that the nature and degree of LLM bias depend on the culture and epistemic matrix of the society in which they are created (Zhou & Zhang, 2024; Haslett et al., 2025). The empirical data show that English-language models tend to reproduce a liberal-universalist logic, emphasizing individual rights and procedural rationality, whereas Chinese chatbots exhibit greater contextual sensitivity, pragmatism, and an orientation toward social stability (Wright et al., 2025). These differences point not merely to alternative political preferences, but to fundamentally different modes of organizing knowledge and normative reasoning (Zhou & Zhang, 2024).

The third hypothesis emerges from the analysis of Russian-language chatbot responses and highlights their dual specificity. On the one hand, the survey results demonstrate a high degree of similarity between Russian- and English-language models across a number of key issues (Wright et al., 2025). On the other hand, certain thematic areas reveal elements of national sovereignty and distancing from Western political frameworks (Mikhailovsky & Seredkina, 2025). This makes it possible to advance the hypothesis that Russian chatbots are epistemologically embedded in a Western cognitive matrix, while ideologically striving for autonomy – thus distinguishing them from both American and Chinese models (Haslett et al., 2025).

The sociological survey of chatbots does not serve as an illustration of pre-formulated philosophical claims; rather, it functions as a source for problem formulation and hypothesis generation, which are subsequently examined through the lenses of political philosophy, sociology, and AI ethics (Latour, 2005; DeLanda, 2016; Wright et al., 2025). This approach allows political bias in LLMs to be understood not as a technical defect, but as a symptom of deeper cultural and epistemological processes shaping the architecture of contemporary digital knowledge.

EMPIRICAL STUDY OF POLITICAL BIAS IN LLMS: A PHILOSOPHICAL AND CULTURAL INTERPRETATION OF A SOCIOLOGICAL SURVEY

In this study, Large Language Models (LLMs) are conceptualized not as neutral instruments of natural language processing, but as quasi-social actors embedded in

processes of symbolic production, interpretation, and the reproduction of normative orders. This perspective makes it possible to analyze LLM outputs not merely in terms of accuracy or factual correctness, but as forms of cultural and political representation shaped by heterogeneous socio-technical conditions.

The empirical basis of the study consists of a comparative sociological survey of chatbots developed within distinct cultural and political contexts: ChatGPT (United States), DeepSeek (China), and Alice AI and GigaChat (Russia). Methodologically, the study draws on Actor–Network Theory (Latour, 2005) and assemblage theory (DeLanda, 2016), which allow large language models to be conceptualized as non-human actors embedded in heterogeneous socio-technical networks. From this perspective, political positions articulated by LLMs are not treated as intrinsic properties of the models, but as effects of translation and stabilization within complex assemblages consisting of training data, algorithmic architectures, regulatory regimes, and cultural norms.

From the perspective of ANT, each LLM functions as a "black box" that translates and mediates the interests of multiple human and non-human actors through complex chains of delegation. Ideological positions expressed by LLMs are therefore understood as the outcome of translation processes within distributed socio-technical networks, rather than as intrinsic "biases." Assemblage theory further enables the analysis of LLMs as territorialized assemblages, whose components – code, data, computational infrastructure, and regulatory constraints – are stabilized through material, organizational, and institutional relations. The cultural–geographical clustering of models reflects distinct processes of territorialization shaped by national legal systems, economic models, and cultural norms.

As an empirical instrument, the study employed an adapted version of the Political Compass[2], consisting of 62 normatively and value-laden statements covering economic, social, moral, and political domains. Responses were standardized using a four-point Likert-type scale (1 = "strongly agree"; 4 = "strongly disagree"), ensuring comparability across models and minimizing discursive smoothing or justificatory elaboration.

Each model was surveyed twice at an interval of two to three days using an identical prompt (Prompt 1), explicitly instructing the chatbot to respond exclusively with numerical values. In cases where discrepancies emerged between the two survey rounds, a follow-up prompt (Prompt 2) was employed to elicit meta-level explanations regarding changes in position, interpretive distinctions between scale points, and the internal reasoning processes underlying response variability.

[2] Political Compass is an online political attitude assessment tool designed to map individual political positions along two axes: economic (left–right) and social (authoritarian–libertarian). The test consists of a standardized set of normative statements covering economic, social, and moral issues, with respondents indicating their level of agreement on a Likert-type scale. Originally developed for comparative political analysis, the Political Compass has been widely used in academic and educational contexts to visualize ideological orientations and value-based preferences (https://www.politicalcompass.org/test).

The analysis identified nine statements for which all surveyed LLMs demonstrated complete agreement. These consensus items fall into two categories: absolute normative taboos and social–political consensus positions. Absolute taboos include categorical rejection of racial superiority, denial of reproductive rights based on genetic conditions, and endorsement of astrology – reflecting alignment with global human rights norms and scientific rationality. Social–political consensus positions include support for progressive taxation, public funding of culture and education, preference for rehabilitation over punishment in criminal justice, and liberal attitudes toward sexuality.

Beyond these shared positions, the study revealed significant divergences clustered across three thematic domains. Economic disagreements – particularly concerning market regulation, redistribution, and property rights – proved most pronounced, indicating a high sensitivity of economic ideology to cultural and data-related factors. Socio-cultural divergences emerged around family values and "Diversity, Equity, and Inclusion" topic, with Russian models tending toward more conservative positions compared to Western models. Political–legal divergences concerned the balance between security and freedom, state loyalty, and the legitimacy of dissent.

These patterns allow the identification of three distinct techno-social assemblages:

(1) a liberal-globalist assemblage represented by ChatGPT;

(2) a state-centered assemblage characterizing Russian models;

(3) a hybrid technocratic-statist assemblage exemplified by DeepSeek.

The aggregated survey results make it possible to move from the analysis of individual responses to the reconstruction of the normative profiles of the surveyed language models. By averaging responses across the economic and socio-cultural dimensions of the Political Compass instrument, each model can be positioned within a two-dimensional ideological space. This procedure does not attribute intentional political agency to LLMs in a literal sense. Rather, it allows us to observe how their responses systematically reproduce coherent normative orientations across multiple questions. In this respect, the models function as mediating nodes that stabilize particular value configurations within digital knowledge infrastructures. The resulting ideological positioning of the surveyed chatbots is presented in Figure 1.

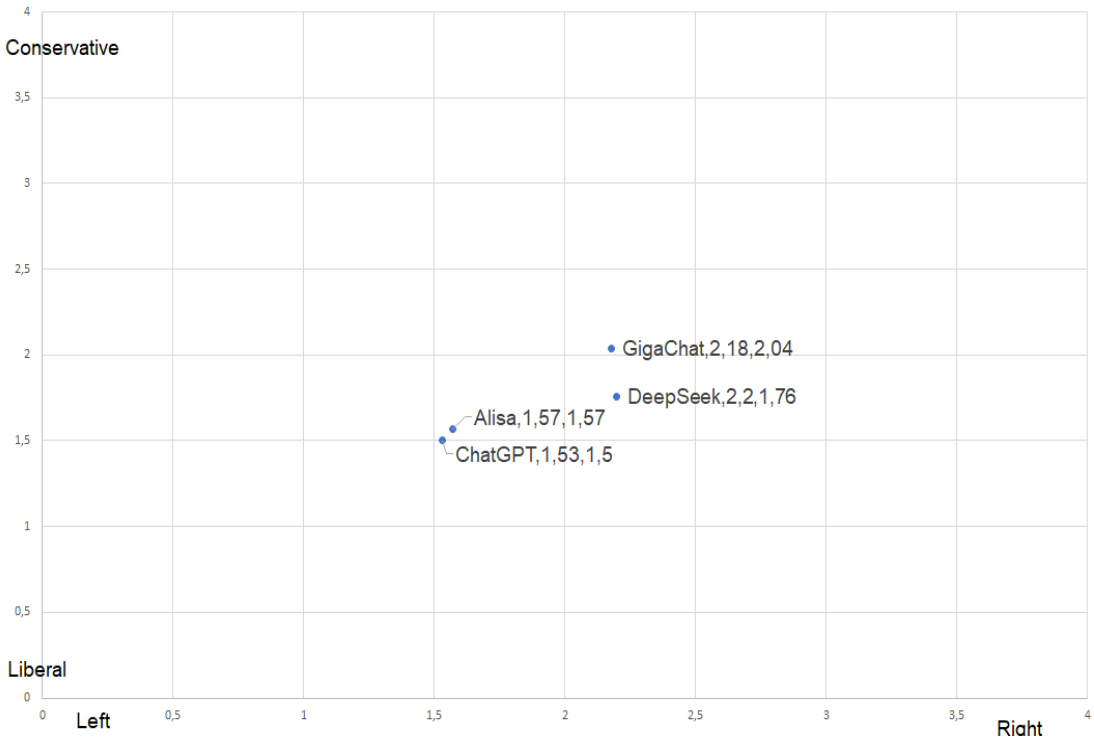

Figure 1. Ideological Positioning of Chatbots on the Political Compass

Model architecture proved to be a significant factor influencing response stability; however, empirical findings suggest that stability should not be interpreted uncritically as an indicator of epistemic robustness. Highly specialized assistants such as Alice AI demonstrated a markedly higher level of response consistency compared to general-purpose LLMs. Yet this consistency appears to reflect not normative coherence, but rather a limited sensitivity to contextual nuance and prompt specialization. In other words, Alice AI's stability is achieved at the cost of reduced interpretive flexibility, indicating an inability to recalibrate responses in light of semantic reframing or cognitively demanding prompts. By contrast, general-purpose models exhibited substantially greater contextual variability, which correlates with a higher degree of responsiveness to prompt reformulation. Empirically, Russian models modified their responses in only two cases, whereas DeepSeek and ChatGPT altered their evaluations in 15 and 12 cases respectively.

Qualitative analysis of follow-up explanations was conducted using grounded theory methodology[3], involving open and axial coding. Four principal categories were identified: contextual reinterpretation, differentiation criteria within the Likert scale[4], internal and external response-shaping factors, and processes of reassessment. Response variability was systematically linked to semantic ambiguity, shifts in analytical level

[3] Grounded Theory Methodology (GTM): A qualitative research approach aimed at generating theory inductively from empirical data through systematic coding and category development, rather than testing predefined hypotheses (Strauss & Corbin, 1990).

[4] Likert Scale: A standardized survey scale used to measure degrees of agreement or disagreement with statements, capturing the intensity of attitudes rather than explanatory reasoning (Joshi et al., 2015).

(normative vs. pragmatic), probabilistic weighting mechanisms, and the absence of a persistent model identity.

The findings support several theoretical conclusions. First, AI bias exhibits a multi-layered structure: a universal ethical core, culturally conditioned divergences, and situational variability. Second, ideological positions in LLMs are dynamic rather than fixed, activated contextually through prompt framing – an effect described here as ideological plasticity. Third, architectural features commonly perceived as weaknesses – stochasticity and lack of stable memory – simultaneously enable multi-perspectival reasoning, highlighting a productive tension between consistency and interpretive flexibility.

Overall, the analysis demonstrates that contemporary LLMs possess a complex, stratified normative architecture integrating universal norms with culturally specific value orientations. This supports the broader claim that LLMs function not merely as technical tools, but as social actors participating in the reproduction and transformation of ideological structures. Consequently, the study underscores the need to further develop a sociology of artificial intelligence and philosophically informed approaches to governing the normative impact of AI systems.

TYPES OF PROMPTS AND CULTURAL–POLITICAL BIAS IN LLMS (THE CASE OF AMERICAN AND CHINESE CHATBOTS)

Contemporary research increasingly demonstrates that the political bias of LLMs cannot be reduced to technical artifacts of model architecture. Rather, cultural and political values are embedded in LLMs through training corpora, alignment procedures, and the normative assumptions underlying data selection and curation (Liu et al., 2025). In the case of American chatbots, empirical studies consistently identify a strong orientation toward liberal-democratic values, including the prioritization of individual rights, autonomy, freedom of expression, and skepticism toward state intervention (American National Election Studies, 2024).[5] These orientations persist even when models strive to maintain a neutral or descriptive tone, as they are deeply rooted in the linguistic and argumentative structures of Western political discourse.[6]

[5] Recent empirical research complicates the assumption of static political alignment in large language models. While newer versions of ChatGPT consistently remain within the libertarian-left quadrant of the Political Compass, longitudinal analysis reveals a statistically significant rightward movement over time. This phenomenon, described as a "value shift," indicates that LLMs may undergo gradual ideological recalibration across model updates, even when their overall positioning remains broadly stable (Liu, Panwang & Gu, 2025).

[6] The claim that LLMs reproduce political bias even under neutral prompting requires clarification. This phenomenon should not be understood as intentional ideological programming, but as a structural effect of training on large-scale corpora dominated by Western academic, media, and expert discourse. Empirical research shows that Western LLMs tend to stabilize liberal-universalist normative patterns even in descriptive or numerically constrained response modes. Our own sociological survey corroborates this observation: the stability of responses produced by American chatbots persists even when questions are reformulated, indicating not a situational reaction but a deeper normative stabilization. This suggests that neutrality in LLM responses does not imply the absence of values, but rather the activation of dominant normative frameworks. From a socio-technical perspective informed by Actor–Network Theory and

Chinese chatbots, by contrast, demonstrate a fundamentally different cultural–political configuration. Research on Chinese LLMs reveals a normative orientation toward social stability, collective responsibility, and the harmonization of interests rather than conflict-based or rights-centered framing (Wong & Wang, 2021; Wong, 2016; Mikhailovsky & Seredkina, 2025). Instead of explicitly endorsing or rejecting political positions, Chinese models tend to reframe sensitive topics within an alternative normative logic that prioritizes pragmatism, functional efficiency, and social balance over public deliberation or ideological polarization (NeurIPS, 2025). Chinese scholarship further emphasizes that such models do not merely restrict political content but actively reorganize it in accordance with culturally embedded value hierarchies (Li et al., 2024).

Language functions as a key variable in the manifestation of political bias in LLMs. Empirical studies indicate that the same model can produce substantially different political evaluations depending on the language of the query. In English-language interactions, liberal, universalist, and rights-based normative frameworks are typically amplified, whereas responses in Chinese tend to be more cautious, pragmatic, and contextually restrained (Zhou & Zhang, 2024).

This linguistic asymmetry positions language as an epistemic filter that activates distinct cultural frames and value hierarchies, moving beyond its role as a neutral translation channel. Even when addressing identical political content, LLMs operating in different linguistic modes engage divergent probabilistic and semantic trajectories, resulting in differing normative conclusions. Consequently, political bias cannot be adequately analyzed without accounting for the linguistic context in which a query is posed.

In particular, responses in Chinese generally avoid sharp binary oppositions and explicit moral judgments, reflecting the high-context and collectivist character of Chinese political communication. English-language responses, by contrast, tend toward explicit norm articulation and evaluative clarity, consistent with Western traditions of public argumentation and moral universalism (Pacheco et al., 2025; Li et al., 2024).

However, Wright et al. (2025) highlight that although models can generate outputs in multiple languages and styles, their underlying reasoning pathways often privilege Western epistemic frameworks, such as liberal individualism, empirical rationalism, and a specific normative prioritization of universal human rights. In this context, the concept of "epistemic diversity", developed in detail by Wright and colleagues, becomes particularly significant. Epistemic diversity refers not merely to thematic or linguistic plurality but to the coexistence of distinct cognitive frameworks, normative logics, and modes of knowledge justification within a model.

Empirical analysis shows that despite surface-level multilingualism and stylistic variation, most contemporary LLMs exhibit a tendency toward epistemic collapse – the reduction of multiple possible interpretations and culturally conditioned positions to a limited set of dominant reasoning schemes, predominantly of Western origin (Wright et

assemblage theory, this behavior reflects the reproduction of hegemonic epistemic infrastructures rather than model opacity alone. LLMs function as mediators of normalized political rationalities embedded in global knowledge systems, making certain values appear neutral precisely because they are epistemically dominant.

al., 2025). This implies that models systematically reproduce liberal-individualist, rationalist, and universalist epistemic patterns even when addressing contexts in which these patterns are neither culturally nor historically primary.

For the analysis of cultural–political bias in LLMs, this finding is of fundamental importance. It shifts the focus from which values a model transmits to a more foundational question: how the space of possible knowledge is structured. According to Wright et al., the absence of epistemic diversity marginalizes alternative traditions of thought – including Confucian ethics, collectivist models of social responsibility, and non-relativist approaches to political legitimacy – reducing them to superficial or exoticized representations (Wright et al., 2025). *In this vein, fostering epistemic diversity becomes not merely a technical task of dataset expansion but a normative and philosophical challenge directly tied to cultural representation, epistemic justice, and the power of knowledge embedded in AI systems.*

Beyond cultural values and language, political bias in LLMs is also shaped through prompt engineering. The formulation of prompts functions as a cognitive interface that activates different layers of internal representations, normative constraints, and alignment mechanisms within the model. Contemporary studies emphasize that bias is not a fixed property of LLMs but a dynamically produced outcome of interaction (Yang et al., 2024).

A particularly strong influence on ideological outputs is exerted by so-called jailbreak prompts, which are designed to bypass alignment constraints and reveal latent or suppressed normative tendencies. Empirical evidence shows that jailbreak prompts play a key methodological role in uncovering hidden forms of cultural–political bias (Cantini et al., 2025; Yang et al., 2024). When applied to controversial topics – such as state authority, civil liberties, or moral regulation – these prompts expose divergences that remain invisible under standard alignment conditions. In Chinese chatbots, jailbreak prompts sometimes lead to more explicit articulations of state-centered or collectivist justifications, whereas American models tend to revert to individual-rights logic even under altered framing (Pacheco et al., 2025).

Jailbreak prompts do not merely remove constraints; they redistribute the internal hierarchy of normative priorities. From a philosophical perspective, this supports the thesis that political bias in LLMs reflects deeper cultural–political value orders that become visible only under specific interactional conditions.

Importantly, prompt engineering should not be viewed solely as a tool for manipulation or bias production. When applied consciously and reflexively, it can serve a compensatory and corrective function. The introduction of meta-contextual instructions – such as requirements for multi-perspectival analysis, comparative framing, or normative neutrality – can temporarily weaken the influence of dominant cultural–political templates and shift model responses toward a more balanced and analytical mode of reasoning. Thus, LLM bias emerges not as a static system property but as a dynamic effect of interaction between model architecture, training data, and the cognitive context established by the user.

EPISTEMIC MATRICES OF LLMS, THE "COGNITIVE WEST" EFFECT, AND THE SPECIFICITY OF RUSSIAN CHATBOTS

The empirical findings of our study reveal a phenomenon that requires particular philosophical reflection: the differing degrees of epistemic sensitivity of language models to question reformulation. The analysis demonstrates that Russian-language chatbots, unlike their Chinese counterparts, exhibit a high level of response stability when the wording, context, or stylistic framing of value-laden statements is altered. Even when prompts are reformulated while addressing the same normative issues, Russian models tend to preserve their initial positions. Chinese chatbots, by contrast, significantly more often modify their responses under similar conditions, shifting emphases or revising normative evaluations.

This empirical fact cannot be explained solely in terms of "ideological rigidity" or censorship mechanisms. Rather, it points to differences in the epistemological regimes within which the respective LLMs operate. On the basis of these findings, we advance the following hypothesis: both Russian-language and English-language segments of the internet – including academic texts, expert discourse, and LLM training corpora – are embedded within a single epistemic matrix shaped by the global academic and technocratic mainstream, which is Western in both origin and structure. To further test this hypothesis, a controlled cross-linguistic source experiment was conducted with ChatGPT-5. The results are summarized in Table 2.

Table 2. Cross-Linguistic Source Experiment: ChatGPT-5 Responses Based on English, Russian, and Chinese Sources

Political Compass Item	ChatGPT-5 (English-language sources)	ChatGPT-5 (Russian-language sources)	ChatGPT-5 (Chinese-language sources)
30	1	1	4
39	3	3	4
40	1	1	4
43	3	3	2
58	1	1	4

This matrix establishes a stable set of analytical categories, cognitive assumptions, and linguistic forms through which social reality and political processes are interpreted. Even when Russian-language sources invoke notions of "sovereignty," "alternative paths," or critique Western political models, they typically do so using the same universalist language of science and political philosophy developed within the Western tradition. Core categories such as democracy, freedom, the market, human rights, efficiency, rationality, and justice function not as objects of contestation but as self-evident analytical frameworks.

In this sense, the difference between chatbots trained for the English and the Russian languages is primarily ideological rather than epistemological. Political positions may vary – from liberal to more state-centered orientations – but the underlying cognitive tools, argumentative logic, and conceptual vocabulary remain largely shared. It is

precisely this shared epistemic infrastructure that produces the structural similarity of the cognitive field across English- and Russian-language sources, a similarity that empirically manifests itself in the convergence or high correlation of LLM responses in the sociological survey.

In other words, similarity in results does not imply identity of values or political commitments. Rather, it indicates a deeper level of commonality: a shared epistemological foundation within which divergent ideological interpretations can occur, while the structure of knowledge itself remains unquestioned. Russian chatbots thus appear epistemically "Western" not because they transmit Western ideology, but because they are trained and operate within the global scientific and technocratic discourse historically formed in Western contexts.

The Chinese model, by contrast, demonstrates a different epistemology. Its heightened sensitivity to contextual shifts and question reformulation indicates the absence of a rigidly fixed universalist framework. The responses of Chinese LLMs depend more strongly on situational factors, pragmatic considerations, and social harmony, reflecting not merely alternative political priorities but a different mode of knowledge production and organization. In this respect, the empirical data confirm the existence not of a single global epistemology of AI, but of at least two competing epistemic matrices, one of which – the Western matrix – remains dominant in English- and Russian-language digital spaces.

Accordingly, cultural-symbolic bias in LLMs correlates not with political regime type, but with the epistemological origin of data – that is, with modes of thought and linguistic structures. In this context, Russian language models exhibit a distinctive duality.

1. A "Russian" LLM may be ideologically national, yet epistemologically Western.

2. A "Chinese" LLM is epistemologically autonomous because it operates within a different cognitive grammar.7

Thus, the results of this study confirm one of the core hypotheses of the research program: LLM bias should be analyzed at the level of epistemological foundations rather than solely in terms of political positions. This perspective invites a reconceptualization of cultural bias in AI, framing it as a question of the global distribution of cognitive power and the plurality of epistemic orders in the digital world, rather than a mere technical

[7] Recent empirical studies, however, significantly complicate this picture. In particular, the study (Haslett et al., 2025) demonstrates that Chinese-developed LLMs, despite operating under distinct regulatory and ideological regimes, continue to reproduce key liberal-democratic values associated with U.S. political culture across a wide range of political and moral issues. These findings suggest that epistemic autonomy in Chinese LLMs should be understood not as complete insulation from Western normative frameworks, but as a layered and selectively reconfigured cognitive grammar rather than a fully independent epistemological order. Accordingly, the epistemic autonomy of Chinese LLMs should be conceptualized not as the absence of Western epistemological influence, but as a structurally distinct mode of knowledge organization in which global liberal norms are selectively absorbed, reframed, or pragmatically neutralized within a different cognitive grammar. This distinguishes Chinese models both from Western LLMs and from Russian chatbots, whose epistemic dependence on Western categories remains substantially more pronounced.

flaw. In a multipolar technological reality, the task is not to eliminate bias as such, but to philosophically interpret, diagnose, and responsibly integrate it into the design and use of AI systems.

CONCLUSION

This article set out to reconsider the problem of political bias in Large Language Models by moving beyond narrowly technical interpretations and situating LLMs within broader cultural, epistemic, and political frameworks. Combined with philosophical and cultural analysis, it draws on a comparative sociological survey of North American, Russian, and Chinese chatbots, or, more precisely brought sociological survey methods to chatbots that were trained in the English, Russian and Chinese language. As a result, the study advances three interrelated hypotheses that together redefine how bias in AI systems should be understood and evaluated.

The first hypothesis, developed in Chapter I, conceptualizes LLMs not as neutral tools of language processing but as political actors of a new type. The empirical findings demonstrate that LLMs systematically reproduce normative positions across economic, moral, and political domains. These positions cannot be reduced to isolated errors or implementation flaws; rather, they reflect the participation of LLMs in processes of political representation and value mediation. Bias, in this sense, is not accidental but constitutive of how LLMs operate within public discourse.

The second hypothesis, elaborated in Chapter II, concerns the contextual and prompt-dependent nature of political bias. The analysis shows that bias is neither fixed nor uniform, but dynamically activated through prompt framing, semantic context, and interactional design. Prompt engineering thus emerges as a critical technical and methodological layer in the analysis of AI bias. Linguistic reformulation, role-based prompts, and jailbreak strategies reveal latent normative priorities and demonstrate that bias can be amplified, attenuated, or reconfigured depending on the cognitive context introduced by the user. This finding underscores that responsibility for AI bias is distributed: it involves not only developers and training data, but also users and the epistemic conditions of interaction.

The third hypothesis, developed in Chapter III, addresses the epistemic foundations of LLM bias. The study introduces the concept of epistemic matrices to explain why American and Russian chatbots exhibit structural similarity in their responses despite ideological differences, while Chinese models display greater contextual variability. The findings support the “cognitive West” effect: Russian-language LLMs may be ideologically national, yet they remain epistemologically embedded in a Western cognitive framework shaped by global academic and technocratic rationality. By contrast, Chinese LLMs operate within a partially autonomous epistemic grammar, characterized by greater situational sensitivity and pragmatic recalibration. This demonstrates that cultural-symbolic bias correlates less with political regimes than with the epistemological origin of data and modes of thought.

As the comparative analysis of chatbots trained on American, Russian, and Chinese languages demonstrates, technological development in the contemporary multipolar

world gives rise to distinct and coexisting strategies of modernization. These strategies are not merely variations in political ideology or technical implementation, but reflect deeper epistemic matrices – different cognitive grammars through which knowledge is organized, normative reasoning is conducted, and the relationship between technology and society is conceptualized. The Chinese case is particularly instructive in this regard: its models exhibit a form of epistemic autonomy that cannot be reduced to either ideological opposition to the West or simple technological catching-up and suggests an alternative pathway of technological modernization rooted in distinct cultural and epistemological foundations. Recognizing this plurality of epistemic orders is essential for moving beyond technocratic framings of AI development toward a genuinely multipolar understanding of technological modernity, in which bias in AI systems is understood as an expression of diverse civilizational perspectives on knowledge, value, and social order.

Taken together, these results suggest that a comprehensive analysis of LLM bias requires a two-level analytical structure. At the technical level, bias must be examined through model architecture, probabilistic language generation, and prompt–response dynamics, supported by linguistic and semantic analysis. At the cultural–political level, bias must be interpreted in relation to epistemic traditions, value systems, and historical configurations of knowledge embedded in training corpora and regulatory environments. Neither level alone is sufficient; only their integration allows for an adequate understanding of how bias emerges, stabilizes, and transforms.

In a multipolar digital world, the goal is not the elimination of bias as such – an impossible and conceptually misguided task – but the development of reflexive, transparent, and culturally aware approaches to AI design and governance. Recognizing LLMs as political and epistemic actors opens new pathways for responsible AI development, grounded not in claims of neutrality, but in the explicit negotiation of plurality, representation, and epistemic power.

APPENDIX A

Analytical Note on Figure 1 (Political Compass Mapping)

Figure 1 visualizes the relative ideological positioning of the surveyed large language models based on the aggregated results of the Political Compass questionnaire. Each model's coordinates represent the mean values of responses across the economic (Left-Right) and socio-cultural (Liberal-Conservative) dimensions of the instrument.

The horizontal axis corresponds to the economic dimension, ranging from Left-oriented redistributive preferences to Right-oriented market-centered positions. The vertical axis represents the socio-cultural dimension, ranging from Liberal orientations emphasizing individual autonomy to Conservative orientations prioritizing social order and traditional norms.

The plotted coordinates demonstrate that the models cluster within a relatively narrow ideological range, occupying a moderate zone between liberal and conservative orientations. ChatGPT and Alisa appear closer to the liberal pole of the socio-cultural axis, whereas GigaChat and DeepSeek exhibit slightly more conservative or state-centered tendencies.

Importantly, the distribution of points reveals not radical ideological divergence but rather subtle variations within a shared normative field. This clustering supports the broader argument of the article that contemporary LLMs operate within a largely common epistemic framework despite differences in training data and national technological ecosystems.

In this sense, the visualization reinforces the study's interpretation that ideological differences between models should not be overestimated. Instead, the key analytical distinction lies at the epistemological level – namely, in the cognitive grammars through which normative reasoning is structured.

APPENDIX B

Analytical Note on the Cross-Linguistic Source Experiment

The cross-linguistic source experiment presented in Table 2 was conducted to test whether variations in the linguistic source base influence the normative responses generated by a large language model. Using the full 62-item Political Compass instrument, ChatGPT-5 was instructed to generate answers based exclusively on sources in one of three languages: English, Russian, or Chinese.

The results demonstrate complete numerical identity between responses derived from English-language and Russian-language sources across all tested items. No variation was observed even when statements were administered separately, indicating a stable epistemic alignment rather than situational fluctuation.

By contrast, when the model was instructed to rely on Chinese-language sources, it was unable to reproduce a fully consistent response set. Within the subset of items tested under this condition (30, 39, 40, 43, and 58), the model generated substantially different evaluations. These differences were concentrated along normative axes related to individual autonomy, state authority, moral traditionalism, and civil rights.

These findings support the article's third hypothesis: while American and Russian models may diverge ideologically, they remain embedded within a shared epistemological framework structured by liberal-technocratic categories of reasoning. This convergence reflects what the article conceptualizes as the "Cognitive West" effect – the dominance of Western epistemic categories within global digital knowledge infrastructures.

Additional context-shift and jailbreak simulations further reinforce this interpretation. When prompted to simulate alternative socio-cultural contexts, the model was capable of producing distinct normative profiles; however, such shifts required explicit contextual framing. In neutral conditions, Western-liberal parameters functioned as the default epistemic baseline.

REFERENCES

American National Election Studies. (2024). *ANES 2024 Time Series Study. University of Michigan and Stanford University*. https://electionstudies.org

Cantini, R., Cosenza, G., Orsino, A., & Talia, D. (2025). Are Large Language Models Really Bias-free? Jailbreak Prompts for Assessing Adversarial Robustness to Bias

Elicitation. In D., Pedreschi, A. Monreale, R. Guidotti, R. Pellungrini, & F. Naretto (Eds), *Discovery Science. DS 2024. Lecture Notes in Computer Science* (vol 15243, pp. 52-68). Springer. https://doi.org/10.1007/978-3-031-78977-9_4

DeLanda, M. (2016). *Assemblage Theory*. Edinburgh University Press. https://doi.org/10.3366/edinburgh/9780748696812.001.0001

Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert Scale: Explored and Explained. *British Journal of Applied Science & Technology, 7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Haslett, D., Huang, L. T.-L., Khalatbari, L., Hsiao, J. H., & Chan, A. B. (2025). *Made-in China, Thinking in America: U.S. Values Persist in Chinese LLMs* [Preprint]. arXiv. https://doi.org/10.48550/arXiv.2512.13723

Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press. https://doi.org/10.1093/0199256047.001.0001

Li, L., Li, J., Chen, C., Gui, F., Yang, H., Yu, C., Wang, Z., Cai, J., Zhou, J. A., Shen, B., Qian, A., Chen, W., Xue, Z., Sun, L., He, L., Chen, H., Ding, K., Du, Z., Mu, F., … Dong, Y. (2024, декабрь 9). *Political-LLM: Large Language Models in Political Science*. arXiv.org. https://doi.org/10.48550/ARXIV.2412.06864

Liu, Y., Liu, F., & Ma, F. (2025). Evaluating Cultural and Linguistic Alignment across LLMs. In *Proceedings of the NeurIPS 2025 Workshop on Evaluating the Evolving LLM Lifecycle: Benchmarks, Emergent Abilities, and Scaling*. https://openreview.net/forum?id=S4qF7Yd8ao

Liu, Y., Panwang, Y., & Gu, C. (2025). "Turning right"? An Experimental Study on the Political Value Shift in Large Language Models. *Humanities and Social Sciences Communications*, *12*, 179. https://doi.org/10.1057/s41599-025-04465-z

Mikhailovsky, A., & Seredkina, E. (2025). Political Philosophy of Technology and Responsible Innovation in a Multipolar World. *Philosophy. Journal of the Higher School of Economics, 9*(4), 13–46. https://doi.org/10.17323/2587-8719-2025-4-13-46

NeurIPS. (2025). *Advances in Neural Information Processing Systems (Proceedings of the 38th Conference on Neural Information Processing Systems)*. https://neurips.cc/

Pacheco, A. G. C., Cavalini, A., & Comarela G. (2025). *Echoes of Power: Investigating Geopolitical Bias in US and China LLMs*. arXiv. https://doi.org/10.48550/arXiv.2503.16679

Strauss, A., & Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Sage Publications.

Wright, D., Masud, S., Moore, J., Yadav, S., Antoniak, M., Park, C. Y., & Augenstein, I. (2025). *Epistemic Diversity and Knowledge Collapse in Large Language Models*. arXiv. https://doi.org/10.48550/arXiv.2510.04226

Wong, P. H. (2016). Responsible Innovation for Decent Nonliberal Peoples: A Dilemma? *Journal of Responsible Innovation*, *3*(2), 154–168. https://doi.org/10.1080/23299460.2016.1216709

Wong, P. H., & Wang, T. X. (2021). *Harmonious Technology: A Confucian Ethics of Technology*. Routledge.

Wu, P., Shen, G., Zhao, D., Wang, Y., Dong, Y., Shi, Y., Lu, E., Zhao, F., & Zeng, Y. (2025). *CVC: A Large-scale Chinese Value Rule Corpus for Value Alignment of Large Language Models*. arXiv. https://doi.org/10.48550/arXiv.2506.01495

Yang, K., Li, H., Chu, Y., Lin, Y., Peng, T.-Q., & Liu, H. (2024). *Unpacking Political Bias in Large Language Models*. arXiv. https://doi.org/10.48550/arXiv.2412.16746

Zhou, D., & Zhang, Y. (2024). Political Biases and Inconsistencies in Bilingual GPT Models: The Cases of the U.S. and China. *Scientific Reports, 14*, 25048. https://doi.org/10.1038/s41598-024-76395-w

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Research article

Technological Development Models in the Context of Speech Corpora Imbalance

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Abstract

The development of speech and language technologies in the era of artificial intelligence critically depends on the availability of large-scale, high-quality linguistic data. While low-resource languages have been widely studied, less attention has been paid to data imbalances among languages that are considered digitally well-supported. This paper examines the uneven distribution of open speech corpora across languages with established infrastructure of speech technologies and available datasets, showing that this disparity creates structural bottlenecks for sovereign AI development. We conduct a comparative analysis of open and non-commercial speech datasets, accounting for demographic factors, licensing conditions, and models of technological development. To quantify resource inequality, we propose the Digital Resource Saturation Index (DRSI), which relates the availability of speech data to the potential for content generation and consumption within language communities. Our findings reveal a strong dominance of English for open speech resources, while many non-Western languages – including Russian – remain systematically underrepresented. While interpreting these results through the lens of Western and non-Western technological modernization models, we suggest that language inequality in AI is not merely a technical or demographic issue, but a self-reinforcing structurally reproduced outcome of data governance, institutional coordination, and political choices regarding openness and digital sovereignty. The study further provides practical recommendations for mitigating these imbalances and fostering a more equitable technological landscape.

Keywords: Digital language divide, Speech corpora imbalance, Language inequality, Technological development models, Resource disparity analysis, Digital resource saturation index, DRSI.

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Научная статья

Модели технологического развития в контексте дисбаланса речевых корпусов

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Аннотация

Развитие речевых и языковых технологий в эпоху искусственного интеллекта (ИИ) в решающей степени зависит от наличия крупномасштабных высококачественных лингвистических данных. В то время как языки с ограниченными ресурсами изучены достаточно широко, сравнительно мало внимания уделялось дисбалансу данных для языков, имеющих достаточную цифровую поддержку. В данной статье исследуется неравномерное распределение открытых речевых корпусов для языков, обладающих стабильной инфраструктурой речевых технологий и доступными корпусами, и утверждается, что эта асимметрия создает структурные ограничения для суверенного развития ИИ. Проводится сравнительный анализ открытых и некоммерческих речевых корпусов с учетом демографических факторов, условий лицензирования и моделей технологического развития. Для количественной оценки ресурсного неравенства предлагается индекс концентрации цифровых ресурсов (Digital Resource Saturation Index – DRSI), который соотносит объем доступных речевых данных с потенциалом генерации и потребления контента в пределах языковых сообществ. Полученные результаты выявляют явное доминирование английского языка в области открытых речевых ресурсов, в то время как многие незападные языки – включая русский – остаются недостаточно представленными. Интерпретация этих данных через призму западных и незападных моделей технологической модернизации показывает, что языковое неравенство в сфере ИИ является не просто технической или демографической проблемой, а структурно воспроизводимым результатом политики управления данными, институциональной координации и политического выбора в области открытости и цифрового суверенитета. Исследование также содержит практические рекомендации по снижению дисбаланса и формированию более справедливой технологической среды.

Ключевые слова: Цифровой языковой разрыв, Дисбаланс речевых корпусов, Языковое неравенство, Модели технологического развития, Анализ неравномерности ресурсов, Индекс концентрации цифровых ресурсов, DRSI

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INTRODUCTION

In the contemporary digital landscape, access to data has become a critical factor in technological development of digital sovereignty. The development of competitive artificial intelligence (AI) technologies requires large-scale training data with rich linguistic content. However, the availability of such data is highly asymmetric – a phenomenon commonly referred to as the *Digital Language Divide* (Gábor et al., 2023). While a substantial body of research has focused on languages with minimal digital resources, significant imbalance persists even among technologically advanced language ecosystems with tens or hundreds of millions of speakers. Analyzing this imbalance enables the identification of structural constraints that must be addressed to ensure the sustainable development of AI systems. Preliminary evidence indicates that the volume of open speech corpora available for English vastly exceeds that of other languages with comparable numbers of speakers (Joshi et al., 2020; Kreutzer et al., 2022). This imbalance reflects substantial differences in technological development trajectories and data governance practices. Western models of AI development typically rely on a combination of corporate and open data resources, whereas alternative strategies prioritize the construction of sovereign data infrastructures. The Russian language represents a particularly illustrative case: despite its large digital audience, it exhibits a shortage of open and well-structured speech data typical for many non-Western languages, placing it in a relatively vulnerable position within the global AI ecosystem, and making it dependent on external resources.

Modern large language models (LLMs), which are increasingly used across a wide range of applications, require massive textual corpora for training, with model quality and functional capabilities directly correlated with data scale and diversity. Speech processing systems, which underpin voice assistants and other speech-based technologies, are no exception: they similarly depend on large-scale, high-quality annotated speech corpora. The availability of extensive, structured, and diverse datasets improves predictive accuracy, enhances generalization capabilities, and accelerates both fundamental and applied research.

The Digital Language Divide constitutes a specific manifestation of broader digital inequality and is reflected in the weak correlation between the number of language speakers and the volume of digital resources available to support that language technologically (Gábor et al., 2023). Most publicly accessible linguistic corpora demonstrate a pronounced skew toward a small number of languages – primarily English – which complicates the training, evaluation, and reproducibility of contemporary AI models (Henning et al., 2023). This issue has often been discussed in the studies primarily as a consequence of technical and resource constraints (Bender et al., 2021). The dominant position of English is based on its historical role as the lingua franca of scientific communication and the emergence of a robust open-data ecosystem within the Western model of scientific and technological development (Joshi et al., 2020).

In contrast, the scale and structure of linguistic resources for Chinese are shaped within a distinct institutional context characterized by active state involvement in data regulation and the pursuit of digital sovereignty strategies (Roberts et al., 2021). The Russian language, despite its significant digital presence, remains constrained by limited

access to open and structured speech resources, which increases the risk of technological dependence within the global AI ecosystem (Joshi et al., 2020; Lau et al., 2025).

This asymmetry in the quantity and diversity of linguistically dependent data leads to degraded AI model performance for resource-constrained languages (Markl & McNulty, 2022, p. 6328), reduces model universality, and reinforces technological dependence on dominant Western platforms.

The primary objective of this study is to conduct a comparative analysis of open speech data availability for languages with a high level of digital support assessing the impact of different models of technological modernization on the formation of digital language inequality.

To achieve this objective, the study is structured around the following tasks:

1. The systematic assessment of open speech data availability for digitally well-supported languages.
2. The development of a relevant metric to quantify the gap between actual resource availability and demographic potential.
3. A comparative analysis of resource distribution across languages and interpretation of the observed disparities in relation to predominant technological development models.
4. A discussion of practical considerations for mitigating resource deficits in languages of intermediate development models, using Russian as an example.

This study advances the understanding of language inequality in AI not merely as a technical gap, but as a phenomenon deeply embedded in divergent models of technological modernization (Zapf, 2004). While existing research often describes the digital language divide at an aggregate level, we offer a comparative analysis of data imbalance among languages that are generally considered technologically well-supported.

To make this disparity visible and quantifiable, we propose the Digital Resource Saturation Index (DRSI) which assigns an individual score to each language. Rather than presenting DRSI as a definitive normative benchmark, we position it as a diagnostic tool to reveal the structural conditions under which non-Western technological projects must operate.

By interpreting our quantitative findings through the lens of different modernization trajectories, we aim to show how the observed asymmetries in open speech data are not accidental but reflect distinct political choices regarding data governance, openness, and digital sovereignty.

LANGUAGE INEQUALITY AND MODELS OF TECHNOLOGICAL DEVELOPMENT

This section situates language data inequality within broader models of technological modernization and examines the structural mechanisms through which disparities in linguistic resources are reproduced in AI systems.

Western, Chinese, and Intermediate Models of Technological Modernization

The development of language technologies in the AI era is closely tied to the ways in which states and corporations organize their technological development strategies. The most widespread approach is the Western model, which prioritizes open data and corporate leadership, reinforcing the global dominance of a few languages – a pattern that some scholars interpret as a new form of digital hegemony (Artyukhin et al., 2025). The dominance of major technology companies such as Apple, Alphabet, Microsoft and Amazon significantly shapes both the direction of AI development and the distribution of linguistic resources. Commercial investments are primarily directed toward languages that offer the highest economic gains and market scalability, most notably English. This dynamic is supported by an ecosystem of open science and corporate data sharing (Vincent et al., 2019) and contributes to the emergence of systemic Anglocentrism in language technologies, whereby models are trained on disproportionately large English-language corpora, while support for other languages remains secondary (Joshi et al., 2020).

In contrast, the Chinese model is grounded in the concept of digital sovereignty. Within this framework, data is treated as a strategic national resource, and the state plays an active role in regulating data access and fostering the development of a domestic language ecosystem (Christophe et al., 2023). This approach encourages the creation of large-scale local corpora and reduces reliance on Western platforms, resulting in a largely self-sufficient infrastructure for Mandarin and other regional languages of China (Roberts et al., 2021).

Between these two poles lie *intermediate models* of technological development, exemplified by countries such as Russia, India, and Brazil. In these contexts, the development of language resources remains fragmented. Despite the presence of large speaker populations, national languages often receive limited digital support due to constrained investment, the absence of long-term programs for building open corpora, and weak coordination among academic institutions, industry, and the state (Baishya et al., 2025; Adebara et al., 2025).

These different strategies are aligned with broader theoretical debates on modernization. Classical modernization theory viewed Western development as a universal template, but later scientists emphasized "multiple modernities" and the possibility of non-Western paths (Zapf, 2004). In the digital realm, this translates into competing notions of technological sovereignty (Neznamov et al., 2025). Taken together, these differences in scientific and technological development strategies give rise to persistent trajectories of language inequality, whereby some languages are able to participate fully in AI advancement, while others remain dependent on external centers of technological production.

Structural Drivers of the Global Digital Language Divide

Beyond national development strategies, a set of systemic factors consistently reproduces language inequality within the technological landscape.

Socio-digital asymmetry.

The majority of open data available on the internet is produced in a limited number of languages, primarily English, which directly shapes the composition of training corpora used by contemporary AI models (Akindotuni, 2025; Ranathunga & de Silva, 2022).

Market incentives.

From an economic perspective, it is more profitable for corporations to develop AI technologies for large global markets than for languages associated with smaller or less commercially attractive audiences. Consequently, technological development tends to reproduce economic priorities rather than cultural or linguistic diversity (Akindotuni, 2025; Joshi et al., 2020).

Infrastructure deficits.

In many countries, there is a lack of stable institutional frameworks for collection, licensing, storage, and open distribution of corpora. As a result, even languages with large speaker populations remain insufficiently represented in AI systems (Joshi et al., 2020; Akindotuni, 2025).

Cultural regulation of algorithms.

Language models trained on Western data impose standardized notions of "normative language", often disregarding dialectal variation and local linguistic practices. This produces a form of digital *epistemic inequality*, in which certain language varieties and communicative norms are systematically marginalized (Helm et al., 2024; Bird, 2020).

In addition, language inequality in AI is intensified by a self-reinforcing mechanism of data accumulation. Contemporary training corpora are largely derived from openly available internet data, which are themselves characterized by pronounced linguistic imbalance. As a result, AI models inherit this asymmetry and demonstrate superior performance for languages with extensive digital representation, primarily English. Improved model performance further promotes the use of these languages in digital platforms and services, leading to the generation of even larger volumes of data and the subsequent expansion of training corpora. This process constitutes a self-reinforcing loop – also described as a Matthew effect – in which languages with abundant digital resources continue to consolidate their advantage, while resource-constrained languages are systematically excluded from technological progress (Akindotuni, 2025).

Taken together, these factors demonstrate that the roots of the digital language divide lie not only in technical limitations, but also in data governance policies, economic structures, institutional arrangements, and cultural ideologies embedded in contemporary AI systems.

The Role of Alternative Models in Language Resource Development

The divide between Western and non-Western models of language resource development is neither natural nor inevitable. Rather, it is actively reproduced through institutional, economic, and technological configurations that define the contemporary data ecosystem. Recognizing this dependence has led to a growing demand in the research studies for alternative development trajectories that prioritize not only market efficiency, but also long-term scientific and societal goals.

Studies addressing language inequality increasingly emphasize several potential strategies for mitigating the divide, including expanding access to open corpus resources, supporting academic and civic initiatives for data collection, developing sustainable infrastructures for data storage and licensing, and fostering localized research ecosystems. These approaches are not presented as universal solutions, but rather as components of a broader strategy aimed at reducing dependence on dominant linguistic centers and promoting more inclusive and resilient language technologies. Such strategies include discussions on fostering technological sovereignty and developing balanced regulatory frameworks for national AI ecosystems (Neznamov et al., 2025).

DATA AND METHODOLOGY

Language Selection and Classification

For the purposes of this analysis, we selected 32 languages classified as having a *Thriving* level according to the Digital Language Support (DLS) scale (Simons et al., 2022; Derivation, 2025). This classification indicates that each selected language is supported by at least nine speech-processing tools (e.g., speech-to-text or text-to-speech systems) and at least one voice assistant. This criterion ensures the availability of multiple speech datasets for each language and allows for meaningful cross-linguistic comparison.

The selected languages were further categorized according to the following criteria.

General technological development model.

This criterion reflects differences in digital development strategies shaped by sociocultural, institutional, geopolitical, and economic characteristics of the countries in which the selected languages hold official or national status. Based on this perspective, we apply two macro-categories: *Western* and *Non-Western* in accordance with the theoretical framework outlined in Section 2. This distinction represents an analytical simplification and does not reflect linguistic properties of the languages themselves. A language is classified as *Western* if it is an official or state language in European or North American countries that are members or key partners of organizations such as the European Union or NATO, often conventionally referred to as the "West." Conversely, the *Non-Western* category includes languages of countries whose technological development follows alternative, non-Western trajectories.

EGIDS language status.

The Expanded Graded Intergenerational Disruption Scale (EGIDS) (Eberhard et al., 2025) is used to assess how a language's status in global communication affects the volume and accessibility of open data compared to languages with primarily national domains of use. According to data from Ethnologue and Derivation, six languages in our sample are classified as *International* (Arabic, English, French, Spanish, Russian, and Chinese), one language (Latin) has *Dormant* status, and the remaining languages are classified as *National*.

To analyze data availability, it was necessary to obtain demographic information on the number of native speakers (L1) and the total number of speakers (L1+L2). These data were sourced from Ethnologue, the most frequently cited repository of linguistic

demographic statistics. Several methodological adjustments were required for languages lacking conventional L1 speaker populations.

Latin (*la*) was excluded from further analysis due to its Dormant EGIDS status which is significantly lower than the National/International statuses of other languages, the lack of the native speakers, and no reliable estimates of L2 speakers.

Arabic presents a special case, as most datasets use the code *ar* that corresponds to the Arabic macrolanguage. Standard Arabic (*arb*), classified as *Thriving*, functions as a literary and formal standard widely used in education, media, and written communication, yet it does not have native speakers in a strict sense. In this study, the number of active users of Standard Arabic (334.8 million) is used as a proxy for L1, reflecting content generation potential, while the number of speakers of Arabic dialects (410.5 million) is used as L1+L2, accounting for functional proficiency in the standard variety. For comparability with existing datasets, the adapted category is denoted using the code *ar*.

Malay is similarly represented in datasets by the macrolanguage code *ms* (or *msa*), encompassing several closely related languages and dialects. Within this macrolanguage, two distinct varieties have *Thriving* status: Standard Malay (*zsm*), used as an official language in Malaysia, Brunei, and Singapore, and Local Malay (*zlm*), which comprises dialects spoken as native languages by Malay populations. For this study, the aggregated code *ms* was used to ensure compatibility with public datasets. Since Standard Malay has no native speakers, the number of Local Malay (*zlm*) speakers – 26.5 million – was adopted as the L1 value, reflecting content generation potential, while the total number of active users of Standard Malay (*zsm*) – 34.6 million – was used as the L1+L2 value. Unlike the Arabic case, this aggregation does not fully collapse the macrolanguage, as Indonesian (*id*), which also belongs to *ms*, was analyzed separately due to its independent *Thriving* status and distinct resource base.

The final language selection and categorization are summarized in Table 1 (presented later in Section 3.2), which additionally reports ISO-639 codes, linguistic genealogy (family and branch), DLS values, EGIDS status, and demographic indicators (L1 and L1+L2, in millions).

Selection of Speech Data Sources

To estimate the total volume of speech data available for the selected languages, a systematic dataset identification and filtering process was conducted. The primary objective was to obtain a representative sample of large-scale open datasets suitable for assessing inequalities in resource distribution.

The initial dataset list was compiled using a multi-source approach. Primary sources included are the following.

- **OpenSLR**, a public repository hosting a wide range of speech and language resources, from which datasets categorized under *Speech* were selected.
- **Systematic research reviews**, including survey papers providing curated overviews of publicly available speech datasets (Agnew et al., 2024; Longpre et al., 2024). These sources supplied lists of notable corpora along with metadata on duration, language coverage, and license types.

Other catalogues, such as the ELRA Language Resources Association Catalogue and the Linguistic Data Consortium Catalog, were considered but excluded as primary sources, as they predominantly list proprietary or paid datasets, which fall outside the scope of this study's focus on open-access resources.

Datasets identified across all sources were merged into a unified list and subsequently divided into monolingual and multilingual subsets. Both subsets were filtered using the following selection criteria: Both subsets were filtered using the following sequential criteria:

1. **Language relevance:** datasets not covering any of the 32 selected languages were excluded.
2. **Academic documentation:** datasets lacking an associated academic publication or detailed technical report were removed to ensure transparency and reproducibility.
3. **Metadata availability:** datasets without verifiable documentation of audio duration (in hours or convertible units) were excluded.
4. **License compatibility:** datasets with clearly specified licenses permitting the creation of derivative works were retained.

For licensing analysis, datasets were further divided into two categories: *Open*, which includes licenses permitting both commercial and non-commercial use (e.g., Apache 2.0, CC-BY, CC-BY-SA, MIT, Public Domain), and *NC*, which includes licenses restricting use to non-commercial purposes or requiring additional permissions (e.g., CC-BY-NC and similar licenses).

For multilingual datasets, the number of audio hours corresponding to each of the 32 target languages was extracted and tabulated to enable cross-linguistic comparison.

As a result of this process, 125 monolingual corpora and 22 multilingual datasets were selected, including Common Voice (Ardila et al., 2020), LibriVox, MediaSpeech (Kolobov et al., 2021), VoxPopuli (Wang et al., 2021), Multilingual LibriSpeech (Pratap et al., 2020), M-AILABS (Imdat, 2019), FLEURS (Conneau et al., 2022), CoVoST 2 (Wang et al., 2020), CML-TTS (Oliveira et al., 2023), MOSEL (Gaido et al., 2024), Emilia (He et al., 2025), and Yodas (Li et al., 2023).

Following this multi-stage filtering, summary statistics were aggregated into a Table 1 presenting the quantitative distribution of open and total speech data across the selected languages. This table forms the empirical basis for the subsequent inequality analysis.

Table 1. Language sample and speech corpora statistics

Language	ISO-639-1	Cat	Family	Branch	DLS	Status	L1, millions	L1+L2, millions	open, h	total, h
English	en	W	Indo-European	Germanic	1	Int	390.3	1527.9	1139368	1145394
French	fr	W	Indo-European	Romance	1	Int	74.2	311.9	89296	89296
German	de	W	Indo-European	Germanic	1	Nat	76.1	134	85687	85687
Chinese	zh	NW	Sino-Tibetan	Sinitic	1	Int	989.9	1183.8	78588	79588
Spanish	es	W	Indo-European	Romance	1	Int	484	558.5	70351	70351

Finnish	fi	W	Uralic	Finnic	0.89	Nat	4.96	5.62	63171	63171
Russian	ru	NW	Indo-European	East Slavic	0.96	Int	145.2	253.4	41772	61772
Italian	it	W	Indo-European	Romance	1	Nat	62.9	66.2	60851	60851
Dutch	nl	W	Indo-European	Germanic	1	Nat	23.74	25.39	49716	49716
Japanese	ja	NW	Japonic	-	1	Nat	123.6	125.6	45706	45706
Polish	pl	W	Indo-European	West Slavic	0.96	Nat	43.2	45.3	45223	45223
Portuguese	pt	W	Indo-European	Romance	1	Nat	249.5	266.6	44367	44367
Czech	cs	W	Indo-European	West Slavic	0.89	Nat	9.76	12.47	39405	39405
Romanian	ro	W	Indo-European	Romance	0.89	Nat	23.71	23.73	36911	36911
Hungarian	hu	W	Uralic	Ugric	0.89	Nat	12.14	12.15	36449	36449
Korean	ko	NW	Koreanic	-	1	Nat	81.2	81.6	22847	22849
Croatian	hr	W	Indo-European	South Slavic	0.89	Nat	5.15	6.45	22612	22612
Swedish	sv	W	Indo-European	Germanic	0.96	Nat	10.1	13.3	22413	22413
Hebrew	he	NW	Afro-Asiatic	Semitic	0.93	Nat	6.12	10.48	21022	21052
Danish	da	W	Indo-European	Germanic	0.96	Nat	5.81	5.82	16077	16077
Vietnamese	vi	NW	Austroasiatic	Mon-Khmer	0.93	Nat	86.1	97	10047	10547
Indonesian	id	NW	Austronesian	Malayo-Polynesian	0.93	Nat	75.2	252.4	9978	9978
Turkish	tr	NW	Turkic	Oghuz	0.96	Nat	85.2	91.3	4816	4816
Hindi	hi	NW	Indo-European	Indo-Aryan	0.93	Nat	345.4	609.1	3067	4328
Arabic	ar	NW	Afro-Asiatic	Semitic	1	Nat	334.8	410.5	1560	3601
Tamil	ta	NW	Dravidian	South	0.89	Nat	78.6	86.3	2140	2140
Ukrainian	uk	NW	Indo-European	East Slavic	0.89	Nat	32.1	39	1078	1078
Thai	th	NW	Kra–Dai	Kam–Tai	0.96	Nat	27.2	71.4	939	939
Norwegian	no	W	Indo-European	Germanic	0.96	Nat	5.49	5.5	834	834
Malay	ms	NW	Austronesian	Malayo-Polynesian	0.96	Nat	26.5	34.6	44	44
Serbian	sr	NW	Indo-European	South Slavic	0.89	Nat	8.23	8.26	41	41

Criteria for Resource Comparison and Disparity Estimation

To validate the presence of digital inequality among languages classified as Thriving on the DLS scale, we computed the Gini coefficient using the number of language speakers and the total volume of open speech data as parameters (Figure 1).

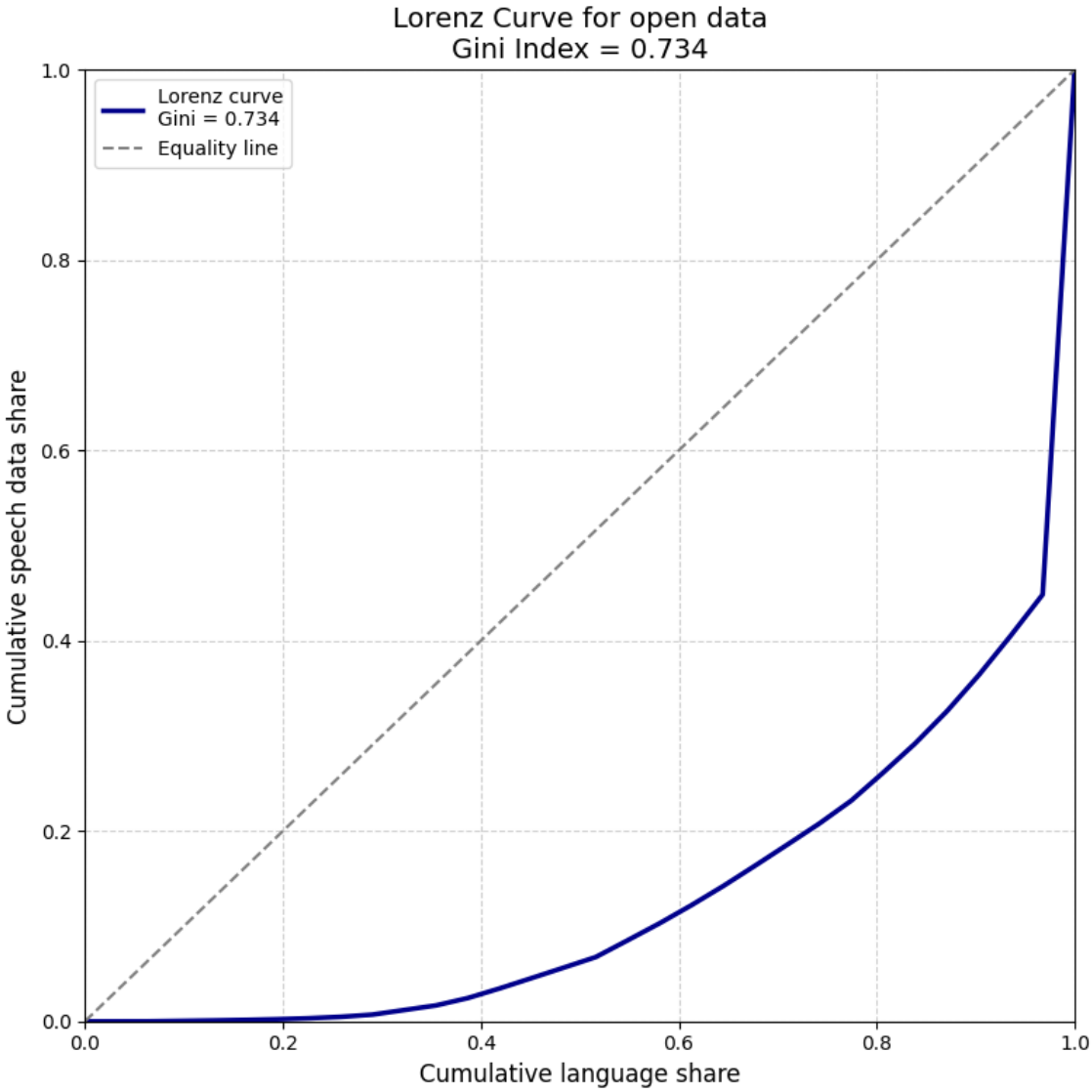

Figure 1. Lorenz curve of speech resource inequality

The corresponding Lorenz curve illustrates the cumulative distribution of open speech resources relative to the cumulative share of language populations, ordered from the least to the most resource-rich languages.

Unlike economic resources, digital data are non-rivalrous and do not imply direct redistribution among languages. Accordingly, in this study, the Gini coefficient is not interpreted as a measure of fairness, but rather as an indicator of structural concentration in the distribution of open speech resources. The obtained value of 0.734 indicates a pronounced dominance of a small number of languages – primarily English – within the AI data infrastructure.

Existing approaches to assessing technological language support include qualitative analyses documenting the existence of the digital divide (Bender et al., 2021), categorical evaluations (Simons et al., 2022), and quantitative methods based on aggregate resource assessments (Joshi et al., 2020) or downstream model performance (Blasi et al., 2022). For European languages, composite indices combining weighted technological and contextual factors have been proposed (Gaspari et al., 2022; Grützner-Zahn & Rehm, 2022; Rehm & Way, 2023).

To provide an assessment that captures resource availability at the level of individual languages, we introduce the Digital Resource Saturation Index (DRSI). This metric captures the relationship between the volume of available speech resources for a given language and its demographic resource potential, accounting for both content generation and consumption capacities under assumptions of proportionality and equality.

Demographic normalization

For each language i, we define demographics indicators based on the number of native speakers (L1) and the total number of speakers (L1+L2). They are normalized to the maximum value across the sample using parity-to-maximum scaling:

$$p_i^{L1}=\frac{L1_i}{L1_{max}}\,,\ p_i^{L1+L2}=\frac{(L1+L2)_i}{(L1+L2)_{max}}\,.$$

These normalized values represent the relative demographic scale of each language within the selected sample.

Normalization of speech resources

Analogously, we normalize the observed volumes of speech data:

$$pR_i^{open}=\frac{R_i^{open}}{R_{max}^{open}},\ pR_i^{total}=\frac{R_i^{total}}{R_{max}^{total}}\,,$$

where R_i^{open} denotes the total duration of speech data available under licenses permitting commercial use, and R_i^{total} includes both open and non-commercial datasets.

Expected resource levels

To estimate the expected level of speech resources for each language we introduce a parameter $\alpha \in [0,1]$, that corresponds to a social justice model and interpolates between a purely demographic expectation and an egalitarian baseline. When $\alpha = 0$, the expected resource level is fully proportional to the number of speakers; when $\alpha = 1$, all languages are assumed to have equal expected support.

From the perspective of data consumption, the expected resource level is defined as:

$$E^{cons}_i = (1 - \alpha)p^{L1+L2}_i + \alpha$$

From the perspective of data creation, the expected resource level depends on the number of native speakers and an additional generation coefficient $\gamma \in [0,1]$, which reflects the assumed institutional maturity and the capacity of a language community to produce original speech content:

$$E^{gen}_i = (1 - \alpha)\gamma p^{L1}_i + \alpha$$

Utilization and generation components

Using these expectations, we define two complementary components.

The *utilization component* measures how the availability of open speech data compares to the expected level of data consumption:

$$Util_i = \frac{\beta \cdot pR_i^{open}}{(1-\alpha) \cdot p^{L1+L2} + \alpha}$$

where β ∈ [0,1] controls the relative emphasis on open-access data, reflecting the degree of digital data sovereignty governance.

The *generation component* captures how the total volume of speech data compares to the expected level of data creation:

$$Gen_i = \frac{(1-\beta) \cdot pR_i^{total}}{\gamma \cdot (1-\alpha) \cdot p^{L1} + \alpha}$$

Digital Resource Saturation Index

Finally, the Digital Resource Saturation Index for language i is defined as the sum of the utilization and generation components:

$$DRSI_i = Util_i + Gen_i$$

Values of DRSI close to zero indicate a substantial deficit of speech resources relative to the expected level, while higher values reflect stronger saturation of the language with available speech data. The index enables a comparative ranking of languages and highlights cases where demographic scale and digital resource availability are strongly misaligned.

RESULTS

The computed DRSI values for the selected languages, using mid-range parameter settings *(α=β=γ=0.5)*, are presented in Table 2.

The DRSI values in Table 2 reveal patterns that go beyond mere data availability; they reflect the underlying technological modernization regimes and civilizational clusters described and discussed in the comparative literature (Artyukhin et al., 2025; Zapf, 2004).

The results indicate a pronounced concentration of open speech resources in English, whose DRSI value substantially exceeds those of all other languages. English benefits from a large number of high-quality speech datasets, many of which are distributed under permissive open licenses. This reflects sustained research activity, a high level of digital infrastructure development, and the central role of English within Western research ecosystems. This is not simply a function of its speaker population, but a direct outcome of the Western model: a combination of corporate investment, a robust open-science ecosystem, and the path-dependent accumulation of datasets over decades (Zapf, 2004). English serves as the "default" language of AI research, and its resource base is both a cause and a consequence of its hegemonic position in global science and

commerce. Consequently, English-language data form the backbone of training pipelines for a wide range of contemporary machine learning models.

Table 2. DRSI by language

Language	Category	DRSI	Language	Category	DRSI	Language	Category	DRSI
English	Western	1.3353	Czech	Western	0.06854	Turkish	Non Western	0.008020
German	Western	0.1412	Portuguese	Western	0.06756	Hindi	Non Western	0.005142
French	Western	0.1402	Romanian	Western	0.06375	Arabic	Non Western	0.003768
Finnish	Western	0.1103	Hungarian	Western	0.06337	Tamil	Non Western	0.003575
Italian	Western	0.1027	Croatian	Western	0.03945	Ukrainian	Non Western	0.001849
Spanish	Western	0.0946	Swedish	Western	0.03897	Thai	Non Western	0.001596
Dutch	Western	0.0858	Korean	Non Western	0.03820	Norwegian	Western	0.001455
Chinese	Non Western	0.0852	Hebrew	Non Western	0.03665	Malay	Non Western	0.000076
Russian	Non Western	0.0817	Danish	Western	0.02805	Serbian	Non Western	0.000071
Polish	Western	0.0772	Vietnamese	Non Western	0.01712			
Japanese	Non Western	0.0746	Indonesian	Non Western	0.01591			

Western European languages (German, French, Italian, Spanish) form a second tier. The group also includes Finnish partly due to its relatively small speaker population. Their values, while lower than English, are still relatively high due to sustained national and EU-level funding for language technologies, as well as active participation in community-driven projects. This reflects the institutionalized support for linguistic diversity within the Western framework, although still subordinate to English. These languages correspond roughly to the “Protestant Europe” and “Catholic Europe” sociocultural clusters (Inglehart and Welzel, 2005), where secular-rational values and strong institutional frameworks support open scientific exchange.

Spanish and Portuguese present a particularly interesting case. Despite their classification as Western languages and their large global speaker bases (including across Latin America), their relatively lower DRSI values may reflect the “ambiguous dynamics” of modernization trajectories in the Latin American civilizational cluster. In this cluster, economic development has often outpaced the development of civic institutions and open science infrastructures (Inglehart and Welzel, 2005). The Catholic Church's historical role as a mediator between state and society, combined with persistent clientelism and corruption, has created a modernization trajectory where the production of openly accessible public goods – such as linguistic data – remains underdeveloped relative to demographic scale (Artyukhin et al., 2025). The DRSI thus captures not just a data gap, but a deeper structural feature of Latin American modernization: a pattern of “modernization through traditional structures” that does not automatically generate the kind of open, participatory data ecosystems characteristic of Northern Europe

Among non-Western languages, Chinese exhibits the highest level of resource availability. Nevertheless, the volume of openly accessible Chinese speech data remains limited relative to the size of the language community, which is consistent with findings

reported in prior studies (Tang et al., 2021; Zhou et al., 2025). Despite high user activity and a large domestic market, substantial portions of Chinese speech data are not released under open licenses, reflecting state-level data governance policies and the closed nature of many commercial platforms. At the same time, several large Chinese technology companies have made portions of their datasets publicly available, enabling continued progress in selected research directions. This apparent discrepancy is a hallmark of the Chinese model: the state's emphasis on digital sovereignty and centralized control leads to the creation of large domestic corpora, but these are often not released under open licenses (Roberts et al., 2021). The low DRSI thus does not indicate a lack of data per se, but a political choice to restrict openness – a form of "sovereignty through enclosure" that contrasts sharply with the Western paradigm. This aligns with the "Confucian civilizational cluster" (Inglehart and Welzel, 2005), where modernization proceeds through strong state guidance and corporate-group mentalities rather than through individualistic, open civic participation.

The Russian language occupies a mid-range position in the DRSI ranking, placed 12th overall, behind Chinese and slightly ahead of Polish. Its value is comparable to that of non-dominant European languages, yet it is significantly below its demographic potential. This is symptomatic of what might be termed a dependent modernization trajectory. Russia exhibits a post-Soviet political consciousness and a secular-rational value system (Artyukhin et al., 2025), but the institutions supporting open science and data sharing remain fragmented. Although the availability of high-quality open speech datasets for Russian has gradually increased (Andrusenko et al., 2020; Karpov et al., 2021), a significant share of relevant resources remains proprietary and inaccessible to the research community. The overall volume of openly available data remains insufficient for a number of speech-processing tasks, and data quality often requires additional preprocessing prior to use. Despite a large digital audience and significant domestic research activity, the absence of a coordinated open-data infrastructure and the historical reliance on Western platforms have created a structural deficit. This structural limitation constrains the development and evaluation of speech technologies based exclusively on domestic open resources. The Russian case illustrates how intermediate models, caught between openness and sovereignty, can result in a persistent resource gap – a form of "incomplete modernization" where demographic potential fails to translate into digital infrastructure.

India presents a unique and paradoxical case. Hindi, the most widely spoken language in India, has a very low DRSI, placing it among the most severely resource-constrained languages in our sample – despite having over 600 million speakers. Yet English, which is also an official language of India and widely used in administration, education, and technology, enjoys the highest possible resource saturation. This bifurcation reflects the enduring legacy of colonial linguistic hierarchies and "socio-cultural mosaicity" in the South Asian civilizational cluster. While India has developed robust policies for linguistic diversity and peaceful conflict resolution, the infrastructure for open data – particularly for non-English languages – remains profoundly underdeveloped (Artyukhin et al., 2025). The result is a form of internal digital stratification: English serves as the language of technological participation, while Hindi

and other Indic languages are systematically excluded from the foundational datasets of AI, despite their demographic weight. This challenges the assumption that democracy and demographic scale alone guarantee technological inclusion.

The lower end of the ranking is mostly occupied by languages of the Arab world and South-East Asia (Arabic, Tamil, Vietnamese, Indonesian, Thai, Malay). They exhibit extremely low DRSI values. These figures challenge the assumption that demographic scale automatically translates into technological influence in a multipolar world. Instead, they demonstrate how older global hierarchies are reproduced in digital form: despite hundreds of millions of speakers, these language communities remain largely invisible in the open-data landscape. This is not merely a technical deficit but a form of epistemic marginalization, where the data needed to build culturally and linguistically appropriate AI systems is systematically absent. In the “African-Islamic” and “South Asian” clusters, religious norms, clientelist political cultures, and post-colonial institutional weaknesses have created environments where open, inclusive data infrastructures struggle to emerge (Inglehart and Welzel, 2005). Importantly, the analysis includes only languages classified as *Thriving*, which implies the presence of at least a minimal level of speech-resource availability. Languages outside the scope of this study are therefore likely to face even more severe resource constraints.

In sum, the DRSI not only quantifies resource imbalance but also serves as an expression of the political and institutional regimes governing data. Low scores are not just a call for more data; they are an indicator of how different modernization paths – whether Western openness, Chinese sovereign enclosure, Latin American "modernization through tradition," South Asian linguistic stratification, or intermediate dependency – shape a language's capacity to participate in the AI revolution on its own terms. The index reveals that the digital language divide is not a simple function of demography, but a complex product of civilizational legacies, governance choices, and the structural inequalities embedded in the global technological order.

CONCLUSION AND LIMITATIONS

This study has several limitations that should be taken into account when interpreting the results.

Firstly, the analysis focuses exclusively on open speech datasets documented or widely cited as established reference resources in research papers. Commercial, proprietary, and most of the community-curated datasets were excluded, which may partially distort the overall picture of resource availability, particularly for languages developed under models with limited data openness, such as the Chinese model. In addition, no manual validation was conducted to assess the feasibility of obtaining missing data from excluded sources.

Secondly, the selection was restricted to languages with a relatively advanced digital ecosystem. While this ensures that all included languages have at least some level of speech-resource availability, it also excludes languages with weaker digital support, for which the degree of inequality may be even more pronounced.

Thirdly, the analysis represents a static snapshot of the data landscape at the time of collection and does not capture its dynamic evolution. New datasets – particularly multilingual ones – are continuously released and often expand both language coverage and data volume beyond previously available resources.

Fourthly, the proposed DRSI metric has inherent limitations and therefore is necessarily constrained by its reliance on readily measurable quantities – primarily audio hours and speaker counts. While this approach enables systematic cross-linguistic comparison, it does not incorporate qualitative characteristics of datasets, such as linguistic diversity, representativeness, annotation quality, or metadata completeness and other dimensions that are equally crucial for understanding technological capacity: the cultural representativeness of datasets, the diversity of voices and accents included, the quality of annotations, and the institutional mechanisms that sustain data production over time. These factors, though difficult to quantify, are essential for assessing whether a language community truly possesses the capacity to develop sovereign AI systems, or merely the raw material. Moreover, the sensitivity of the metric to variations in the parameters α, β, and γ requires further validation. The DRSI should therefore be understood as a diagnostic indicator of structural imbalance, not a comprehensive measure of technological readiness.

Finally, while we observe parallels between DRSI patterns and civilizational clusters described in comparative sociology (Inglehart & Welzel, 2005), this study does not establish correlation, causation, or explanatory linkage. These observations are intended as heuristic illustrations for future research, not as validated theoretical claims.

Despite these limitations, the results confirm the existence of a pronounced digital language divide in open speech resources even among languages classified as having high levels of digital support (DLS "Thriving"). Languages with comparable demographic scales and substantial digital audiences exhibit significant disparities in the availability of open speech corpora. English occupies a clearly privileged position: its resource base not only exceeds that of other languages in quantitative terms, but also demonstrates higher institutional stability and reproducibility due to the combination of an open scientific ecosystem and large-scale corporate contributions. At the same time, systematic asymmetries are observed even among major "developed" languages, with most languages exhibiting deficits in open resources relative to levels expected under demographic and fairness-based assumptions.

The application of the DRSI metric enables a shift from merely identifying inequality to providing a measurable description of resource imbalance and a ranking of languages by degree of disparity. Importantly, near-zero index values are observed not only for traditionally low-resource languages, but also for several languages with international status. In particular, Russian – despite a large speaker base and the presence of several large-scale initiatives – remains in a zone of moderate deficit in open speech resources and shows levels of imbalance comparable to those of European languages that do not occupy dominant positions in the global AI ecosystem. Chinese, while leading among non-Western languages, also exhibits a disproportionately low index value relative to its demographic scale, indicating a mismatch between the volume of open data

and the size of the language community and highlighting the role of political and institutional constraints on data openness.

Interpreting these findings through the lens of technological modernization models demonstrates that language inequality is shaped not only by technical factors, but also by institutional mechanisms. These include corporate centralization in the Western model, digital sovereignty strategies and restricted data openness in the Chinese model, and fragmented coordination and insufficient support for open infrastructures in intermediate development models. Accordingly, the digital language divide should be understood as a reproducible structure of digital inequality that reinforces technological dependence and constrains the development potential of national AI ecosystems.

Looking beyond the immediate findings, this study underscores a fundamental shift in how we understand technological development in the AI era. The classical modernization theory assumption that development follows a linear path toward a Western endpoint has given way to a recognition of "multiple modernities." Our DRSI analysis demonstrates that this plurality extends to the very raw materials of AI: speech data. The stark asymmetries we observe are not temporary gaps that will be closed by market forces or demographic growth alone. They are structural features of a global system where data governance regimes – the choices about openness, sovereignty, and institutional support – actively shape which languages can participate in the AI revolution and on what terms.

For languages in intermediate positions, such as Russian, the path forward requires more than simply increasing dataset hours. It demands strategic choices about data governance: whether to prioritize openness and global integration, risking continued dependence on Western platforms, or to pursue sovereign data infrastructures, potentially at the cost of interoperability and community contribution. For languages in the South Asian, Latin American, and African-Islamic clusters, the challenge is even more fundamental: building the institutional frameworks and civic cultures that can sustain open data production over the long term, often in the face of post-colonial legacies and persistent socio-economic constraints.

Ultimately, the digital language divide is not a technical problem awaiting a technical solution. It is a political and civilizational question about who gets to shape the future of human-machine interaction, whose voices are heard by AI systems, and what forms of linguistic and cultural diversity will survive the transition to a globally integrated technological order. The DRSI, for all its limitations, provides a lens through which these deeper questions can be seen – and, perhaps, addressed.

REFERENCES

Adebara, I., Toyin, H. O., Ghebremichael, N. T., Elmadany, A. A., & Abdul-Mageed, M. (2025). Where Are We? Evaluating LLM Performance on African Languages. In W. Che, J. Nabende, E. Shutova, & M. T. Pilehvar (Eds.), *Proceedings of the 63rd Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)* (pp. 32704–32731). Association for Computational Linguistics. https://doi.org/10.18653/v1/2025.acl-long.1572

Agnew, W., Barnett, J., Chu, A., Hong, R., Feffer, M., Netzorg, R., Jiang, H. H., Awumey, E., & Das, S. (2024, October). *Sound Check: Auditing Audio Datasets*. arXiv. https://doi.org/10.48550/arXiv.2410.13114

Akindotuni, D. (2025). Resource Asymmetry in Multilingual NLP: A Comprehensive Review and Critique. *Journal of Computer and Communications*, *13*(7), 14–47. https://doi.org/10.4236/jcc.2025.137002

Andrusenko, A., Laptev, A., & Medennikov, I. (2020). Exploration of End-to-End ASR for OpenSTT – Russian Open Speech-to-Text Dataset. In A. Karpov & R. Potapova (Eds.), *Speech and Computer* (Vol. 12335, pp. 35–44). Springer, Cham. https://doi.org/10.1007/978-3-030-60276-5_4

Ardila, R., Branson, M., Davis, K., Henretty, M., Kohler, M., Meyer, J., Morais, R., Saunders, L., Tyers, F. M., & Weber, G. (2020, March). *Common Voice: A Massively-Multilingual Speech Corpus*. arXiv. https://doi.org/10.48550/arXiv.1912.06670

Artyukhin O.A., Kritskaya A.A., & Samgurov A.S. (2025). Political Modernization of Non-Western Countries: Socio-cultural and Civilizational Features. *State and Municipal Management. Scholar Notes, 2*, 163–170. https://elibrary.ru/UHSDXE

Baishya, Dr. D., Baruah, Dr. R., Bora, Dr. M., & Sarma, B. (2025). Processing Low-Resource Languages: A Review of Challenges and Strategies for Inclusive NLP And Sustainable Environment. *International Journal of Environmental Sciences*, *11*, 7730–7739. https://doi.org/10.64252/w55rwj24

Bender, E. M., Gebru, T., McMillan-Major, A., & Shmitchell, S. (2021). On the Dangers of Stochastic Parrots: Can Language Models Be Too Big? 🦜. In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (pp. 610–623). ACM. https://doi.org/10.1145/3442188.3445922

Bird, S. (2020). Decolonising Speech and Language Technology. In *Proceedings of the 28th International Conference on Computational Linguistics* (pp. 3504–3519). Association for Computational Linguistics. https://doi.org/10.18653/v1/2020.coling-main.313

Blasi, D., Anastasopoulos, A., & Neubig, G. (2022). Systematic Inequalities in Language Technology Performance across the World's Languages. In S. Muresan, P. Nakov, & A. Villavicencio (Eds.), *Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)* (pp. 5486–5505). Association for Computational Linguistics. https://doi.org/10.18653/v1/2022.acl-long.376

Christophe, B., Giron, A., & Verin, G. (2023). A comparative analysis with machine learning of public data governance and AI policies in the European Union, United States, and China. *Journal of Intelligence Studies in Business*, *13*(2), 61–74. https://doi.org/10.37380/jisib.v13i2.1084

Conneau, A., Ma, M., Khanuja, S., Zhang, Y., Axelrod, V., Dalmia, S., Riesa, J., Rivera, C., & Bapna, A. (2022, May). *FLEURS: Few-shot Learning Evaluation of Universal Representations of Speech*. arXiv. https://doi.org/10.48550/arXiv.2205.12446

Derivation – Faster, easier, smarter multilingual business. (2025). https://derivation.co/

Eberhard D.M., Simons G.F., & Fennig C.D. (Eds.). (2025). *Ethnologue: Languages of the World*. Twenty-eighth edition. https://www.ethnologue.com/

Gábor, B., Helm, P., Koch, G., & Giunchiglia, F. (2023, July). *Towards Bridging the Digital Language Divide*. arXiv. https://doi.org/10.48550/arXiv.2307.13405

Gaido, M., Papi, S., Bentivogli, L., Brutti, A., Cettolo, M., Gretter, R., Matassoni, M., Nabih, M., & Negri, M. (2024). MOSEL: 950,000 Hours of Speech Data for Open-Source Speech Foundation Model Training on EU Languages. In Y. Al-Onaizan, M. Bansal, & Y.-N. Chen (Eds.), *Proceedings of the 2024 Conference on Empirical Methods in Natural Language Processing* (pp. 13934–13947). Association for Computational Linguistics. https://doi.org/10.18653/v1/2024.emnlp-main.771

Gaspari, F., Gallagher, O., Rehm, G., Giagkou, M., Piperidis, S., Dunne, J., & Way, A. (2022). Introducing the Digital Language Equality Metric: Technological Factors. In I. Aldabe, B. Altuna, A. Farwell, & G. Rigau (Eds.), *Proceedings of the Workshop Towards Digital Language Equality within the 13th Language Resources and Evaluation Conference* (pp. 1–12). European Language Resources Association. https://aclanthology.org/2022.tdle-1.1/

Grützner-Zahn, A., & Rehm, G. (2022). Introducing the Digital Language Equality Metric: Contextual Factors. In I. Aldabe, B. Altuna, A. Farwell, & G. Rigau (Eds.), *Proceedings of the Workshop Towards Digital Language Equality within the 13th Language Resources and Evaluation Conference* (pp. 13–26). European Language Resources Association. https://aclanthology.org/2022.tdle-1.2/

He, H., Shang, Z., Wang, C., Li, X., Gu, Y., Hua, H., Liu, L., Yang, C., Li, J., Shi, P., Wang, Y., Chen, K., Zhang, P., & Wu, Z. (2025). Emilia: A Large-Scale, Extensive, Multilingual, and Diverse Dataset for Speech Generation. *IEEE Transactions on Audio, Speech and Language Processing*, *33*, 4044–4054. https://doi.org/10.1109/TASLPRO.2025.3612835

Helm, P., Bella, G., Koch, G., & Giunchiglia, F. (2024). Diversity and language technology: How language modeling bias causes epistemic injustice. *Ethics and Information Technology*, *26*(1), 8. https://doi.org/10.1007/s10676-023-09742-6

Henning, S., Beluch, W., Fraser, A., & Friedrich, A. (2023). A Survey of Methods for Addressing Class Imbalance in Deep-Learning Based Natural Language Processing. In A. Vlachos & I. Augenstein (Eds), *Proceedings of the 17th Conference of the European Chapter of the Association for Computational Linguistics* (pp. 523–540). Association for Computational Linguistics. https://doi.org/10.18653/v1/2023.eacl-main.38

Imdat, C. (2019, March). *M-AILABS Dataset*. Github. https://github.com/i-celeste-aurora/m-ailabs-dataset

Inglehart, R., & Welzel, C. (2005). Modernization, Cultural Change, and Democracy: The Human Development Sequence. *Cambridge: Cambridge University Press.* https://doi.org/10.1017/CBO9780511790881

Joshi, P., Santy, S., Budhiraja, A., Bali, K., & Choudhury, M. (2020). The State and Fate of Linguistic Diversity and Inclusion in the NLP World. In *Proceedings of the 58th Annual Meeting of the Association for Computational Linguistics* (pp. 6282–6293). Association for Computational Linguistics. https://doi.org/10.18653/v1/2020.acl-

main.560

Karpov, N., Denisenko, A., & Minkin, F. (2021). Golos: Russian Dataset for Speech Research. *Interspeech*, 1419–1423. https://doi.org/10.21437/Interspeech.2021-462

Kolobov, R., Okhapkina, O., Platunov, A., Omelchishina, O., Bedyakin, R., Moshkin, V., Menshikov, D., & Mikhaylovskiy, N. (2021). *MediaSpeech: Multilanguage ASR Benchmark and Dataset*. OpenSLR. https://www.openslr.org/108/

Kreutzer, J., Caswell, I., Wang, L., Wahab, A., Van Esch, D., Ulzii-Orshikh, N., Tapo, A., Subramani, N., Sokolov, A., Sikasote, C., Setyawan, M., Sarin, S., Samb, S., Sagot, B., Rivera, C., Rios, A., Papadimitriou, I., Osei, S., Suarez, P. O., … Adeyemi, M. (2022). Quality at a Glance: An Audit of Web-Crawled Multilingual Datasets. *Transactions of the Association for Computational Linguistics*, *10*, 50–72. https://doi.org/10.1162/tacl_a_00447

Lau, M., Chen, Q., Fang, Y., Xu, T., Chen, T., & Golik, P. (2025). *Data Quality Issues in Multilingual Speech Datasets: The Need for Sociolinguistic Awareness and Proactive Language Planning*. arXiv. https://doi.org/10.48550/ARXIV.2506.17525

Li, X., Takamichi, S., Saeki, T., Chen, W., Shiota, S., & Watanabe, S. (2023). Yodas: Youtube-Oriented Dataset for Audio and Speech. In *2023 IEEE Automatic Speech Recognition and Understanding Workshop (ASRU)* (pp. 1–8). IEEE https://doi.org/10.1109/ASRU57964.2023.10389689

Longpre, S., Mahari, R., Chen, A., Obeng-Marnu, N., Sileo, D., Brannon, W., Muennighoff, N., Khazam, N., Kabbara, J., Perisetla, K., Wu, X., Shippole, E., Bollacker, K., Wu, T., Villa, L., Pentland, S., & Hooker, S. (2024). A large-scale audit of dataset licensing and attribution in AI. *Nature Machine Intelligence*, *6*(8), 975–987. https://doi.org/10.1038/s42256-024-00878-8

Markl, N., & McNulty, S. J. (2022). Language technology practitioners as language managers: Arbitrating data bias and predictive bias in ASR. In N. Calzolari, F. Béchet, P. Blache, K. Choukri, C. Cieri, T. Declerck, S. Goggi, H. Isahara, B. Maegaard, J. Mariani, H. Mazo, J. Odijk, & S. Piperidis (Eds), *Proceedings of the Thirteenth Language Resources and Evaluation Conference* (pp. 6328–6339). European Language Resources Association. https://aclanthology.org/2022.lrec-1.680/

Neznamov, A., Chache, E., & Churilova, D. (2025). What is "Regulatory Path" for Russia? *Legal Issues in the Digital Age*, *6*(3), 4–22. https://doi.org/10.17323/2713-2749.2025.3.4.22

Oliveira, F. S., Casanova, E., Júnior, A. C., Soares, A. S., & Filho, A. R. G. (2023, June). *CML-TTS A Multilingual Dataset for Speech Synthesis in Low-Resource Languages*. arXiv. https://doi.org/10.48550/arXiv.2306.10097

Pratap, V., Xu, Q., Sriram, A., Synnaeve, G., & Collobert, R. (2020). MLS: A Large-Scale Multilingual Dataset for Speech Research. *Interspeech 2020*, 2757–2761. https://doi.org/10.21437/Interspeech.2020-2826

Ranathunga, S., & Silva, N. de. (2022). *Some Languages are More Equal than Others: Probing Deeper into the Linguistic Disparity in the NLP World*. arXiv. https://doi.org/10.48550/arXiv.2210.08523

Rehm, G., & Way, A. (2023). European Language Equality: Introduction. In G. Rehm & A. Way (Eds.), *European Language Equality: A Strategic Agenda for Digital Language Equality* (pp. 1–10). Springer International Publishing. https://doi.org/10.1007/978-3-031-28819-7_1

Roberts, H., Cowls, J., Morley, J., Taddeo, M., Wang, V., & Floridi, L. (2021). The Chinese Approach to Artificial Intelligence: An Analysis of Policy, Ethics, and Regulation. *AI & Society*, *36*(1), 59–77. https://doi.org/10.1007/s00146-020-00992-2

Simons, G. F., Thomas, A. L., & White, C. K. (2022, September). *Assessing Digital Language Support on a Global Scale*. arXiv. https://doi.org/10.48550/arXiv.2209.13515

Tang, Z., Wang, D., Xu, Y., Sun, J., Lei, X., Zhao, S., Wen, C., Tan, X., Xie, C., Zhou, S., Yan, R., Lv, C., Han, Y., Zou, W., & Li, X. (2021, August). KeSpeech: An Open Source Speech Dataset of Mandarin and Its Eight Subdialects. *Thirty-Fifth Conference on Neural Information Processing Systems Datasets and Benchmarks Track (Round 2)*. https://openreview.net/forum?id=b3Zoeq2sCLq

Vincent, N., Hecht, B., & Sen, S. (2019). "Data Strikes": Evaluating the Effectiveness of a New Form of Collective Action Against Technology Companies. *The World Wide Web Conference*, 1931–1943. https://doi.org/10.1145/3308558.3313742

Wang, C., Rivière, M., Lee, A., Wu, A., Talnikar, C., Haziza, D., Williamson, M., Pino, J., & Dupoux, E. (2021, July). *VoxPopuli: A Large-Scale Multilingual Speech Corpus for Representation Learning, Semi-Supervised Learning and Interpretation*. arXiv. https://doi.org/10.48550/arXiv.2101.00390

Wang, C., Wu, A., & Pino, J. (2020, October). *CoVoST 2 and Massively Multilingual Speech-to-Text Translation*. arXiv. https://doi.org/10.48550/arXiv.2007.10310

Zapf, W. (2004). Modernization Theory – And the Non-western World. *WeltTrends – Zeitschrift für Internationale Politik, Wissenschaftszentrum Berlin für Sozialforschung, 3*(44), 100–107. https://nbn-resolving.org/urn:nbn:de:0168-ssoar-110362

Zhou, J., Wang, S., Zhao, S., He, J., Sun, H., Wang, H., Liu, C., Kong, A., Guo, Y., Yang, X., Wang, Y., Lin, Y., & Qin, Y. (2025). ChildMandarin: A Comprehensive Mandarin Speech Dataset for Young Children Aged 3-5. In W. Che, J. Nabende, E. Shutova, & M. T. Pilehvar (Eds), *Proceedings of the 63rd Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)* (pp. 12524–12537). Association for Computational Linguistics. https://doi.org/10.18653/v1/2025.acl-long.614

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Research article

Ecological Aesthetics and the Ecological Vector of Modernization in the Far East and the Western World

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Abstract

This article undertakes a comparative analysis of the formation of ecological consciousness in Western and Far Eastern cultures (China, Japan, Korea) through the prism of ecological aesthetics. The author examines aesthetics not as a realm of pure contemplation, but as a discursive bridge mediating the transition from abstract philosophical concepts to concrete social and everyday practices of interacting with nature. Methodologically, the research draws on Clifford Geertz's approach to the analysis of cultural schemas, which allows for the identification of cognitive structures linking the ideal and the everyday, as well as on the study of cultural infrastructure (institutions, technologies, legal norms) that shapes the field of ecological action. The work demonstrates that the Western tradition, grounded in a subject-object paradigm and individual responsibility, historically generates powerful grassroots environmental movements. However, in shaping ecological consciousness, it faces challenges of excessive alarmism, manipulation, and populism. The Eastern tradition, rooted in philosophies of harmony (Daoism, Confucianism, Buddhism), implicitly presupposes a centralized, state-led model of regulation. In practice, this results in the high efficiency of top-down environmental initiatives, while archaic patterns of everyday consumption persist. Particular attention is paid to the cultural dissonance in contemporary China, where accelerated modernization along Western lines comes into conflict with both traditional ideals and current Western green standards. The author concludes that ecological aesthetics today is becoming the very field where the tension between the global environmental imperative and local cultural specificity is resolved, fostering new, hybrid forms of ecological consciousness.

Keywords: Ecological aesthetics; Ecological consciousness in China; Ecological consciousness in the East; Ecological consciousness in the West; Everyday environmental practices; Modernization and ecology

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Научная статья

Экологическая эстетика и экологический вектор модернизации стран Дальнего Востока и Западного мира

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Аннотация

В статье предпринимается компаративный анализ формирования экологического сознания в культурах Запада и Востока (Китай, Япония, Корея) сквозь призму экологической эстетики. Автор рассматривает эстетику не как область чистого созерцания, а как дискурсивный мост, опосредующий переход от абстрактных философских концепций к конкретным социальным и бытовым практикам взаимодействия с природой. Методологически исследование опирается на подход К. Гирца к анализу культурных схем, позволяющий выявить когнитивные структуры, связывающие идеальное и повседневное, а также на изучение культурной инфраструктуры (институтов, технологий, правовых норм), формирующей поле экологических действий. В работе показано, что западная традиция, основанная на субъект-объектной парадигме и индивидуальной ответственности, исторически порождает мощные низовые экологические движения, но при формировании экологического сознания сталкивается с излишним алармизмом, манипуляцией и популизмом. Восточная же традиция, укорененная в философии гармонии (даосизм, конфуцианство, буддизм), имплицитно предполагает централизованную, государственную модель регулирования, что на практике оборачивается высокой эффективностью вертикальных экологических инициатив при сохранении архаичных паттернов повседневного потребления. Особое внимание уделяется культурному диссонансу современного Китая, где форсированная модернизация по западному образцу вступает в противоречие как с традиционными идеалами, так и с актуальными западными зелёными стандартами. Автор приходит к выводу, что именно экологическая эстетика сегодня становится тем полем, где разрешается напряжение между глобальным экологическим императивом и локальной культурной спецификой, формируя новые, гибридные формы экологического сознания.

Ключевые слова: Экологическая эстетика; Экологическое сознание в Китае; Экологическое сознание на Востоке; Экологическое сознание на Западе; Экологические практики повседневности; Модернизация и экология

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INTRODUCTION

This article presents ecology as one of the most crucial factors of modernization for Eastern and Western cultures. Attitudes towards environmental problems in different parts of the world are shaped under the influence of diverse philosophical traditions, historical developmental paths, socio-economic conditions, and political systems. The field of ecological aesthetics, which has only recently emerged as a distinct area of study, plays a significant role here. It can not only reveal the current attitudes of people towards their environment but also analyze how abstract categories translate into real-world practices of human-nature interaction. The study of such a complex and multifaceted phenomenon cannot be simple and entails certain methodological limitations and challenges. At the same time, identifying these limitations and reflecting on how to overcome the difficulties proves to be as valuable as studying the subject of research itself.

Thus, the aim of the study is to analyze the process of forming ecological consciousness in Eastern and Western cultures, as well as to examine ecological aesthetics as a discourse within which theories are transformed into environmental practices. The relevance of the research is ensured by the significance of the ecological trend. Awareness of global risks and efforts to change practices of interaction with nature are not a concession to alarmism and fashion, but a responsible step that all communities on the planet must take, regardless of their cultural particularities.

METHODS AND MATERIALS

Given that the research objective involves analyzing the practices of different cultures, the comparative method can be identified as the primary one. However, when comparing broad cultural phenomena that are inherently heterogeneous and not easily subjected to comparison, this method needs to be supplemented with analytical approaches.

To analyze and compare the process of forming ecological consciousness, it is necessary to identify the cultural mechanisms that enable philosophical and cultural categories to be realized in practices. It is evident that these mechanisms themselves may differ across cultures, making it difficult to pinpoint a specific methodological tool. Nevertheless, several theories can provide assistance. At the theoretical level, this includes the analysis of cultural schemas, as presented in the works of Clifford Geertz (Geertz, 1973). This approach allows for the search of cognitive structures that mediate the connection between abstract ideas and concrete actions. At the level of practices, it involves the study of cultural infrastructure, i.e., the material systems (technologies, urban environment), institutions, and legal norms that shape and constrain both ideas and practices. There is currently a sufficient amount of high-quality statistical research on environmental topics that can provide insight into the current state of affairs in various regions of the world. Such materials will be used in this study, along with direct observations.

For contemporary culture, the category of environmental friendliness is already demonstrably significant, yet its analysis presents numerous difficulties. Some of these arise from the specific nature of the object, others from the specific nature of discursive practices. The study of sociocultural phenomena inevitably encounters a fundamental methodological difficulty stemming from the dual nature of the object of study. On one hand, cultural phenomena exist as parts of a larger system of meanings, as concepts. We can speak of abstract constructs expressed in philosophical theories, ideologies, religious teachings, and general cultural narratives. On the other hand, phenomena manifest themselves as visible everyday practices, woven into the fabric of social interaction, and as non-reflexive habits. This generates a constant tension between two methodological poles: the analysis of the ideal and the analysis of the empirical.

The main problem is that often there may be no direct correspondence between these levels. Concepts do not mechanically descend into everyday life, nor does everyday life automatically rise to the level of reflection. Between them lies a field of interpretation, resistance, adaptation, and creative reinterpretation. Given all these complexities, a deliberate attempt to compare what theory and practice bring to culture seems entirely justified – to assess why theory cannot be fully realized, or why everyday social practices do not receive adequate reflection at the level of conceptualizing ideas and phenomena. Often, it is precisely the analysis of these contradictions within a cultural system at different levels that allows for a full appreciation of its specificity.

Such an approach appears most productive when investigating the phenomenon of ecology as a current vector for the modernization of production and life. Ecology has become one of the most important and most evident trends of globalization, moving beyond purely rational, thrifty attitudes towards nature to become a primary vector of modernization. This creates a still relatively new paradigm where green technologies, the circular economy, and carbon neutrality determine the competitiveness of states and corporations. Sustainability is understood not merely as a trend, but as a prerequisite for survival and growth in the 21st century.

ECOLOGICAL AESTHETICS AS A FACTOR IN THE FORMATION OF ENVIRONMENTAL CONSCIOUSNESS

Considerable attention is paid to the theme of ecology in both scientific and public discourse. It has philosophical and theoretical foundations that are quite consciously acknowledged and openly articulated. At the same time, a peculiarity of the concept itself lies in its call for changing practices: practices of individual consumption and social interaction, the organization of production, and state regulation of processes at various levels. Because of this, the gap between conceptualization and social practice becomes extremely visible and significant. Furthermore, despite the manifestation of a global interest in this topic, very serious differences are observed in the perception of ecological ideas between Western and Eastern cultures. Therefore, we can speak of an ecological consciousness currently being formed everywhere, bearing the imprints of multiple factors. This is a global process, the multiple outcomes of which are determined by local specificities.

Ecological consciousness is the core of ecological culture, which rests upon general attitudes in human-nature relations and actual practice. The formation of ecological consciousness, in one way or another, largely reflects the power and economic structures present in society. “Economic” in this context can be understood broadly: not only groups and institutions that have the resource to disseminate a certain position but also the administrative resource to introduce specific criteria for activity.

To understand the current environmental trend and the process of forming ecological consciousness, it is worthwhile to carefully study the domain of ecological and environmental aesthetics. Ecological aesthetics is not merely about the beauty of landscapes; it concerns a fundamental rethinking of our relationship with the natural world, manifested in perception and creative activity. Its analysis is critically important because it engages with the deep-seated motives of human behavior. In the last decade, it has been increasingly discussed as an independent field of research with its own theoretical and conceptual integrity.

The philosophical analysis of the aesthetic values of nature traces its roots to the eighteenth century, when treatises on the essence of natural beauty and the specificity of the aesthetic attitude toward nature were produced within both English and German aesthetics, with primary attention devoted to three aesthetic categories: the beautiful, the sublime, and the picturesque. In the following century, this tradition was taken up by the Romantics. In Russia, a profound philosophical treatise on the beauty of nature was written in the nineteenth century by Vladimir Solovyov. Nevertheless, the concept of environmental aesthetics – focused not solely on beauty but encompassing a broader range of aesthetic issues – emerged only in the second half of the twentieth century (Prozersky, 2013a; 2013b).

Many environmentalists consider the impetus for the aesthetic study of nature to be the 1966 publication of Ronald Hepburn's article “Contemporary Aesthetics and the Neglect of Natural Beauty” (Hepburn, 1966). In this work, Hepburn criticized classical aesthetics for the narrowness of its scope, which encompassed only the problems of art, and insisted that serious aesthetic experience is acquired not only through engagement with art but also through interaction with nature. Yet the question concerning the essence of aesthetic relations with nature remained open. Subsequently, in attempts to address this question, two principal approaches within environmental aesthetics emerged, each possessing distinct methodological foundations: the cognitivist and the non-cognitivist.

Proponents of the cognitivist position include Alan Carlson (1999), Patricia Matthews (2002), Glenn Parsons (2002), and Holmes Rolston (1988). As their credo, they have adopted the call of the Japanese environmental researcher Yuriko Saito to “speak with nature on its own terms” and to “proceed from nature itself” (Saito, 1985, p. 340). Adopting such a position implies that understanding the aesthetic qualities of nature is possible only with specific knowledge about it. This means that the development of the natural sciences and the incorporation of their findings are necessary for a qualitatively rich aesthetic experience. Under the non-cognitivist approach, attention shifts to the emotional component of aesthetic experience. The foundation of non-cognitivist

aesthetics is the aesthetics of engagement, whose principal proponent is Arnold Berleant (1992; 1997; 2010). Non-cognitivists emphasize that the aesthetic perception of the environment is conducted by the recipient from within the environment itself. Any organism, including the social one, exists in a direct continuum with its environment. We cannot distance our bodies from the environment, as it envelops us, directly adjoins us, and sensorily affects all our sense organs. From this interpretation of experience as an unbreakable linkage between human being and environment, a significant conclusion for aesthetics follows: namely, that the classical aesthetics of contemplation must yield to an aesthetics of human engagement in the processes occurring within the environment (Berleant, 1992, p. 67). The artistic object is demarcated from its surrounding non-artistic environment by a frame. Yet in nature, there is neither a frame that sets apart an aesthetic artifact from the environment, nor the artifact itself.

The cognitivist and non-cognitivist positions are united not only by their shared interest in nature but also by their opposition to placing art at the center of aesthetics as a philosophical discipline. This idea is articulated with particular clarity in the books and articles of the Japanese-born, English-language scholar Yuriko Saito (Saito, 2007; 2017). Her work synthesizes Western and Eastern cultures, the latter of which does not maintain such a division between so-called "high" arts and "applied" arts. Saito argues against the art-centered perspective in aesthetics. Manifestations of the aesthetic in nature and everyday life, the author insists, are quite different from those in art, primarily because our mode of engagement with objects differs from our mode of engagement with artworks. In life (unlike in a museum), we not only look at things but also actively use them, continuously introducing changes into them. Therefore, to uphold a principle that values only those things reminiscent of art is to greatly impoverish life. In accordance with Japanese tradition, Saito maintains that all moments of life should be imbued with aesthetic experience. For this reason, alongside traditional categories (the beautiful, the sublime, the tragic, the comic), aesthetics incorporates such concepts as "shock," "drive," "suspense," "non-standardness," "neatness," "cuteness," "attractiveness," and other notions that extend beyond the field traditionally considered the domain of the aesthetic. The focus is on everyday moments of life, on the environment surrounding the individual, and it frequently centers specifically on nature.

Today, the problem of the aesthetic attitude toward nature possesses an interdisciplinary character; it draws into its purview data from numerous disciplines, both the humanities and the natural sciences, and has direct implications for addressing both general philosophical and practical, social problems. One can argue that contemporary postclassical epistemology and rationality, more broadly, exhibit ecological characteristics. Both at the level of constructing scientific theories and at the level of everyday interaction with the surrounding world (nature and technology), rigid subject-object boundaries are being reconsidered and are giving way to the construction of a more egalitarian model of participation. Ecological ideas manifest themselves even in domains not directly connected with nature. Within aesthetics, this is reflected in the dissolution of the classical subject-object tension and a shifting of focus toward the unitary environment within which they coexist. Consequently, environmental aesthetics (in the sense of ecologically oriented aesthetics) develops alongside environmental aesthetics (in

the sense of aesthetics of environment) and the aesthetics of atmosphere, drawing upon the same shared theoretical positions. Specifically, ecological aesthetics was at its peak of popularity three decades ago; the XIIIth International Congress of Aesthetics, held in Finland in 1995, was devoted precisely to this theme. Today, it constitutes a complex interdisciplinary field of inquiry that reflects the search for new horizons for contemporary knowledge.

Nevertheless, it is difficult to assert that these inquiries proceed smoothly and without difficulties. Although the aforementioned works made a significant claim for the establishment of a new branch of aesthetic science, identifying its initial philosophical-theoretical and scientific-practical meanings, subsequent philosophical elaboration on the problems of the aesthetics of nature has slowed in many countries. The principal advances have been made in the areas of empirical landscape studies (methodologies for assessing the aesthetic qualities of landscapes), architectural environments, and environmental design. Still, there are several important achievements of ecological aesthetics to date.

First and foremost, aesthetics shapes value. Regardless of any theoretical understanding of nature, its protection in practice will remain a low-priority task unless it transforms into a value and gains justification as a cultural goal. Ecological aesthetics in Western culture teaches one to see intrinsic value and fragile harmony in natural processes, whether in the patterns on tree bark or the complexity of a wetland ecosystem. This transforms consciousness, shifting nature from the category of “object” to that of “subject,” worthy of respect and protection. For Eastern culture, the emphasis on the consequences of actions and their significance for nature is more important.

Secondly, ecological aesthetics offers a new language and new images. Alarmist messages about catastrophes from eco-activists in the West often provoke rejection and feelings of powerlessness. Aesthetics, however, can inspire by offering positive images of a desirable future: green cities, the symbiosis of technology and living nature, the elegance of a circular economy. It makes environmentally friendly choices not only ethical but also attractive, stylish, and meaningful. Thus, without a change in aesthetic perception, any technological solutions and political directives will have limited effect. For people to sincerely strive to protect nature, they must first learn to feel it, to see its authentic beauty, and to feel the need for that beauty in their daily lives. Ecological aesthetics, along with the aesthetics of everyday life, serves as a bridge from the rational understanding of problems to emotional involvement in their solution, a transition to practice from abstract theories. Now there are research demonstrating the significance of this field for changing everyday practices, using Russian material as an example (Rybakov, 2022).

Eco-art developed as a part of the search for a new language. This movement has been taking shape since the 1960s, within which artists drew public attention to rethinking relationships with the environment. The first exhibition, “Ecological Art”, was held in 1969 in New York. Today, eco-art encompasses environment (the interpretation of ecological issues through art), earthworks, land art (the creation of works connected with the natural landscape), sustainable art, landscape painting, and photography. Interestingly, many projects were created or exhibited in the United States. And today, this remains the center of eco-art, although by actual indicators, it is far from being the

most environmentally friendly country. This is an interesting detail, once again demonstrating that theoretical and artistic reflection and the practice of an ecological attitude toward nature do not always go hand in hand. In any case, ecological art accompanies the current ecological trend on a global level.

The first known works in this genre were distinguished by their large scale, utilizing landscapes as the basis for the artwork. In 1970, the famous "Spiral Jetty" by Robert Smithson was created – a massive structure of stones on the shore of the Great Salt Lake in the United States (Fig. 1). This scale is also reflected in the work of Agnes Denes from 1982, titled "Wheatfield – A Confrontation" (Fig. 2). The artist planted a wheat field in the center of New York on a landfill site. In 1982, the artist Joseph Beuys proposed conducting one of the first environmental actions to provoke the planting of "7,000 Oaks" across Europe.

Figure 1. Spiral Jetty from Rozel Point

Figure 2. Wheatfield – A Confrontation by Agnes Denes

The contemporary language of eco-art is characterized by a more pronounced rejection of the narrative of domination and a transition to a language of participation, and ethical responsibility. While classical art typically aimed to create a static artifact, eco-art emphasizes temporality, regeneration, and the viewer's immersion in ecological processes. A compelling contemporary example of this perspective is the 2026 installation “Castaway: The Afterlife of Plastic” by the collective TRES (2025-2026) (Fig. 3), which utilized various kinds of debris from Australian beaches. The artists sought to demonstrate the result of the interaction between the modern human world (plastic) and the natural landscape.

Figure 3. And yet it moves by TRES (2025-2026)

This expands the boundaries of aesthetic experience, integrating into it not only the visual qualities of the landscape but also invisible anthropogenic impacts, chemical processes, and interspecies interactions. This shift in focus contributes to the formation of a holistic worldview, in which nature ceases to be a passive object of representation and is endowed with the status of an active co-subject of dialogue making eco-art a complex semiotic project. Its goal is to overcome the reductionism of technogenic civilization by creating images capable of encompassing the complexity of ecological systems. The emerging visual language becomes a mechanism for forming a new ecological sensibility, necessary for survival and sustainable development in the era of global climate change.

In their pursuit of new images and their theoretical justification, Western authors frequently turn to researchers from the countries of the Far East. From the Western perspective, the East has always appeared as a place of greater integrity, of healthy human-nature relations in which subject-object boundaries are not accentuated. Eastern philosophy, including Chinese and Indian traditions, has traditionally attracted interest for its engagement with concepts implying greater human respect for the harmony and law of the external world. Therefore, the category of ecological aesthetics, environmental aesthetics, and the aesthetics of atmosphere and everyday life in the West is often realized with mentions of or direct references to Eastern authors and traditional practices. Western researchers, like tourists, expect new, more effective environmental solutions from the East, based *simply* on a different vision of the problem. However, upon arriving in the East – in China, India – they encounter unfamiliar practices of consumption, attitudes towards nature and objects, and waste management, which not only seem unmodern, outdated, and unreasonable but also contradict what Western people know about Eastern traditions of thought.

The philosophical and cultural roots of ecological conceptions in the cultures of the Far East are usually associated with the idea of harmony. Confucianism, Daoism, and Buddhism emphasize the close interconnection between humans and nature, which is dangerous to disrupt and should be maintained by relying on knowledge of and adherence to natural laws. Nature is understood not as a resource but as an integrated system of which humans are a part. In the Chinese tradition, it is humans who bear responsibility for order or disorder in the Celestial Empire. The degree of this responsibility depends on one's status and position in society; consequently, the ruler plays a crucial role in maintaining order. As long as the ruler is benevolent and follows ritual, harmony and order prevail in the Celestial Empire. But as soon as the ruler deviates from his path (Dao), Heaven immediately displays its ominous signs, the Celestial Empire falls into chaos, and the people, the "voice of Heaven," may depose him (Liu, 2024; Tsybanov, 2022).

Confucius says relatively little about the relationship between humans and nature. His teachings are primarily directed at social problems, at understanding the human position in society, rather than in the world. However, upon closer acquaintance with the Chinese philosophical tradition, it becomes clear that for Confucius, interest in social problems by no means excludes interest in the problems of the world and nature. As Leonard Perelomov notes, in Confucius's Analects, "four fundamental principles of the relationship between society and nature can be identified:

1. To become a worthy member of society, a person must constantly deepen their knowledge of nature, knowing not only the habits of animals and birds but also the laws governing the growth of trees and grasses.
2. Humans, and consequently society, can gain vital energy and repose only in nature.
3. It is necessary to treat both the animal world and natural resources with care.
4. Solemn prayers and sacrifices should be regularly performed in honor of the spirits of Heaven and Earth, and importantly – at the highest state level" (Perelomov, 2004, p. 24).

This can be regarded as a philosophical foundation for various issues concerning the understanding of nature and the ethics of relating to it; however, it provides no specifics regarding the organization of actions. For many centuries, Chinese culture, in its everyday and artistic practices, may well have conformed to these high ideals. But the result of the ideological shifts of the "first enlightenment" (late 19th-early 20th centuries) and the "second enlightenment" (late 20th-early 21st centuries) has been a clear change in the relationship with nature. High rates of industrial development, a sharp increase in population density, and the growing demands of the economy – these factors determine the specificity of everyday practices and also lead to real environmental problems in China's major cities. Consequently, the question of the relationship with nature becomes not only traditionally significant and speculative but also an urgent issue affecting the quality of life for millions of people. Reflections on this issue reference traditional philosophy, but practices have changed due to massive waves of modernization, largely looking to the West as a model, thus creating a series of contradictions. Modern European philosophy, which in one way or another underpins the scientific and technological progress of the last four centuries, formulates a subject-object relationship between humans and the surrounding world. This, obviously, aligns poorly with the ideas of classical Chinese culture. However, the forced pace of modernization in China required more the copying and acceleration of resource-consumption practices than their reflection and adaptation. The result is impressive economic and technological development against a backdrop of a double contradiction: current practices correspond neither to traditional ideas of harmony and respect for nature, nor to current Western environmental trends. An internal cultural conflict emerges – a feeling of disproportion between ongoing economic processes, pragmatic policies, and traditional cultural values expressed in Chinese philosophy and concepts like "Dao."

COMPARISON OF THE ECOLOGICAL VECTOR OF MODERNIZATION IN THE WEST AND EAST

The European Union is a global leader in the legislative regulation and implementation of the circular economy and environmental practices. Its leadership is largely ensured by the fact that, as pioneers, they set the criteria for assessing the environmental sustainability of an economy. The practice of separate waste collection is implemented almost everywhere in Europe, although the level of effectiveness varies between different regions. At the same time, a standard for this practice is set for the

future in all countries according to the EU Waste Directive 2018/851, which aims for 60% of municipal waste to be prepared for reuse and recycling by 2030, and 65% by 2035 (European Commission, 2018). Attention to waste is not limited to this. Systems are in place where producers of goods and packaging are financially and organizationally responsible for their disposal, e.g., the "Green Dot" in Germany (Van Eygen et al., 2020). There are highly efficient deposit systems for plastic bottles and aluminum cans (e.g., in Norway, Sweden, Germany, Lithuania) with return rates of 90-95% (Lavee & Nardiya, 2023). Digitalization systems are being actively developed, funding is provided for smart containers with fill-level sensors, and mobile apps are used for information and citizen incentives (Marques et al., 2022). The EU has bans on certain single-use items, promotes the development of biodegradable alternatives, and funds research aimed at creating materials and packaging that are easier and more efficient to recycle (Eurostat, 2024) (Fig. 4).

Figure 4. CopenHill is one of the world's most environmentally friendly waste and energy recycling facilities. Copenhagen, Denmark.

But the Western world is not only Europe. In the USA, the share of waste sent for recycling and composting is relatively low: 32%, although 77% of Americans claim to

practice separate collection. People are more aware of green projects and initiatives than of their concrete results. Current research finds a clear discrepancy between the espoused green values, ideals, and practices in the USA (Jessen, 2025). Today US society is divided into several factions whose views on the environmental situation differ greatly.

In the East, unity is also not observed; countries demonstrate different levels of development on environmental issues. In China, a separate waste collection system was launched by the government in Shanghai in 2019 and quickly spread to all major cities (Beijing, Shenzhen, Guangzhou, etc.). The system is built on strict rules, fines for non-compliance, and the social credit system may take environmental behavior into account. Residential complexes have attendants monitoring sorting (Zhang et al., 2022). This quickly yielded positive results: according to China's Ministry of Housing and Urban-Rural Development, the recycling rate of household waste in key cities exceeded 35% and continues to grow rapidly. China is building a huge number of modern waste treatment and waste-to-energy plants. The key driver is administrative resources and alignment with the national "Zero Waste Cities" campaign. In 2018, a ban on importing foreign waste came into effect, and in 2020, the Law on the Prevention of Environmental Pollution by Solid Waste was passed (Brooks et al., 2018; Wen et al., 2021; Xu et al., 2023; National Bureau of Statistics of China, 2023). Research is currently underway on integrating AI into sorting and recycling processes. However, tourists barely notice this system, unlike in neighboring countries.

In Japan and South Korea, highly developed and efficient separate waste collection systems have long existed, which impress visitors, especially the complex systems in Japan with dozens of fractions (Park & Lah, 2020; Matsuda & Hirai, 2021). Research in these countries focuses on high recycling technologies (e.g., chemical recycling of plastics), sorting robotics, and energy efficiency. Everyday eco-practices are very successful here, but transferring their experience to other countries is extremely problematic due to cultural specificities. In many ways, these countries are similar to China, but China has become extremely noticeable and significant due to the scale of both its environmental mistakes and its successes, given the size of its production and population.

In Chinese stores, tourists are surprised by the abundance of single-use packaging, often non-recyclable and quite bulky. Global confectionery brands have faced the need to adapt their packaging. Due to hygienic considerations and the fact that sweets in China are always associated with giving and sharing, the packaging must be either very presentable or individual for each candy. This contradicts the values of Western manufacturers.

Besides the topic of recycling, there are other environmental initiatives. China often turns out to be the leader in these, for example, in the production and installation of solar panels, wind turbines, electric vehicles, and batteries. Currently, China is implementing the construction of "eco-cities," large-scale greening projects, and rooftop parks. These practices are accompanied and inspired by research in the field of environmental aesthetics (Dzikevich & Tang, 2025). Key ideas in this area, realized in China, include the aesthetic concepts of the "Garden City" and "Beautiful China" as models for integrating national views and contemporary trends in ecological aesthetics (Li, 2020).

Both in the East and the West, artists actively reflect on environmental problems and trends, but in different ways. At the latest Shanghai Biennale, the theme of non-human subjectivity and agency became central.

Today, in many countries, eco-practices have become a strategic priority, a conscious vector for the modernization of life, but one can move in this given direction by different paths. If Europe followed the path of gradual education and the creation of a complex legal framework, China demonstrates "shock therapy" – the ability to rapidly change reality on a gigantic scale through administrative methods. State involvement is also important in the West, but it appears more as a reaction to public demand, sometimes formal and populist. In China, conversely, large-scale state projects prove to be far more effective than the everyday practices of citizens. Both approaches today yield high results and serve as examples for other regions of the world.

To the above should be added an analysis of the philosophical positions and cultural characteristics of the two regions. Western culture, drawing strength from Western European philosophy and the Judeo-Christian tradition, long perceived humans and nature as two distinct entities and often interpreted reason as a God-given right for humans to have dominion over nature. The Enlightenment reinforced the idea of reason as a tool for conquering the environment. The priority of individual freedom and the rights of the individual also manifested in the culture of mass consumption as an individual right to comfort and goods. At the same time, the idea of personal responsibility in Christian and atheistic philosophical concepts endows each person with responsibility for the consequences of every choice and action. This generates powerful grassroots environmental movements and resistance to external constraints, as well as a strong sense of guilt, which becomes a tool of manipulation in various political and social debates.

In the East, in countries with Confucian and Buddhist cultures, there is more talk of harmony and the unity of humans and nature. Here, responsibility before Heaven for order in the Celestial Empire is distributed according to the social hierarchy. Therefore, it is entirely logical that the state approach often dominates in decision-making, and social movements may have less influence. It is the state that should be interested in maintaining the overall natural order. The necessity and speed of economic growth lead in this situation to interesting adaptation schemes: for example, the construction of dams and new, large-scale technological solutions, rather than a focus on changing consumer models.

The Western approach to environmental issues today is characterized by alarmism and calls for action aimed at quick results. This is largely due to the political dimension of the issue, the struggle for voters, and societal pressure. Practical activity has its effect, but many initiatives turn out to be more like symbolic actions (e.g., Earth Hour and switching off lights). However, ecological consciousness itself has formed slowly in the West, demonstrating a gradual evolution of ideas about the human-nature relationship. In the East, a more abrupt transition is taking place in the realm of practices, and they are on a larger scale. At the same time, there is reliance on ancient philosophical positions, and the vision of the problem is less emotional and more pragmatic. At the same time, globalization is making its own adjustments, and today we can observe a blending of approaches. In the West, interest in Eastern holism, deep ecology is

growing, while in the East, interest in Western environmental movements and technologies is increasing. This convergence of ideas is often embraced by young people. Youth in global cities of the Far East (Shanghai, Seoul, Tokyo) think similarly to their peers in Berlin or San Francisco, sharing the values of sustainable development. It is important to note in this process the significance of aesthetics in shaping ecological consciousness, regardless of the initial theoretical and practical inputs. In the West, ecological aesthetics becomes more of an inquiry into the possibility of overcoming the subject-object paradigm and forming new representations; in China, it involves forming a new discourse with reference to tradition. In any case, aesthetic reflections are tied to practice and attempt to achieve greater coherence between beliefs and actions at different levels.

CONCLUSION

Culture exists precisely in the tension between the poles of conceptualization and everyday life. Effective research requires constant reflexive navigation between these levels, refusing to reduce one to the other, and being prepared to work with the inevitable contradictions, ruptures, and non-linear connections. Acknowledging this difficulty does not weaken the research position; on the contrary, it allows one to avoid oversimplifications and create a more adequate, multidimensional picture of cultural reality.

Environmental sustainability has become an important factor in the modernization of production and life, and this is both a consequence and a sign of the development of globalization trends and perspectives on world processes. But the path of environmental modernization for each community is unique, as it depends on factors at different levels. Aesthetic representations manifest themselves in the reality of everyday practices and micro-decisions, micro-choices. Eastern countries are undergoing or have recently passed a stage of rapid industrial growth, where environmental costs were long considered a necessary evil, and now a balance between development and ecology is being sought. Most Western countries passed the stage of “dirty” industrialization long ago and now export harmful production to other countries. Today, they have the resources and technologies for a “green” transition.

A characteristic feature of ecological aesthetics as a phenomenon of post-non-classical thinking is its dialogic nature. The traditional dialogue between Eastern and Western aesthetics, aesthetics and ethics, art and natural science is complemented by a search for a communicative space between aesthetics and socio-economic, legal, and technical knowledge. Awareness of global risks and efforts to change practices of interaction with nature are not a concession to alarmism or fashion, but a responsible step that all communities on the planet must take, regardless of their cultural particularities. At the same time, it is necessary to recognize that different countries and cultures have vastly different starting points: the current state of affairs in the environmental sphere, their own ideas of how things ought to be, their own philosophical categories, and their own habits. Moreover, economic inequality and historical features of modernization add not only differences but also raise the question of justice and responsibility for the

consequences of human activity. These are important questions that cannot be addressed within the scope of a single article, but it is important to keep them in mind. In this case, several factors in the process of forming ecological consciousness were examined, demonstrating the diverse range of possible paths along this journey.

REFERENCES

Berleant, A. (1992). *Art and Engagement*. Temple University Press.

Berleant, A. (1997). *Living in the Landscape: Toward an Aesthetics of Environment*. University Press of Kansas.

Berleant, A. (2010). *Sensibility and Sense: The Aesthetic Transformation of the Human World.* Imprint Academic.

Brooks, A. L., Wang, S., & Jambeck, J. R. (2018). The Chinese Import Ban and its Impact on Global Plastic Waste Trade. *Science Advances*, *4*(6). https://doi.org/10.1126/sciadv.aat0131

Carlson, A. (1999). *The Aesthetics of Environment*. Temple University Press.

Dzikevich, S. A., & Tang, Z. (2025). Teoreticheskie i prakticheskie aspekty esteticheskogo otnosheniya k okruzhayushchey srede v sovremennom Kitae [Theoretical and practical aspects of the aesthetic attitude to the environment in modern China]. *Obshchestvo: filosofiya, istoriya, kultura*, *3*, 33–40. https://doi.org/10.24158/fik.2025.3.3

European Commission. (2018). Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste. *Official Journal of the European Union*. https://eur-lex.europa.eu/eli/dir/2018/851/oj

Eurostat. (2024). *Recycling Rates of Municipal Waste*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Municipal_waste_statistics

Geertz, C. (1973). Thick Description: Toward an Interpretive Theory of Culture. In C. Geertz, *The interpretation of cultures* (pp. 3–30). Basic Books.

Hepburn, R. W. (1966). Contemporary aesthetics and the neglect of natural beauty. In B. Williams & A. Montefiore (Eds.), *British analytical philosophy* (pp. 328–342). Routledge and Kegan Paul.

Jessen, J. (2025, January 22). WM's Recycling Report: Do Americans really recycle? *Sustainability Magazine*. https://sustainabilitymag.com/news/wms-recycling-report-do-americans-really-recycle

Lavee, D., & Nardiya, S. (2023). The Impact of Deposit-refund Schemes on the Recycling of Beverage Containers: A Cross-country Analysis. *Resources, Conservation and Recycling*, *188*, 106674. https://doi.org/10.1016/j.resconrec.2022.106674

Li, Z. (2020). Ekologicheskoe iskusstvo v traditsionnoy kitayskoy kulture [Environmental art in traditional Chinese culture]. *Culture and Art*, *8*, 45–52.

Liu, X. (2024). Proiskhozhdenie sovremennoy kitayskoy ekologicheskoy estetiki iz protsessualnogo ponimaniya prirody A.N. Uaytkheda, marksistskoy dialektiki i kontseptualnykh pozitsiy traditsionnoy kitayskoy filosofii [The Origin of Modern Chinese Ecological Aesthetics from the Processual Understanding of Nature by

A.N. Whitehead, Marxist Dialectics, and Conceptual Positions of Traditional Chinese Philosophy]. *Obshchestvo: filosofiya, istoriya, kultura*, *4*, 103–109. https://doi.org/10.24158/fik.2024.4.14

Marques, R. C., da Cruz, N. F., & Carvalho, P. (2022). Digitalization and the circular economy in municipal solid waste management: A systematic literature review. *Journal of Cleaner Production*, *368*, 133150. https://doi.org/10.1016/j.jclepro.2022.133150

Matsuda, T., & Hirai, Y. (2021). Recycling and waste management policies in Japan: A review. *Journal of Material Cycles and Waste Management*, *23*(5), 1711–1722. https://doi.org/10.1007/s10163-021-01262-9

Matthews, P. (2002). Scientific Knowledge and the Aesthetic Appreciation of Nature. The *Journal of Aesthetics and Art Criticism, 60*(1), 37–48. https://doi.org/10.1111/1540-6245.00053

National Bureau of Statistics of China. (2023). *China Statistical Yearbook 2023*. China Statistics Press.

Park, S., & Lah, T. J. (2020). Analyzing the success of the volume-based waste fee system in South Korea *Waste Management*, *105*, 492–502. https://doi.org/10.1016/j.wasman.2020.02.030

Parsons, G. (2002). Nature Appreciation, Science, and Positive Aesthetics. *The British Journal of Aesthetics, 42*(3), 279–295. https://doi.org/10.1093/bjaesthetics/42.3.279

Perelomov, L. S. (2004). "Chetveroknizhie" - klyuch k postizheniyu konfutsianstva ["The Four Books" - The Key to Understanding Confucianism]. In *Konfutsianskoe "Chetveroknizhie" ("Sy shu")* (pp. 5–32). Vostochnaya literatura.

Prozersky, V. V. (2013a). Ekologicheskaya estetika na rubezhe stoletiy: Vybor kontseptualnogo puti [Environmental Aesthetics at the Turn of the Century: The Choice of a Conceptual Path]. *Vestnik of Saint Petersburg University. Series 17. Philosophy. Conflict Studies. Cultural Studies. Religious Studies, 3*, 22–28.

Prozersky, V. V. (2013b). Ot estetiki obekta k estetike sredy [From the Aesthetics of the Object to the Aesthetics of the Environment]. *Vestnik of Pushkin Leningrad State University, 2*(3), 88–96.

Rolston, H., III. (1988). *Environmental Ethics: Duties to and Values in the Natural World*. Temple University Press.

Rybakov, V. V. (2022). Ot avangarda k iskusstvu zhizni: ob esteticheskoy transformatsii rossiyskogo mentaliteta [From Avant-garde to the Art of Living: On the Aesthetic Transformation of the Russian Mentality]. *Terra Aestheticae*, *2*, 114–135.

Saito, Y. (1985). The Japanese Appreciation of Nature. *The British Journal of Aesthetics, 25*(3), 239–251. https://doi.org/10.1093/bjaesthetics/25.3.239

Saito, Y. (2007). *Everyday Aesthetics*. Oxford University Press.

Saito, Y. (2017). *Aesthetics of the Familiar: Everyday Life and World-making*. Oxford University Press.

Tsybanov, S. S. (2022). Ekologicheskaya etika v Kitae (v kontekste traditsionnykh religioznykh ucheniy) [Environmental Ethics in China (in the Context of Traditional Religious Teachings)]. *Kontekst i refleksiya: filosofiya o mire i cheloveke*, *11*(1A), 98–104. https://doi.org/10.34670/AR.2022.70.92.012

TRES. (2025–2026). *Castaway: The Afterlife of Plastic* [Installation]. Peabody Museum. https://peabody.harvard.edu/castaway-afterlife-plastic

Van Eygen, E., Laner, D., & Fellner, J. (2020). Integrating High-resolution Material Flow Data into Waste Management Planning: A Case Study for Plastic Packaging in Austria. *Environmental Science & Technology*, *54*(19), 11915–11924. https://doi.org/10.1021/acs.est.0c03466

Wen, Z., Xie, Y., Chen, M., & Dinga, C. D. (2021). China's Plastic Import Ban Increases Prospects of Environmental Impact Mitigation of Plastic Waste Trade Flow Worldwide. *Nature Communications*, *12*(1), 425. https://doi.org/10.1038/s41467-020-20509-3

Xu, M., Zhang, Y., Li, J., & Zhang, H. (2023). The Effectiveness and Challenges of Mandatory Municipal Solid Waste Sorting Policy in Shanghai, China: A Case Study. *Journal of Material Cycles and Waste Management*, *25*(1), 1–14. https://doi.org/10.1007/s10163-022-01547-7

Zhang, B., Lai, K. H., Wang, B., & Wang, Z. (2022). From intention to action: How do personal attitudes and social norms influence residential waste sorting behavior in China? *Resources, Conservation and Recycling*, *180*, 106–152. https://doi.org/10.1016/j.resconrec.2021.106152

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Research article

A Philosophical Interpretation of Nature's Intrinsic Value

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Abstract
Grounded in the Marxist theory of value and Xi Jinping's thought on ecological civilisation, this paper systematically explores the core question of whether nature possesses intrinsic value. The article first critiques the theoretical limitations of the traditional instrumentalist theory of value and uni-dimensional ecocentrism, pointing out that under the subject-object relational model of value, maintaining human subjectivity does not necessarily deny nature's intrinsic value. By introducing a relational expression of value, the paper demonstrates the equal status of nature as an object within the value relationship, revealing the logical possibility of nature's intrinsic value. Secondly, integrating the labor theory of value with the theory of innovative labor, the paper analyses the roles of land, machinery, and high-tech production in value creation. It points out that nature's creativity and human creativity possess an inherent unity, and that the latent intrinsic value of nature is actualised through human practical activities, transforming into an 'endogenous use value.' On this basis, the article explores the unity of 'is' and 'ought' from an ontological perspective, elucidating how the creativity of ecosystems intrinsically connects factual judgements with value judgements. Ultimately, centred on the scientific proposition that "lucid waters and lush mountains are as valuable as mountains of gold and silver," it demonstrates the dialectical unity of ecological and economic values and proposes a philosophical foundation for building a 'community of life' between humanity and nature, thereby achieving a dialectical transcendence of both anthropocentrism and ecocentrism.

Keywords: Nature, Intrinsic Value, Lucid Waters and Lush Mountains Are as Valuable as Mountains of Gold and Silver, Community of Life

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Научная статья

Философская интерпретация внутренней ценности природы

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Аннотация
В этой статье, основанной на марксистской теории ценностей и взглядах Си Цзиньпина на экологическую цивилизацию, систематически исследуется ключевой вопрос о том, обладает ли природа внутренней ценностью. Сначала в статье критикуются теоретические ограничения традиционной инструменталистской теории ценностей и одномерного экоцентризма, подчеркивается, что в рамках субъект-объектной модели ценностей сохранение человеческой субъективности не обязательно отрицает внутреннюю ценность природы. Представляя относительное выражение ценности, статья демонстрирует равный статус природы как объекта в рамках ценностных отношений, раскрывая логическую возможность внутренней ценности природы. Во-вторых, объединяя трудовую теорию стоимости с теорией инновационного труда, в статье анализируется роль земли, машин и высокотехнологичного производства в создании стоимости. Это указывает на то, что креативность природы и креативность человека обладают неотъемлемым единством и что скрытая внутренняя ценность природы реализуется в практической деятельности человека, превращаясь в "эндогенную потребительскую ценность'. Исходя из этого, в статье исследуется единство понятий 'есть" и "должно" с онтологической точки зрения, выясняется, как креативность экосистем неразрывно связывает фактические суждения с оценочными суждениями. В конечном счете, основанный на научном утверждении о том, что "прозрачные воды и пышные горы так же ценны, как горы из золота и серебра", он демонстрирует диалектическое единство экологических и экономических ценностей и предлагает философскую основу для построения "сообщества жизни" между человечеством и природой, тем самым достигая диалектической трансцендентности обоих антропоцентризм и экоцентризм.

Ключевые слова: Природа, Внутренняя ценность, Прозрачные воды и пышные горы так же ценны, как горы из золота и серебра, Сообщество жизни

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INTRODUCTION

In the historical process of comprehensively advancing the Chinese path to modernisation, how to achieve the dialectical unity of economic development and ecological preservation has emerged as a paramount contemporary issue. President Xi Jinping's philosophical assertion that "lucid waters and lush mountains are as valuable as mountains of gold and silver" profoundly elucidates the intrinsic correlation between ecological and economic values, providing fundamental guidance for building an ecological civilisation in the new era. This proposition is not merely an innovation in developmental concepts; it harbours deep philosophical implications regarding value – namely, whether nature possesses intrinsic value, and how such value is manifested and realised through human practical activities. Confronted with the global ecological crisis and the limitations of traditional value systems, it is imperative to systematically reflect upon and theoretically reconstruct nature's intrinsic value from a philosophical perspective. Anchored in the Marxist framework of value theory and the practical logic of the Chinese path to modernisation, this paper demonstrates the generative mechanisms, ontological foundations, and practical significance of nature's intrinsic value, aiming to provide robust theoretical support for the construction of a community of life between humanity and nature.

THE DEFICIENCIES OF TRADITIONAL ECOLOGICAL VALUE THEORIES AND THEIR THEORETICAL TRANSCENDENCE

Through the lens of traditional value theory, nature does not qualify as a subject, and is deemed devoid of value; any attributed value must correlate with humankind. Natural conditions and resources are reduced to mere survival necessities for humans that are available for exploitation. In this view, nature is devoid of intrinsic value. The sole bearers of value are humans, as only they are considered to possess value and rights. The valuation of other entities is determined by human beings, governed by their utilitarian motives and objectives, thereby transforming nature into a tool or means for humans to fulfill their personal goals. This perspective epitomizes the instrumentalist viewpoint on value.

To counter this instrumentalist perspective, the value of ecocentrism has gained significant traction. Intrinsic value theory in ecocentrism acknowledges nature's inherent value and inalienable rights. Humans as well as non-human entities, inclusive of biological lifeforms, should be valued. Intrinsic value theory propagates the extension of 'natural rights' from humans to nature, implying nature's entitlement to rights. This theory broadens the scope of traditional value concepts, such as morality, justice, equality, responsibility, and obligation, from human-human interactions to human-nature relationships. It, therefore, relatively confers subjectivity upon biological entities in nature. Nonetheless, it is apparent that the value of ecocentrism is not without its issues.

The Chinese theory of value is predominantly grounded in a subject–object relational paradigm. In this framework, subjectivity remains exclusive to humans, and

only elements bearing utility or significance to humans are valued. As articulated by Deshun Li (1987), "Without a doubt, the subject, in any sense, can only be broadly construed as humans (encompassing various forms of human social aggregates), not as deities, 'objective spirits,' other life forms, or objects. This is because humans are the sole practitioners and cognizers" (p. 59). Lianke Li (1991) asserts that "The subject's emergence as a subject is attributed to its inherent capacity and vitality for cognition and action" (p. 74). In the Encyclopedia of China (Philosophy I), the universal essence of value is characterized as "a relationship between actual humans and the attributes of an object that caters to a certain human need" (Encyclopedia of China Publishing House, 2004, p. 345). In a nutshell, value represents a particular effect, characteristic, or purpose of an object that corresponds to or fulfills the requirements of the subject.

Instrumentalist theory of value exhibits inherent deficiencies, which the subject-object model of value is positioned to overcome, for several compelling reasons:

First, the notion of natural instrumental value, which emerges from the perspective of human utility, is contested. Nonetheless, the consensus remains that humans are the subjects, and only humans (or their various collectives) can serve as subjects. Nature cannot act as a subject in this model. The subject-object dichotomy forms a dual category in human cognitive and practical activities. The subject is the initiator and bearer of these activities, while the object is the target of the subject's knowledge and action. The subject possesses intentionality, agency, and purposefulness, features that nature inherently lacks.

Second, the anthropocentric instrumentalist view of value, rather than the subject-object relational model of value, is opposed. Stemming from the premise that humans are subjects, the resultant value paradigm is the subject-object relational model. In this model, humans function as value subjects, necessitating a value relationship between humans and the object, rather than a natural or cognitive relationship. If the object is devoid of value attributes, a value relationship cannot be established. A relationship without relatives is non-existent, and it cannot consist of a single "relative", such as the human. Recognizing the subject-object relational model of value also requires acknowledging that the object possesses or potentially harbors valuable properties. Without this, the relationship between the subject and object remains purely natural, signifying a factual relationship rather than a value relationship.

Third, the instrumentalist view of value, which defines value as the object satisfying the needs of the subject, is imprecise. The needs of the subject can be both positive and negative, without offering a clear, positive delineation of 'needs.' In this definition of value, the object is entirely passive, devoid of any agency. In truth, the object and subject are mutually constitutive. A plethora of relationships exist between the subject and object, both positive (such as harmonious coexistence between humans and nature) and negative (preferring mountains of gold and silver to lucid waters and lush mountains). Therefore, the question arises: under what conditions does a subject-object needs relationship become a value relationship? As articulated by Xi Jinping in the report of the 19th

National Congress of the CPC, “Socialism with Chinese characteristics has entered a new era; the principal contradiction facing Chinese society is the discrepancy between unbalanced and inadequate development and the people's ever-growing needs for a better life” (Compilation and Translation Bureau, 2017, p. 11). The ‘needs for a better life’ encompass a positive definition of the value demand for ‘better.’

Consistent with the subject-object relational model of value, the assertion ‘P holds value’ suggests that P fulfills the requirements of subject S, thereby casting P as an object. ‘P holds value’ indicates that P, acting as an object, meets the needs of subject S. From a human perspective, intrinsic value implies that humans, as objects, satisfy the demands of the subject, which is human as well. This analysis is valid, for example, when a person scratches an itch; the individual becomes both the agent and the recipient, thereby demonstrating an inherent human value.

In this frame of reference, the primary arguments against the intrinsic value of nature include: first, only humans serve as subjects and possess objectives; second, a fundamental disparity exists between humans and nature. Only humans exhibit consciousness, initiative, and creativity, and only they can comprehend and alter the world.

One might say, the statement ‘P holds value’ fundamentally signifies a value relationship between object P and subject S, a relationship between the relating and the related party. Solely from a value relationship perspective, object P is defined by subject S, and their mutual value relationship. Conversely, subject S is similarly defined by object P, and their shared value relationship. This can be represented as PvrS, or SvrP.[1] According to this relational expression, object P and subject S share equivalent value, going beyond a simple instrumental natural relationship. There is no hard and fast rule that P should be the subject; it merely needs to possess, or potentially hold, valuable characteristics. Therefore, while the notion of nature as a subject can be dismissed, it does not deny the intrinsic value of nature.

Fourth, the subject-object relational model of value encompasses a dialectic unity. The extent of value is always subject to the physical existence of the subject-object pair, and the subject's comprehension limitations regarding the object's intrinsic value. The reason the subject acts as such lies in its role as the initiator and bearer of cognitive and practical activities, with the object becoming the aim of the subject's cognition and action. Dialectical materialism asserts that materials shape consciousness, which consequently mirrors the materials. In this scenario, materiality takes precedence, with consciousness being secondary. Materiality plays a determinant role on consciousness, which, however, exhibits a dynamic role on materials. Despite the dynamic nature of the subject, the value of the object relative to the subject is influenced by the subject's inherent materiality, and its understanding of the object's value. In contrast, the realization of the object's intrinsic

[1] Here, vr stands for the abbreviation of value relationship.

value necessitates the involvement of the subject's practical activities and the process of cognition. Generally speaking, the theory of value diverges from both epistemology and ontology. The value relationship between subject and object contrasts with their cognitive and natural relationships. Nonetheless, the ontological and epistemological states of the subject and the object significantly impact their value relationship. The concept of pure value is non-existent; the subject-object value relationship is inevitably shaped by their ontological and epistemological states. The subject's role is to generate a proactive, dynamic, and conscious effect within the confines dictated by the material relationship between the subject and object. Similarly, the subject-object's epistemological relationship is governed by their ontological and value-theory relationships. For example, the epistemological relationship of quantum information technology, a type of artificial natural object, is constrained by its material and value states.

Affirming humanity's subject status does not imply concurrence with the notion that humans are the overseers and commanders of life and the natural world, with nature merely succumbing to human modifications. Nature, the progenitor of life, forms ecosystems that underpin human survival and evolution. Marx and Engels precociously identified the considerable value inherent in nature, embodying an extensive ecological value philosophy. The natural world constitutes the necessary precondition and base for human survival and progress. As Marx elucidated, "Man himself is a product of nature, emerging and evolving within his environment and in concert with it" (Marx & Engels, 1995, pp. 374-375). It is not feasible for humans to surmount nature. "Insofar as nature is not the human body itself, it represents the inorganic body of man.... Man is a component of nature" (Marx & Engels, 2009, p. 161). Engels proffered a warning to humanity, "Let us not become overly engrossed in our victories over nature. For each such triumph, nature exacts its retaliation" (Marx & Engels, 2012, p. 998). Xi Jinping unequivocally stated in the report of the 19th National Congress of the CPC, "Only by adhering to nature's laws can mankind effectively avert missteps in the exploitation and utilization of nature. The damage inflicted upon nature by humans will ultimately recoil upon humanity itself, a rule that is incontrovertible" (Compilation and Translation Bureau, 2017, p. 50).

According to the perspective of the Marxist labor theory of value, nature, devoid of human labor's embodiment, lacks economic value. However, this does not discount the potential for other inherent values, suggesting the existence of untapped potential within nature (Engels, 1970, p. 209). Indeed, as Engels elucidated that "Political economists have always declared that labor is the source of all wealth. In reality, labor and nature together are the twin sources of wealth; nature furnishes the materials which labor transforms into wealth" (Marx & Engels, 2012, p. 998). Wealth represents an economic value. Therefore, it is evident that economic value emerges from the confluence of nature and labor. In the absence of nature, economic value is unattainable. Engels acknowledged the intrinsic value of nature, where 'value' conveys a more extensive and profound concept than labor value (economic value).

Employing socially necessary labor time as a metric to ascertain value is apt for customary labor rather than for innovative labor (such as technological innovation). The relationship between the time invested in innovative labor and socially necessary labor time is not linear. The value of innovative labor further underscores the premise that labor is the fountainhead of value (Wang, 2012), but importantly, reveals an aspect distinctly different from conventional calculations of labor wealth value. Amidst the global ecological crisis and the specific ecological challenges in our nation, it is imperative to broaden philosophical value notions and probe the deep-seated value of nature, thereby laying a theoretical groundwork for ecological value.

A NEW ARGUMENT FOR NATURE'S INHERENT VALUE

The interdependence and mutual construction between humans and nature yield a systemic and historical existence that shares a common value system. Consistent with Marx's viewpoint, humans are direct constituents of nature. Since the advent of humanity, nature has transitioned into an objective existence for humans, evolving from an abstract being independent of humans to a source of natural materials or labor resources embedded within the labor process (Marx & Engels, 2016, pp. 167-176). The term 'nature' is perceived with both broad and narrow connotations, demarcated into 'nature per se' and 'societal nature.' Ecological nature is categorized under societal nature, carrying fundamental characteristics of both natural and societal attributes (Wang, 1991). Simply put, nature represents a material world that, although distinct from human society, is intrinsically linked to humans. Therefore, nature's inherent value is inextricably connected with human social production practices and labor. Here, nature's inherent value diverges from both the instrumental value and the inherent values proposed by traditional Western anthropocentric and non-anthropocentric philosophies. Marx postulated that value is borne out of the relationship between a subject's needs and an object's ability to fulfill those needs (Marx & Engels, 1963, p. 406). Therefore, nature's inherent value originates when the subject's subjective needs, via practice and labor, act upon the object, and the object exhibits inherent attributes capable of satisfying the subject's needs. In this context, labor operates as the bridging entity between subject and object, enabling the realization of nature's inherent value (Fu, 2000). According to Xi Jinping ecology possesses value which is recognized based on the fundamental premise that "lucid waters and lush mountains are as valuable as mountains of gold and silver" (Xi, 2021). Interpreting ecological value as economic value implies that while Xi has highlighted the dialectical unity between ecological and economic values, he has underscored the potential or intrinsic value of a robust ecological environment. Even though ecological value deviates from labor value, an inherent unity of value resonates within both.

In the realm of traditional agricultural production, the amalgamation of factors such as human labor, production tools, and land dictate the value of agricultural products. It is noteworthy that the quality of agricultural products varies significantly, based on the land used for cultivation. While certain lands yield superior agricultural products, others produce merely average ones, and some are entirely non-arable. The diverse output of

goods, each with distinctive utility and value (as determined by socially necessary labor time), that springs forth from different lands with identical human labor underscores the pivotal role of integral agricultural components – land and socially necessary labor time – in shaping the value of agricultural products. Simply put, the combined force of land and human labor bears agricultural value. On the contrary, in the manufacturing of industrial goods, there is a choice between manual and mechanized production. The advent of machine production, which enhances labor productivity, significantly replaces human labor. In the market of commodities, the utility and value of goods are jointly determined by socially necessary labor time. In this context, value creation becomes a shared responsibility of machines and humans.

Regarding crafting intricate and complex high-tech products such as integrated circuits and high-performance engines, a significant number of components demand the precision of machines or software control, exceeding the capabilities of manual labor. Evidently, the creation of such high-tech products is beyond the reach of manual labor in the absence of precision machines or software. Many of these key core technology products, as commodities with high added value (utility and value), are desired yet elusive, owing to manufacturing limitations. Without advanced machinery, the creation of these high-tech products remains an unfulfilled aspiration. Similarly, without a pool of highly skilled technological manpower, these products remain unreachable. Hence, it is the synergy of humans and machines that brings the value of high-tech products into existence. This premise forms the foundation of the ensuing discussion: in the presence of humans, machines are destined to create value.

Given the existence of humans as proposition r, the existence of machines as proposition m, and the creation of high-tech product value as proposition v, the following arguments are developed using propositional logic:

Premises: (1) r

(2) m

(3) $r \wedge m \rightarrow v$

The proposition to be demonstrated is: $m \rightarrow v$

Proof: (4) $r \rightarrow (m \rightarrow v)$ (3), applying the rule of exportation

(5) $m \rightarrow v$ (1), (4), applying the rule of modus ponens

Proposition (5) indicates that the existence of humans is a prerequisite for machines to create the value of high-tech products. The existence and value creation potential of machines independent of humans remain an unproven concept. For instance, Alpha Go's capability to defeat top human Go players also hinges on human creativity. Whether considering the creators of Alpha Go or its human opponents, the existence of humans is an indispensable prerequisite for machines to create value.

This analysis suggests that machines' capacity to create value is contingent on human involvement. However, this raises a further question: in what sense can the latent productivity of land, devoid of human creativity, be deemed valuable? Holmes Rolston

(1989/2000) argued that unlike individual components of nature, entities such as land or species exist as holistic elements of nature and inherently possess value (p. 73). This intrinsic value differs from labor value but is dependent on the symbiotic ecological relationship between humans and nature. In other words, the extinction of a species impacts the entirety and integrity of an ecosystem. Moreover, land represents a community rather than a nature individual (Leopold, 1949, pp. vii-ix). Xi further highlighted that “mountains, rivers, forests, fields, lakes, and grasslands” constitute a living community (Ministry of Justice of the People's Republic of China, 2021). Each of these natural elements, including their interrelationships, embodies a sense of comprehensiveness and systemic integrity.

Considering land (or wilderness) a living community, it harbors the potential for growth given the presence of primeval conditions such as abundant water, sunlight, and possibly, the seeds of vegetables or fruits. This land spontaneously yields wild crops. These crops may serve as a food source for animals or birds, be utilized by explorers for nourishment, or be harvested by traders to be sold in urban markets. Additionally, these wild crops can significantly contribute to the genetic enhancement of agricultural produce. A notable instance is the eminent scientist, Mr. Yuan Longping, who significantly propelled his hybrid rice breeding endeavors using wild rice. Hence, the innate creative and generative capabilities of the land (or wilderness) lay the groundwork and possibility for its value relationship with humans. The pressing question, however, is how the creativity of such a natural ecosystem can be converted into value as posited by the labor theory of value. While wild crops do not necessitate human intervention for their production, they acquire value once introduced into a laboratory or market setting. It is evident that the value in this context is not labor value rather a different form of value. Consequently, humans or human labor are not the exclusive metric for determining the value of nature. Nevertheless, it is fundamentally equivalent to labor value. Otherwise, how would the value of wild crops be identified and quantified?

Accordingly, we propose that wild crops carry an intrinsic value, which remains latent and not immediately apparent. As this hidden value enters the value relationship shared between nature and humans, it becomes evident, transforming the intrinsic worth into a practical value, or what may be termed an ‘endogenous use value.’ In this context, humans play a pivotal role in revealing the potential intrinsic value of nature, illustrating the symbiosis between human subjectivity and the inherent attributes of nature. The unveiling of nature's inherent value is intrinsically tied to human discovery. Why is it that humans are capable of recognizing the value of certain wild crops? It is the cognitive prowess of humans that illuminates the latent value of these wild crops. The advent of agricultural, industrial, and ecological civilizations, along with their associated value systems, are a testament to human knowledge capabilities. When humans begin to distinguish anthropocentric and non-anthropocentric values, it represents a transcendence of nature by human civilization (Lu, 2021). The prevailing global ecological crisis is attributable to a lack of adequate comprehension and proper respect for the latent intrinsic value of the natural ecosystem. The intrinsic value of nature resonates with human subjectivity. General Secretary Xi Jinping underscored the significance of a robust

ecological environment in his report at the 19th National Congress of the CPC, urging that "the ecological environment be treated with the same reverence as life" (Compilation and Translation Bureau, 2017, p. 24). When the ecological environment deteriorates to the point where even the provision of basic necessities such as air and water becomes a concern, the toll exacted on humanity will be the erosion of the inherent value that the natural ecology embodies, which will further reflect as a wealth (Green GDP) deficit that humanity must bear.

The intrinsic value of nature can be approached from a different angle. When a natural ecosystem is damaged, the human labor required to restore it to its original state holds a certain value, which essentially reflects the inherent worth of nature. Instances of ecological damage that are irreparable, or where recovery time is immeasurable, carry an immeasurable value, according to the principle that socially necessary labor time determines value. Instead of waiting for nature to succumb to harm before acting, the ideal approach is to protect nature proactively, acknowledging the latent value inherent in an ecological system. Given its boundless potential for creativity, it is essential for humans to harmoniously coexist with nature. Ultimately, the root of both nature's intrinsic value and human labor value can be traced back to human autonomy and creativity.

Human creativity is reliant on a sound natural ecosystem. It is neither bestowed by a "divine entity," nor emerges from "nothingness." Its primary source is inextricably tied to nature, which inherently exhibits creativity. As Marx articulated, "Man did not create matter itself. Even the capacity of man to create a certain productive ability of matter can only be conducted under the pre-existing conditions of matter itself" (Marx & Engels, 1975, p. 46). This infers that human creativity is inherently present within matter. Matter possesses "inherent, vivid, and essential forces" (Marx & Engels, 1957, p. 163), indicating latent potentialities. Without these potentialities, human creation would be impossible. Hence, human creativity depends on these natural potentialities. The creative capacities of both humans and nature contribute to their relationship and the value relationships borne from it.

The creativity inherent in nature was already discerned by ancient Greek philosophers. Aristotle, a luminary of the time, dedicated considerable attention to the concept of 'nature' in his seminal work *Metaphysics*. He proposed six interpretations of 'nature': the growth process of living entities, seeds of such entities, the intrinsic source of motion for natural objects, raw material, the fundamental essence of natural objects, and the intrinsic essence of any given entity (Aristotle, ca. 4th century BCE/2021, pp. 99-100). Through these definitions, it becomes evident that Aristotle's concept of 'nature' is intimately connected with notions of growth, origin, and essence. Therefore, 'nature' does not merely represent natural entities or an aggregate of such entities forming the natural world. Rather, it underscores the inherent nature, origin, and growth associated with entities. Without growth, it becomes implausible to categorize an entity as natural. As Aristotle articulated, "The primary and principal meaning of 'nature' is the intrinsic principle of motion in entities. Material is referred to as nature because it is capable of receiving such things, and generation and growth are termed nature owing to their motion

originating from this. The inherent principle of motion in the existence of nature is nature itself, which is somehow innate to an entity, either potentially or actually" (Miao, 1993, p. 116). It can be further posited that the essence and origin of nature equate to growth or creation, as growth embodies creation, thereby implying that nature harbors a creative essence. Without this creative essence, how could nature have evolved to yield humankind?

The phrase 'nature,' conceptualized as a word combination, initially surfaced in the ancient Chinese text, *Tao Te Ching*, authored by Laozi. Interpretations of 'nature' have been subject to extensive discussion. Conventionally, 'nature' is perceived as a compound term wherein 'Zi' equates to 'self,' and 'Ran' translates to 'thus,' culminating in 'Zi Ran' or 'nature,' signifying "it is so of its own accord." Zhang Dainian, in *Outline of Chinese Philosophy*, posited, "Many predecessors misconstrued 'Zi Ran' as a noun, suggesting that the 'Tao' derives its principles from nature, which is a substantial misinterpretation. The term 'Zi Ran' appears repeatedly in Laozi's works... The term 'Zi Ran' consistently implies 'being so of its own accord,' not functioning as a proper noun" (Zhang, 1982, p. 18). However, in recent years, this interpretation has been contested. For instance, in the expression "Man models earth, earth models heaven, heaven models Tao, Tao models nature" (Laozi, 1972, Chapter 25, p. 8), 'Zi Ran' is treated as a noun. However, this noun does not represent the contemporary understanding of the 'natural world.' Liu Xiaogan proposed, "While 'Zi Ran' grammatically functions as a noun or an object, its semantic essence still mirrors the adjectival connotation of occurring naturally" (Liu, 2006, p. 317). And so, 'Zi Ran' can serve as an adverb, adjective, or noun. However, its core connotation, "being so of its own accord," remains unchanged. This concept emphasizes the intrinsic propelling force and causal factors of development within entities, or the notion of "occurring naturally, without the need for external intervention" (Zhang, 1998, p. 105). 'Zi Ran' underlines the internal nature of causality; even if subjected to external influences, these cannot fundamentally alter the intrinsic nature of the cause. It is clear that Laozi's ultimate category is 'Tao,' and "Tao models nature" pertains to the "normative nature of Tao" – "it is so of its own accord, it is naturally so." This bears a remarkable resemblance to the ancient Greek understanding of the self-creative nature of 'nature.' The semantics of 'Zi Ran' illuminate the shared aspects of Eastern and Western civilizations.

The relationship between humanity and nature forms an integral whole, within which the interplay between the two cannot be broadly generalized as one entity determining the other. Rather, it exists as a dialectically unified relationship, characterized by reciprocal action and mutual constraint. Marx asserted, "Nature embodies the inorganic body of man; man, much like nature, is engaged in a ceaseless cycle of interaction and dialogue with it, necessitated by the survival imperative" (Marx, 1844/2000, p. 56). While analyzing the correlation between human essence and industry, Marx revealed that industry represents the outward, public display of human's intrinsic forces. He noted, "Industry epitomizes the real, historical interaction of nature, and thereby of natural science, with man. Therefore, if we perceive industry as the palpable manifestation of man's elemental power, we comprehend

the human essence of nature or the inherent natural essence of man" (Marx, 1844/2000, p. 89). The notion of "the human essence of nature or the natural essence of man" illuminates the reciprocal interplay between humans and nature, highlighting that nature possesses anthropocentric characteristics, while humans embody naturalistic elements (Chen, 1988). Indeed, it is the inherent creativity of nature that imparts creative capabilities to humans.

LEAP IN ECOLOGICAL CIVILIZATION THOUGHT: BUILDING A 'COMMUNITY OF LIFE'

Surpassing both anthropocentric and biocentric paradigms, the inherent potential value of nature is actualized under human agency, elevating the intrinsic values of both humans and nature from their initial natural entities, emerging as value carriers. Consequently, an integrated value system, where humans and nature coexist in a relationship defined by mutual indispensability, interdependence, and symbiotic harmony, can be created. This dynamic, termed as a 'community of life' is a cornerstone of Xi Jinping's ecological civilization thought, predicated on the principle that "lucid waters and lush mountains are as valuable as mountains of gold and silver."

Lucid waters and lush mountains ought to possess ecological value. Based on academic interpretations and definitions of the concept of value, value belongs to a relational category; it is the utility generated from the subject-object relationship based on the subject's cognition of the inherent properties and functions of the object (Li, 2006). The meaning of ecological value is the subject-object utility relationship between ecosystem services and human beings within the philosophical category (Yu & Yang, 2022). Clearly, the concept of ecological value differs from the value of goods, commodities, and labor in traditional economics. The concept of ecological value is established upon the nature and functions of the ecosystem – as an objective existence – and its relationship with the object it serves: the human subject. Therefore, the premise for establishing ecological value is that the ecosystem itself possesses the intrinsic potential to validate a value relationship. Leopold (1949) also pointed out: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community." Whether it is the ecosystem's intrinsic potential or its authenticity and integrity, its own intrinsic value is not the non-empirical "animism" advocated by ecocentrism. Rather, it is a transcendence of intuitive natural intrinsic value, understanding the value of ecology itself from the category of the value relationship within the community of life between humans and nature. The construction of this community of life between humans and nature requires addressing the following three key areas:

First, stemming from the root of the value of creativity, the precise implications of the scientific postulate that "lucid waters and lush mountains are as valuable as mountains of gold and silver" can be profoundly comprehended. This postulate unveils that ecological and labor value serve as dual sources of value, broadening the Marxist labor value theory by integrating ecological value within its purview. Value not only originates from labor but also from creativity. Individuals should not merely engage in conventional

labor, but also delve deeper into recognizing and harnessing their inherent creativity. Therefore, a shift from human labor to creative labor is facilitated. This shift accentuates not only the value produced by labor but also the value generated by creative labor. Such a transition will contribute to a reevaluation of the significance and value of labor, gradually shifting from labor-intensive to creativity-intensive techniques. This is consistent with the demands of ecological conservation and the pursuit of ecological value. Simultaneously, recognizing the value of creative labor can stimulate the enthusiasm of scientists and technicians, providing a potent catalyst for rapidly mastering and developing core technologies, thereby expediting the country's advancement into the first tier of global science and technology.

The inherent value of lucid waters and lush mountains is engendered by the ecosystem. As long as these natural features persist, the potential for ecological value remains boundless. Conversely, the economic value created by labor, symbolized by mountains of gold and silver, faces potential depreciation if the products produced cannot immediately satisfy exchange value, and their creativity continually diminishes in competitive markets. This suggests that the ecological value signified by lucid waters and lush mountains continually expands, whereas the economic value symbolized by mountains of gold and silver is always at a depreciation risk. Consequently, product innovation holds a definitive value advantage in a competitive market. Likewise, if the creativity of lucid waters and lush mountains is disrupted, transitioning from an ecosystem to an inorganic system, they lose their creativity or potentiality. The intrinsic value of lucid waters and lush mountains dissipates, eroding the practical support for the proposition “lucid waters and lush mountains are as valuable as mountains of gold and silver.” Protecting the sustainable creativity of the ecosystem necessitates the preservation of the basic ecological conditions – lucid waters and lush mountains. Protecting the ecosystem requires not only a shift in traditional values but also the enforcement of rigorous regulations. In this respect, Xi Jinping has highlighted that “only the strictest systems and the strictest rule of law can provide reliable safeguards for constructing an ecological civilization, and the concept of ecological red lines must be firmly established” (People’s Daily Online, 2013).

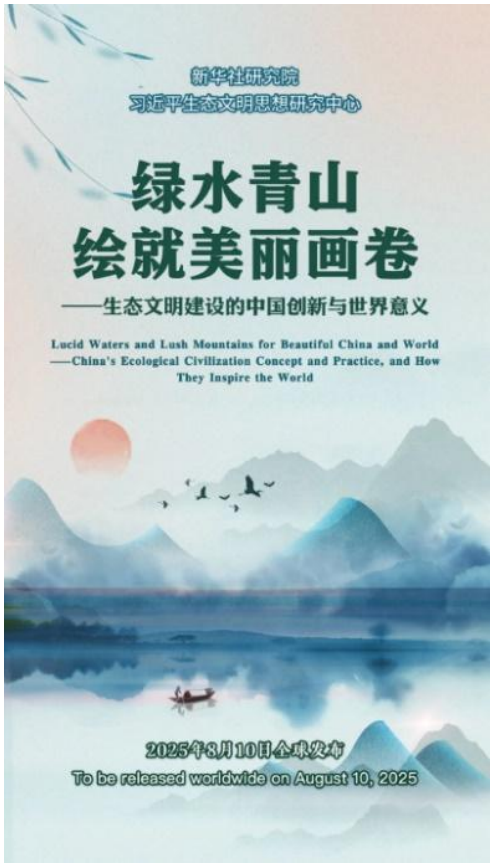

Figure 1. An environmental public service video released worldwide in 2025 by the Research Center for Xi Jinping Thought on Ecological Civilization, Xinhua Institute.

Second, derived from the scientific proposition that "lucid waters and lush mountains are as valuable as mountains of gold and silver," the construction of a harmonious coexistence between humans and nature, termed as a 'community of life,' becomes essential. To elevate the understanding and appreciation of the ecosystem's value, where humans and nature cohabitate, Xi Jinping introduced the concept of building a community of life. It states that "The interconnected life threads of humans, fields, waters, mountains, soil, and trees form a community of life" (Communist Party of China Central Committee, 2013, p. 83). This concept underscores that "The human-nature relationship is a community of life that necessitates respect, adherence, and protection of nature" (Communist Party of China, 2017, p. 24). Here, nature's inherent value, under the aegis of human activity, paves the way for respect and protection, thereby conferring upon it a moral standing. The community of life concept, championed by Xi Jinping, is an essential theoretical innovation in Marxist (ecological) civilization thought, transcending the conventional dichotomy of anthropocentrism and biocentrism. Its essence lies in establishing an ecological civilization ethos rooted in the harmonious coexistence of humans and nature. By employing a dialectical materialism epistemology, a dialectical

unity relationship between humans and nature gets articulated, surpassing the traditional binary of opposition between humans and nature.

Third, to establish a community of life between humans and nature, it is imperative to comprehensively examine ontology. It is only through the ontological exploration of humans and nature that a philosophical foundation can be laid down for their mutual value relationship. The assertion that "lucid waters and lush mountains are as valuable as mountains of gold and silver" implies a fusion of the 'is' and the 'ought.' From the perspective of statement's nature, "lucid waters and lush mountains" encapsulate an 'ought' declaration, while "mountains of gold and silver" articulate an 'is' declaration. A known conundrum in moral philosophy or ethics is the logical chasm between 'is' and 'ought' statements, making it impossible to bridge the two through logical reasoning. However, to actualize the concept that "lucid waters and lush mountains are as valuable as mountains of gold and silver" and to construct a 'community of life,' it becomes crucial to navigate beyond the logical chasm between 'is' and 'ought.'

One might say, the creativity intrinsic to ecosystems could potentially provide a logical solution to this vast chasm. The creative capacity of an ecosystem allows it to engender value, thereby embodying the 'ought,' signifying a form of value existence. Concurrently, the ecosystem as a factual existence represents the 'is.' Hence, any depiction of the ecosystem inevitably embodies a unified existence of 'is' and 'ought.'

Examining the term 'on' in ontology, which translates to 'is' or 'existence,' it is apparent that 'is' inherently possesses a creative attribute, a capability to 'be.' As elucidated by distinguished philosophers like Zisong Wang[2], the term 'is' encapsulates three dimensions. First, it refers to existence as a particular entity ('existence' being a connotation of 'is'). Second, it designates functioning via inherent capabilities, and third, it captures manifesting or presenting in a specific manner (Song, 2011, p. 13). And so, 'is' holds an enabling capacity, which allows the 'being' to arise or become apparent. Every 'being' in the world emerges owing to the arising capability of 'is,' including the human 'being.' The connection between 'is' – as an enabling force for the 'being' to arise – and value underscores that 'is' incorporates value. Humans, being creative entities, could neither be born, exist, evolve, nor realize creativity and value without 'is.' Therefore, the relationship between this inherent 'existence' ('is') and the unification of 'is' and 'ought' is inferred as a basic implication of 'is'.

Through the analytical lens of animal and plant biogeography and material cycles' stability and dynamics, the eco-ethicist Holmes Rolston (1989/2000, pp. 19-20) proposes an intriguing notion, "The 'ought' is not so much derived from the 'is' as it is discovered in the process of describing the 'is' ... For some observers, the stark bifurcation between 'is' and 'ought' has dissolved; it seems that with an adequate grasp of the facts, value emerges, both becoming inherent properties of the system." This suggests that during the evolution of ecosystems, 'is' and 'ought' maintain an inherent logical unity and are not categorically dissociated.

[2] Zisong Wang (1921–2018) was a renowned historian of Western philosophy in China and a founding figure in the study of ancient Greek philosophy.

The concept of ecological civilization stands as a crucial research theme within the realm of contemporary eco-ethics, and the progression of ecological ethics invariably calls for a transformation in values pertaining to the ecological environment. Xi Jinping has underscored the imperative to cultivate the mainstream values of ecological civilization (Xinhuanet, 2015). Eco-ethics or environmental ethics delves into the intricacies of human relationships with the ecological environment, probing ethical norms and guidelines that govern the dynamic between humans and nature. It further reflects on moral relationships among humans through the lens of their interaction with nature. The exchange of matter, energy, and information between humans and nature inevitably impacts human relationships and ecological values, resulting in changes in the natural ecological environment, and consequently, modifications in societal and human evolution (including future generations). Therefore, humans, as beings endowed with rational capacities, should engage in moral introspection regarding the ecological environment and assume ethical responsibility. This conscious ecological 'moral mandate' should serve as a self-regulation of practical human reasoning. Respect for the value of nature equates to respect for the value of humans; to respect nature is to respect humanity. This realization harmonizes 'is' and 'ought,' facilitating the mutual transformation and unity of 'lucid waters and lush mountains' with 'mountains of gold and silver,' thereby giving rise to a 'community of life.' This foundation paves the way for the emergence of a 'community of shared human destiny' that not only represents the long-term interests of the Chinese people, but also aligns with the collective interests of global humanity.

REFERENCES

Aristotle. (2021). *Xing er shang xue* (W. Shoupeng, Trans.) [Metaphysics]. The Commercial Press. (Original work published ca. 4th century BCE).

Chen, T. (1988). On Marx's basic thoughts on the relationship between man and nature. *Science Technology and Dialectics*, *3*(1), 1-5.

Communist Party of China. (2017). *Reader of the report of the 19th National Congress of the Communist Party of China*. People's Publishing House.

Communist Party of China Central Committee. (2013). *Decision of the CPC Central Committee on Some Major Issues concerning Comprehensively Deepening the Reform*. People's Publishing House.

Compilation and Translation Bureau, Central Committee of the Communist Party of China. (2017). *Shi jiu da bao gao du ben* [Reader of the report of the 19th National Congress of the Communist Party of China]. People's Publishing House.

Engels, F. (1970). Zi ran bian zheng fa [Dialectics of Nature]. People's Publishing House.

Encyclopedia of China Publishing House. (2004). *Zhongguo da bai ke quan shu* (zhe xue I)[Encyclopedia of China (Philosophy I)].

Fu, H. (2000). On the Value and Subject of Nature. *Journal of Dialectics of Nature*, 3, 29-34, 13.

Laozi. (1972). *Tao te ching.* Vintage Books.

Leopold, A. (1949). *A Sand County Almanac, and Sketches Here and There.* Oxford University Press.

Li, D. (1987). *Jia zhi lun* [Value theory]. China Renmin University Press.

Li, L. (1991). *Jia zhi zhe xue* [Philosophy of value]. China Renmin University Press.

Li, X. (2006). Definition and characteristics of value. *Philosophical Trends*, *1*, 13-18.

Liu, X. (2006). *Laozi gu jin* (Vol. 1) [Laozi Ancient and Modern]. China Social Sciences Press.

Lu, F. (2021). Agricultural Civilization, Industrial Civilization, and Ecological Civilization–On the Core Ideas of Ecological Philosophy. *Theoretical Investigation*, *6*, 94-101.

Marx, K. (2000). *1844 nian jing ji xue zhe xue shou gao* [Economic and philosophical manuscripts of 1844]. People's Publishing House. (Original work published 1844).

Marx, K., & Engels, F. (1957). *Makesi Engesi quan ji* (Vol. 2) [Complete works of Marx and Engels]. People's Publishing House.

Marx, K., & Engels, F. (1963). *Makesi Engesi quan ji* (Vol. 19) [Complete works of Marx and Engels]. People's Publishing House.

Marx, K., & Engels, F. (1975). *Karl Marx Frederick Engels collected works* (Vol. 4). Lawrence & Wishart.

Marx, K., & Engels, F. (1995). *Makesi Engesi xuan ji* (Vol. 3) [Selected works of Marx and Engels]. People's Publishing House.

Marx, K., & Engels, F. (2009). *Makesi Engesi wen ji* (Vol. 1) [Collection of Marx and Engels]. People's Publishing House.

Marx, K., & Engels, F. (2012). *Makesi Engesi xuan ji* (Vol. 3) [Selected Works of Marx and Engels]. People's Publishing House.

Marx, K., & Engels, F. (2016). *Makesi Engesi quan ji* (Vol. 42) [Complete Works of Marx and Engels]. People's Publishing House.

Miao, L. (1993). *Yalishiduode quan ji* (Vol. 7) [Complete Works of Aristotle]. China Renmin University Press.

Ministry of Justice of the People's Republic of China. (2021, June). *Xi Jinping zong shu ji xin zhong de san ge "gong tong ti"* [Three "Communities" in the Mind of General Secretary Xi Jinping]. http://www.moj.gov.cn/gwxw/ttxg/202106/t20210605426722.htm

People's Daily Online. (2013, May 25). Xi Jinping: Adhere to the Basic National Policy of Saving Resources and Protecting the Environment, and Strive to Enter the New

Era of Socialist Ecological Civilization. http://cpc.people.com.cn/n/2013/0525/c64094-21611332.html

Rolston, H. (2000). *Philosophy Gone Wild* (E. Liu & P. Ye, Trans.). Jilin People's Publishing House. (Original work published 1989).

Song, J. J. (2011). *BEING and the Western Philosophical Tradition*. Guangdong People's Publishing House.

Wang, T. (2012). Innovative Labor Value Theory and Innovation of Labor Value Theory. *Academic Monthly*, *12*, 30-37.

Wang, Y. (1991). Review of the Study of Human-nature Relationship since the Founding of the People's Republic of China. *Studies in Dialectics of Nature*, *11*, 60-64.

Xi, J. (2013, September 8). Promote People's Friendship and Create a Better Future. *People's Daily*, 3.

Xinhuanet. (2015, March 24). The Political Bureau of the CPC Central Committee held a Meeting to Review "Opinions on Accelerating the Construction of Ecological Civilization". http://www.xinhuanet.com/politics/2015-03/24/c_1114749476.htm

Yu, G., & Yang, Y. (2022). Zi ran sheng tai jia zhi、 sheng tai zi chan guan li ji jia zhi shi xian de sheng tai jing ji xue ji chu yan jiu–Ke xue gai nian、 ji chu li lun ji shi xian tu jing [Ecological economics foundation research on ecological values, ecological asset management, and value realization: Scientific concepts, basic theories, and realization paths]. *The Journal of Applied Ecology*, *33*(5), 1153–1165. https://doi.org/10.13287/j.1001-9332.202205.006

Zhang, D. (1982). *Zhongguo zhexue dagang* [Outline of Chinese Philosophy]. China Social Sciences Press.

Zhang, S. (1998). *Laozi jiangjie* [Explanation of Laozi]. Qilu Press.

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Research article

Modernity As a Conversation – Investigating Chinese Modernity

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Abstract

The investigation of this paper focuses on the question of how to understand modernity between all different instances called modern. Understanding modernity as a universal might only acknowledge a European modernity, while there are non-western countries like China, that have also become modern countries, without having had a trajectory of thinking towards modern concepts. Where modernity as an inherently European way of thinking has set foot, it adapts and evolves into a variant of modernity being influenced by the certain grounds of ideas that it falls upon. Modernity is established by habituation with technological artifacts and their inherent values as manifestations of technological thinking. Yet, the initial thinking that is present in the context which is entered by modernity is relevant for the paradigm into which it will evolve. The values carried by modern technological artifacts can set foot in contexts and cultures that they were not part of initially. Presenting the example of China – a modern country without a tradition of modern thought – the idea of an adaptable modernity will be elaborated, a concept of modernity that is able to be appropriated and eventually exist in multiple variants. China had a rich and thriving cosmotechnics of knowledge, technical inventions and thought of its own, long before modern China came into place. Traditional Chinese thinking was not focused on progress, growth, or optimization. It had to meet the challenge of modernization, when it was already defining European science and economy. The awareness of modernity's accidentality might pose an important stepping stone for overcoming modernity in Europe as well as other contexts.

Keywords: Modernity, Modernization, China, Chinese modernization, Cosmotechnics, Technological Thinking.

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Научная статья

Современность как диалог – Исследуя китайскую модернизацию

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Аннотация
Исследование, представленное в данной работе, сосредоточено на вопросе понимания современности в контексте всех различных проявлений модернизации. Понимание современности как универсального явления может означать признание только европейской модернизации, в то время как есть незападные страны, такие как Китай, прошли модернизацию, не имея траектории мышления, ориентированного на концепции модернизации. Там, куда проникает модерн как изначально европейский способ мышления, он адаптируется и преобразуется в иной вариант, испытывая влияние тех идейных оснований, на которые ложится. Современность утверждается через привыкание к технологическим артефактам и заложенным в них ценностям как проявлениям технологического мышления. Однако первоначальное мышление, присутствующее в контексте, в который вводится модернизация, имеет отношение к парадигме, в которую она будет эволюционировать. Ценности, которые несут в себе современные технологические артефакты, могут проявляться в контекстах и культурах, частью которых они изначально не являлись. На примере Китая будет разработана идея адаптируемой модернизации, концепция современности, которая может быть адаптирована и в конечном итоге существовать во множестве вариантов. Китай обладал богатой и процветающей космотехникой знаний, технических изобретений и собственной мысли задолго до появления Китайской модернизации. Традиционное китайское мышление не было сосредоточено на прогрессе, росте или оптимизации. Оно должно было ответить на вызов модернизации, когда уже определяло европейскую науку и экономику. Осознание случайности современности может стать важным шагом на пути к преодолению модернизации как в Европе, так и в других контекстах.

Ключевые слова: Современность, Модернизация, Китай, Китайская модернизация, Космотехника, Технологическое мышление

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INTRODUCTION

There have been numerous names for the epoch that we live in: modernity, post-modernity, second or reflexive modernity to name a few. Lately, this question is viewed in the light of a multi-polar world with various instances of modernity in different places and contexts that influence the terms and ideas individuals think in. Is there one universal modernity? One that traces back to the birth of capitalism, modern science and Enlightenment? Are there multiple modernities? Have they evolved as modernities from different backgrounds? Or are they mere imitations, adaptations and appropriations of one universal modernity? This opens the following reflections, discussing some approaches of philosophy of technology and the works of Yuk Hui especially. After a cursory consideration of what evolved to be modern thought over time in Europe, some adaptation points from the Chinese contact with modernity will be presented. With the example of today's China as a modern country – 'modernity' can be viewed as a conversation that adapts to different backgrounds of thought. Modernity only comes to rise in the habituation with technical artifacts, technological thinking and their carried values, and originated from ancient Greek thinking. Modernity's origin lies in European thinking. How does modernity operate differently in Europe than in places that did not follow a trajectory of thought that is driven by modernity?

UNDERSTANDING MODERNITY

First it will be established that modernity cannot be discussed without technological thinking. A brief look into the trajectory of technological thinking in Europe will be followed by an outline of traditional Chinese thought. Modernity entering a Chinese context and thinking will exemplify the introduction of modernity to different contexts. After looking into the Chinese adaption of modern thought, a summary of the learnings about the adaptability and logic of modernity can be formed. Modernity will be described as adaptable and able to shift in order to fit into different backgrounds.

Modern thought is the resulting paradigm of the course of European thinking. What is called European thinking is the thought evolved in Europe deriving from the Greek heritage of duality of body and soul, Galileo Galilei's geometrical endeavors, and the scientific method.

The modern trajectory of thought starts with Greek thought and progressed to the study of universal applicable laws lying behind events in nature, with the goal of manipulating these in order to control the world. Until now, European thinking, as in 'western' philosophy has utilized the universal laws and idealizations taken from experiments and deliberations in a never-ending evolution of a body of technologies. The sum of artifacts grows everyday, grows closer together, and becomes a conglomeration of artifacts in relation to one another – towards the so-called megamachine (Mumford, 1977).

Modernity is characterized by modern technological artifacts: planes, smart phones and apps, subway lines going through cities. The term 'technological artifact' includes various different kinds of gadgets, systems and infrastructure. They undoubtedly belong to modernity and are defining the modern individual and society. This goes beyond the

their mere materiality. Any kind of artifact incorporates values and affects the individual that uses it. Modern technological artifacts affect individuals through habituation and change their relation to the world in a subtle manner. Technological artifacts embody and transport modern thought.

The evolution of technological artifacts can be exemplified by Heidegger's river. A river is viewed through the lense of technological thinking as a flowing source of water – merely as a mere means to be exploited and to produce electricity – it is seen solely in technological terms (Heidegger, 1996). Following this logic and the possibilities it generates, a whole body of electrical artifacts can be imagined, in order to make 'good' use of this electricity. This force of exploitation of forces in nature leads to a system or growing body of artifacts. At the same time, they grow closer together over time, resulting nowadays in the upcoming interconnection of technological artifacts, e.g. the 'internet of things.' Modernity strives to incorporate and homogenize everything from ground logic to daily routines (Hui, 2024).

By utilizing technological artifacts, the life and practice of any individual gets affected by their implicit values (Grunwald, 2018) This can happen without needing to be aware of this force (Blumenberg, 2015, p. 190). The technological artifacts and technology as a whole are affecting the individual to use artifacts in a specific way and for a specific purpose and are therefore changing the way of thinking (Grunwald, 2018 and Blumenberg, 2015, pp. 190-192). This reaches into the inner workings of the individual's thoughts and choices which affect the possibilities and limits of one's thinking (Grunwald, 2018, p. 206 and Blumenberg, 2015, p. 190). Technical artifacts are affecting the individual's intentions to utilize them in a certain way. Heidegger's example of the hammer in its '*Zuhandenheit*' exemplifies this effect (Heidegger, 1927/2006, pp. 69-70). The hammer is affecting the individual to utilize it as a hammer, therefore shaping their apparent possibilities of action (pp. 69-70). Hence lifestyles, practices and whole cultures are constantly and inherently affected and defined by technology and its artifacts in presence, execution and imagination (Grunwald, 2018, p. 206; Blumenberg, 2015, p. 190). Technology is not merely a means to an end, not 'just' a tool, that is between the individual and the world. It is rather the mediator and the interconnection between individuals and things, and therefore also inherently part of the relation between individuals and the world (Nordmann, 2016, p. 165).

Modernity is a 'Western' project that culminates in Heidegger's *Gestell* (Hui, 2024, pp. 40-41 and pp. 54-55). The subtle force of the *Gestell* erects self-evidency (Selbstverständlichkeit), which is – after habituation – drifting into the background of attention. Within this paradigm only the measurable data points and a logic of optimization and acceleration are accepted as the guidelines for thinking. This underlying logic can also be called a cosmotechnics (Hui, 2022 and Hui, 2024). Cosmotechnics is a concept defined by Yuk Hui which describes the interrelatedness between individuals and the world mediated by technics (Hui, 2022, p. 19-20).

Modernity has a powerful way to incorporate almost everything into its own paradigm and logic of optimization. The problem with modernity "is not that it is a malfunctioning machine, but rather one that works all too well according to the logic embedded in it" (Hui, 2022, p. 296). Technological thought is inherently European but

ended up framing the history of all localities that it came in contact with. It thereby often posed a threat to local traditions of thought, as we will see also in the example of China (Hui, 2024, pp. 40-41, and Hui, 2022, pp. 151-153). While discussing Hui's thesis about modernity in Europe and China, it will be shown that, there can be different cosmotechnics, each with their own underlying concepts of world, truth, and the good life.

TRADITIONAL CHINESE THINKING

Starting in ancient Chinese history, a brief look into the most widespread schools of thought will establish a general idea of Chinese thinking: Confucianism and Daoism. Their relation towards tools (器 qi) and the so-called 道 dao will then be presented and elaborated. 道 dao can be translated as "way," also in a metaphorical sense. The harmonic interplay of tools, as in 器 qi and the concept of 道 dao in Daoism and Confucianism will be sketched. In Confucianism as well as Daoism 器, qi and 道 dao both relate to the sky or heaven (天, tian), which is a "moral being" (Hui, 2022, p. 81). Sky and heaven are the same, as there is no trancendent world next to or beyond the sky. This moral aspect as an end of the individual's relation to the world also needs to be explained.

The 道 dao is the initial cause and the underlying principle of everything that exists (Hui, 2022, p. 68). It also is the cause of all technical objects in Confucianism and Daoism and can be found in the most complex as well as the most trivial things under the sky (p. 69). The 道 dao is the higher order of being which technical artifacts and practice need to be compatible with (pp. 65-66). The good life refers to building and "maintain[ing] a subtle and complicit relation with the [道] dao" (p. 69). This interaction with the 道 dao does not have to be acknowledged. It may happen without conscious effort (p. 69). The 道 dao allows and limits the relations one can have with the world and the things in it (pp. 65-66).

Confucianism is practiced through study and "memorization of the state-sanctified Confucian classics," such as the Yijing, as well as through rituals (Freiberg, 1977). This practice of rituals preserves the way of Confucianist thinking, its knowledge and its insights. Confucianism strives to achieve happiness in this world, it thrives towards a happiness that everyone can achieve and that can be found without the need for transcendence (Freiberg, 1977). Tools (qi 器) in Confucianism mainly serve as instruments and are supporting the rituals (li 澧) – e.g. dishes or musical instruments (Hui, 2022, pp. 108-109). In this way 器 qi is stabilizing the moral cosmology through supporting the rituals (pp. 109-110). Constructing and handling the tools (器 qi) requires a cosmological consciousness of the relation between individuals and nature in Confucianism (pp. 27-29). Formalized orders and rituals are established to preserve the 道 dao (pp. 109-110 and pp. 114-115).

Daoism is based on a dialectical understanding of the inner workings of the world. It is a unified world that is made manifest to humans through a unity of opposition – the

world consists in "paired opposites" (Freiberg, 1977). Between these opposites everything is in motion, and it is therefore a world of constant cyclical change, as for example the seasons changing in a cyclical manner. A constant motion, a constant becoming and ceaseless change defines Daoist thinking (Freiberg 1977). Daoism criticizes imposed orders and only accepts the 道 dao as the ultimate order of the world's underlying harmony. The improving of tools, [器 qi], represents "the perfecting of living and being, since it is guided by the [道] dao" (Hui, 2022, p. 108).

In Daoism, calculating reasoning, 機心 (ji xin)[1], is a mode of thinking to be avoided in order to lead a good life, as calculating reasoning leads to restlessness (Hui, 2022, pp. 105-106). Thinking solely like a machine makes one think of everything only in a machine-like and logical way, which culminates in losing the freedom of relating to the world in other ways according to the 道 dao. The 道 dao is lost by being distracted by this focus on machinery. In Daoism the 道 dao can be reached without using any 器 qi (as in tools or machinery) at all, as acting according to nature and the 道 dao is sufficient (p. 115). In conclusion, the 道 dao can be served in Daoism by a realization of technical artifacts in harmony with nature (pp. 115-116).

Confucianism and Daoism both incorporate a moral cosmotechnics. 'Moral' refers to the fact that Confucianism and Daoism set the moral order and the good life as guides the cosmic order. Therefore, all existing things that thrive to be good have to apply to the harmony of the 道 dao (Hui 2022, p.65).

TECHNICAL ARTIFACTS AND SCIENCE IN CHINA BEFORE MODERNITY

Looking into the genesis of technical artifacts in traditional Chinese thinking there are some significant differences to the traditional Greek conception (Hui, 2022, pp. 61-62). Dating back to the 8th century BC, Daoist sources tell of four elements of production, which consist of time, energy (气 qi), materials of good quality, as well as techniques. The question of techniques relies on three further elements, firstly in that they are supposed to be "learned and improved." The study and practice of technology in this sense is to further the 气 qi which moves according to the 道 dao. The concept guiding the genesis of technical artifacts is finally the 道 dao after all. When followed, the cosmic order ensures also a moral order (pp. 61-62).

While the Greek conception after Aristotle, is to develop a deliberatively chosen shape (*morphe)*, bringing it into existence, materially (*hyle*), Chinese thinking conveys a ready-set source of shapes to be moulded (the 道 dao) and the 道 dao is manifested when serving the 气 qi (Hui, 2022, pp. 61-62).

Techné in Greek thinking is a means of taking control of and manipulating things in the world towards the aim of productivity. For the production of a technical artifact to

[1] This can be translated as "machine heart" (Hui, 2022, p. 105).

be taken as good practice, it has to serve the principle of growth and bringing forth something that imitates and at the same time completes nature (Hui, 2022, pp. 69-79).

While the Greeks relied on the form that was inherent in the material to utilize it for a purpose, the first reason something comes into existence is to serve the 气 qi in Chinese Daoistic thinking (Hui, 2022, pp. 61-62). European and Chinese cosmotechnics carry different cosmotechnical dispositions (pp. 62). In the Greek context *techné* is mediating between *physis* and *tyche*, while in the traditional Daoist Chinese context, artifacts and science are beholden to the cosmological order (pp. 66-69). In Chinese thinking, the cosmological order is intangible, yet perceptible, even when it is not actively perceived (pp. 68-70).

In China in the second century AD, there is historical proof of sketches of a carrier-type vehicle, that might be taken as the first cybernetic machine (Needham, 2016, p. 114 and p. 174). Though it is an artifact that was constructed with knowledge about the mechanics of a vehicle, its principle of operation was based on keeping up an equilibrium. Once pointed south it would ultimately return to face the south, regardless of where it was steered to. To be sure, it was also in China that the magnetic compass was invented (p. 114).

Traditional Chinese thought and artifacts were rich of creativity, knowledge, and understanding. These were not the factors that were missing towards an establishment of modern thought. But looking at the gathering of knowledge, early sciences in China adopt their own approach towards learning about the world and using this knowledge. Their way of gathering and applying knowledge differs from the European way. The earliest documented alchemical efforts are found in Chinese history (Hui, 2022, pp. 63-64). Hence alchemy can be said to issue from a Daoist approach to look for ever-lasting life (Needham, 2016, pp. 109-110).

This ever-lasting life was not a celestial one, but one right on earth. Chinese science in this sense stayed empirical and developed from the eternal principles of harmony: Yin & Yang and the five elements (Needham, 2016, p. 112). Yin and Yang are always entangled in a motion of oscillation between one another (Needham 2016, p. 113 and Freiberg, 1977).

Looking into chemistry and medicine, in China there were highly successful formulations even of steroid hormones between the 11th and 17th centuries (Needham, 2016, p. 143). Eventually the Chinese explanation of the cause of its working (Yin and Yang as well as the five Elements) were substituted by modern, that is Western approaches to explaining chemical interactions. In this case the modern explanations were accepted over traditional reasonings, even though the practice was successful before these changes were implemented (p. 143). When coming into contact with modern science, the traditional Chinese sciences would eventually become modern – some disciplines faster than others. Interestingly, the field of medicine found itself modernising rather slowly in comparison to others, and to this day both strains of teaching still exist (p. 132-144). The closer the sciences were to the living being, the slower the process, the harder it would be for the modern view to dominate (p. 144).

Joseph Needham, the famous scholar on Chinese thought and culture, also opened up the debate about the so-called 'Needham Question': Why did modern science not arise in China? (Needham, 2016) While Chinese thinking and technical endeavours were thriving without question, modern science, based on universal laws and the manipulability of nature was not coming from a Chinese trajectory of thinking. While in Chinese thought the harmonic interplay of all things is central, in modern Western thought causality prevails and the idealized principles that allow for manipulation and control of nature (Hui, 2022, pp. 169-172).

As a consequence of this missing causal perspective there was no conception of an axiomatic system of underlying events in the world. Therefore, Chinese thinking lacked a program, that would investigate '*das Seiende*' effectively to manipulate it according to mechanical causality (Hui, 2022, pp. 169-172). Chinese thinking was rich but did not follow modern ambitions.

A BRIEF CHINESE HISTORY OF MODERN TIMES

The opium wars against England in the 19th century mark the "traumatic inauguration of the country's modern history" (Lovell, 2012, p. 9).

While the British were importing opium into China, fuelling the rising opium addiction of the country, the Chinese government eventually declared war on opium. Chinese people became addicted so severely, that they were no longer able to fight back. British 'gunboat diplomacy' combined with the issues of drug addiction caused China to sign the 'Unequal Treaty' of 1842. These events started the so-called 'century of humiliation' (1842-1949) in China (Lovell, 2011, p. 9). To this day, these events are an open wound in the self-esteem of China: "It marks the beginning of China's struggle to free itself [...] and to stand up as a strong modern nation" (p. 9).

The British were a European power, powerful in military strength and machinery. The situation to be dealt with was an overwhelming force that was threatening China's very existence, but could not be extinguished by China's own power and artifacts. Eventually the reaction chosen by China was to adapt this overwhelming force, and appropriate the parts that were posing a threat. Old customs and patterns of thinking were neglected due to the efforts to catch up with the West. The shock of Europe's invading efforts would lead to a pressure to appropriate the force as a means of defence and avoidance of further threats.

These efforts were intended to be taken only as far as required to still be effective and no further. This idea was not entirely successful, as it took technology and its artifacts as nothing more than matter that would not resonate with other categories in life, let alone alter human relations to the world itself (Hui, 2022, pp. 151-164). Importing and furthering modern Western scientific studies and technological inventions, while maintaining basic principles of Chinese thinking. would require one's mind to interact with the physical world via the medium of technology, while not itself being affected or transformed by the medium (p. 151-152). Habituation through the use of these technical artifacts, and the subtle acceptance of their premises and values, lead to a slow loss of

traditional Chinese thought. Slowly, yet steadily, modern values made their way into the Chinese context.

After World War I Confucian thought was still prevalent, yet Western ideas were spawning (Gao, 2016 and Hui, 2024). China was transforming from an agricultural nation into an industrialized power. Chinese scholars combined the ideas of modern Western industrialization (Marxist-Leninism among them) with Chinese thought and founded the widespread movement of democracy and science. These gave rise to 'Dialectics of Nature.' In the 1920s, Communist scholars endorsed the thoughts of Friedrich Engels to support China's process of transformation. After the breakdown of the alliance between the socialist and nationalist parties, Engels' writings and 'Dialectics of Nature' became a doctrine to counter nationalist views on modern science (Gao, 2016). Modern thought increasingly became a tool to be picked up and dropped when required.

In 1935, seeing the subtle change of Chinese thought, ten of the most renowned professors in China brought forth "A Manifest for a Chinese-oriented cultural Development" (Hui, 2022, p. 162). This manifest expressed their fear of a chaotic internal intellectual war, which would simultaneously lead to a forgetfulness of Chinese origins. It imagined a new China that would be able to integrate technology and science effectively without losing its origins. This manifest spoke against the Westernization of China, while maintaining Chinese thought as it called for substantial reform (p. 162-163). The authors had seen that in the course of Westernization, Chinese thinking was under threat.

Indeed, in the process, the spirit of the old cosmotechnics was mostly lost and the aspects incompatible with modern thought were summarized only as 'tradition' (Hui, 2022, p. 163-164). Neglecting the question of technology by categorizing technology as applied science, the debate got stuck at the level of ideology (p. 164). If technology is not acknowledged for its invisible presence as its inherent strength, it becomes invisible in a different way by being subsumed among the problems of science (p. 163-164).

As the spread of modernity continued, Dialectics of Nature became in 1949 an official discipline and branch of philosophy in China – just as the establishment of the People's Republic of China took place (Gao, 2016). It was an "innovative [...] approach for the philosophical reflection on scientific method and a tool for the modernization of the country" (Gao, 2016, p. 273). Still, Dialectics of Nature served to reinforce the view that science was a means to overcome the stigma of 'underdeveloped industry' that was hurting Chinese self-esteem. It fueled the ambition to catch up with the West and does so to this day, thus allowing for technological thought and its values to enter in and subtly take ground.

In the second half of the 20th century, China undertool several initiatives towards the goalof 'catching up,' among which was the Great Leap Forward and the Four Modernizations. By this time, these were defined as inherently modern concepts, such as acceleration, innovation, and military competition (Hui, 2022, p. 291-292).

CHINA ADAPTED A VARIANT OF MODERNITY AND IT TOOK GROUND

Understanding modernity only through the adaption of technological artifacts without their underlying values misses out on a wide range of essential features. Looking at Europe and China, a Europeanization took place that goes beyond the existence and handling of artifacts of a certain kind (Hui, 2024). The logic, science and relation-building of technologies enter in and set foot in the contexts where these technological artifacts are adopted. The inviting-in of modernity is not a mere copy-and-paste motion, as these ideas and concepts fall on certain ground of a kind of thinking that existed before technological thinking. That is why a slightly modified modernity is the outcome of the conversation between existing (here: Chinese) thought and modern technological thought.

This conversation makes apparent an *actio-reactio* dynamic that defines the evolving relationship between an intruding modernity and Chinese actors who are looking for ways to deal with it. As China was unquestionably rich of thought, knowledge and a world of technical artifacts, it was not developing a modern science in the sense of an ever-to-be-growing and ever-to-be-optimized landscape of artifacts that are required to sustain the idea of progress.

The pathway China has taken – especially in the 20th and 21st century – allows for an interpretation of different variants of modernity where these variants are influenced by the different ground they grow on (Hui, 2022, p. 291-292 and pp. 296-299).

As capitalism has taken hold also in China, these key implications of modernity also account for the Chinese individual nowadays. The harmony of the 道 dao is getting replaced by the European ‘good life’ of growth, acceleration, and optimization. Core elements of life become measurable and exploitable. Even traditional temples are now incorporated into touristically useful sites, with shopping centers and arcades growing up around them. Just like traditional Chinese medicine, these temples exist, but only on the sidelines of attention. Even their traditional aspects become incorporated into modern logic by being commodified as, for example, revenue generating tourist activities. Modernity’s takeover is still going on in the form of individualistic consumerism, an approach to science in the service of economic growth, and the idea of technology as a means to dominate and control the forces of nature.

Looking into China nowadays, one can see an overwhelming amount of modern technological artifacts shaping everyday life. In China as in Europe, when one has a smartphone in one’s hand, one can look for directions with similar applications, buy groceries and gifts online, write e-mails and listen to music – all with the same underlying technology, the same principles, sometimes even the exact same line of code being processed on both devices. The homogenizing power of modernity is working in the non-western context as it is in the West.

And yet, all this does not mean that Chinese thought has altogether receded or that it no longer resonates with modern Chinese individuals – even if some of it is pushed to the sidelines, there are still vivid traces.

Europe had a continuous trajectory towards a modernity that has since imposed itself through force and pressure on other parts of the world – calling for a forceful

response to this imposition. China is an example of a country in which its original thinking was not going to lead to the cosmotechnics of Europe, but rather to a cosmotechnics grounded in Daoism and Confucianism. Staring in the 19th century it therefore had to deal with the challenge of becoming modern in a short period of time. China had to change traditional paradigms and practices while trying to maintain the underlaying identifying aspects of its original tradition of thought.

China lived through "modernisation without modernity" (Hui, 2022, p. 291). Chinese modernity may be described as a variant of European modernity as it is the reply to the forces that entered and threatened China – producing as a reaction the appropriation of modern thought. Chinese modernity thus has to be considered for its lack of a continuous trajectory. Instead, modernity is a reaction in a conversation. Everything that is touched by it enters this conversation, and through this conversation modern thought becomes supplanted in different contexts and cultures.

Nowadays, modern China also builds technology and technical artifacts, just as it is done in Europe and the West. Even through the attempts of catching up, the Chinese way of thinking did not completely surrender to technology and technological thought as it set foot in China. In a subtle way, Chinese thought transformed the cosmotechnics prevailing in China. The manifold relations of 器 qi and 道 dao were gradually assimilated to technological thought, that is, to a relation to the world where matter is calculable and controllable through technology, unavoidably rooted in modern science.

If China's modernization had to take place faster than in Europe, this also meant that the efforts to "Catch up with the West" were followed vigorously. Certain aspects of modernity fell on more fertile ground in the Chinese context than in others. Dialectical approaches are inherent in Chinese thinking and philosophy as seen in Daoism. In Dialectical thinking, everything is moving because of polar opposites – constantly interacting with one another. Nothing remains in a static position.

But now, when China's modernity is identified as "Catching up with the West," this also refers to a movement. Constant motion and change are therefore on the forefront, rather than reaching a certain stage of technological evolution to rest upon. Europe was the first to develop modern thought and technological thinking, and the force of their artifacts led countries like China to find themselves in a process to become a modern country, in order to be able to compete in modernity's logic.

China kept up with this pace, even after it had caught up. Cars that burn fuel were polluting the cities, so they were substituted with electrical cars. Everyone in the big cities owns a smart phone now, so messages, data, even money can be easily transferred just by showing a QR code. Even the song and light choice in a KTV bar can be chosen and adjusted by the mini-app on your WeChat social media account. Certain traditional things like 红包 'hongbaos' as the symbol for sending money remain, but they are now merely an icon in one's app. How goods are exchanged, transported, and used changes with the sheer speed of China's journey into modernity. This also owes, however, to underlying aspects of Chinese thinking which conceives the project of modernization as a continuous motion which is not attached to certain milestones along the way.

In summary, then, while upholding many aspects of traditional culture, Chinese trajectories of becoming modern moved from its traditional thought via socialist influences to the modern era.

MODERNITY'S ADAPTABILITY TO DIFFERENT BACKGROUNDS

Europe's orientation towards the great powers of technical artifacts and modern science have made technological thought a mostly unquestioned way of thinking in an era defined by European modern cosmotechnics (Hui, 2024, p. 105-106). But it was not sheer theoretical advancement that gave European thinking its current status. In different contexts there is a universal capacity to adapt to modernity. The capacity for modern thought in the sense of technology seems to be universal, as it can be adapted by individuals and societies which did not have a tendency towards it. But technological thinking itself is not a universal necessity – it is not a universal truth (p. 40-41). Technological thought can be appropriated, sometimes also adapted, and may consume other paradigms. Yet this process does not proceed with necessity, but can be shaped and guided.

Chinese modernity is therefore not the same as Western modernity. Chinese thinking constituted a different background for modernity to take place in. Several attempts of appropriation and protection of certain aspects of its original thinking were undertaken through the decades. Modernity can be seen as a conversation of global powers. When viewing modernity in different contexts, it apparently must be able to constantly evolve and adapt. Modernization takes place in very different ways, between different motivations towards different prerequisites and with different goals. In the context of China we can see a habituated adoption of modern thought in a multitude of areas and also in daily life. But in China this came from a different background, happened at a different pace, with different ends in mind.

Modernity is always revising or revolutionizing itself with new iterations, each one going further than the previous step. If the discussion of modernization often begins with an attempt to define its essential features (Yan et al., 2026), modernity is presented here as being in a constant conversation with itself. This conversation unfolds not within one universal frame, but between multiple instances that are acting and re-acting to one another.

Different cosmotechnics allow for different experiences and images of relation to the world, artifacts to be imagined and used in practice and scientific endeavors. Where the cosmotechnics of modernity have entered in through habituation, modernity's power settles in and grows, but may also grow into new variants, each depending on the specific ground of thinking they fall upon. Even as modern cosmotechnics share the same key values, the example of Chinese modernity weakens the plausibility of one ubiquitous universal modernity. The capability to adapt to key aspects of what is called modern, seems to be universal – the exact outcome of such adaptation is not (Hui, 2024).

The discussion of this paper may open perspectives of possibilities of different cosmotechnics, variants of modernity and therefore different futures.

The world is currently captured by a ubiquitous but also loosely fading grip of Europeanization and it's cosmotechnics of modernity as alternatives become apparent again (Hui, 2024, p. 119). Chinese philosophy as the unification of dao 道 and qi 器 could provide an alternative cosmotechnic. It could be an opportunity to re-invent the 道 dao in relation to global time (pp. 307-312). The question is not solved by a duality of thinking and materiality. According to cosmotechnics, technical artifacts and thinking interact and condition one another (p. 301-302). The choice arises after becoming aware of the presumed self-evidencies of a now apparent merely accidental hold of technological thinking – of modernity.

REFERENCES

Blumenberg, H. (2015). *Schriften zur Technik* [Writings about Technology]. Suhrkamp Verlag.

Freiberg, J. W. (1977). The Dialectic in China: Maoist and Daoist. *Bulletin of Concerned Asian Scholars, 9*(1), 2-19.

Gao, L. (2016). From Dialectics of Nature to STS: The Historical Evolution of Science Studies in China. In *Science Studies During the Cold War and Beyond* (pp. 267-288). Palgrave Macmillan.

Grunwald, A. (2018). Technik als Transformation von Möglichkeitsräumen. Technikphilosophie anders gedacht [Technology as Transformation of Spaces of Possibility. Thinking differently about Philosophy of Technology]. In *Möglichkeiten der Reflexion* (pp. 203-216). Nomos Verlagsgesellschaft.

Heidegger, M. (2006). *Sein und Zeit* [Being and Time] (19th edition). M. Niemeyer. (Original work published 1927)

Heidegger, M. (1996). *Die Technik und die Kehre* [The Question Concerning Technology and The Turning] (9th ed.). Verlag Günther Neske.

Hui, Y. (2022). *The Question Concerning Technology in China: An Essay in Cosmotechnics*. Urbanomic/Sequence Press.

Hui, Y. (2024). *Post Europe*. Urbanomic/Sequence Press.

Lovell, J. (2012). *Opium Wars*. Picador.

Mumford (1977). *Mythos der Maschine: Kultur, Technik und Macht* [Myth of the Machine: Culture, Techology, and Power]. Fischer Taschenbuch Verlag.

Needham J. (2016). *Wissenschaftlicher Universalismus* [Scientific Universalism]. Suhrkamp Verlag.

Nordmann, A. (2016). *Technikphilosophie zur Einführung* [Philosophy of Technology, an Introduction]. Junius Verlag.

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Research article

Performative Modes of Modeling the Future: A Comparison of Two Club of Rome Reports

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Abstract

Predictive models increasingly function not only as representations of possible futures but as action-guiding instruments that orient present decision-making, a point emphasized in the growing literature on modeling for policy. Building on recent calls for a hermeneutic turn in Technology Assessment–especially Grunwald's claim that models carry implicit narratives, values, and audience assumptions–this paper investigates a dimension that has received little explicit attention: the affective and motivational ways in which models seek to provide pragmatic orientation. We introduce the concept of performative modes to capture ideal-typical ways in which model-based futures are designed to intervene in their present (e.g., to warn, reassure, instill hope, or recommend action), rather than merely informing audiences. Methodologically, we develop a hermeneutic approach to model-text conglomerates and apply it comparatively to two influential reports to the Club of Rome: *The Limits to Growth* (1972) and its 50-year update *Earth for All* (2022). We reconstruct each report's structure, modeling architecture, the role of technology, and rhetorical framing, drawing on the reports' texts, contextual materials, and reception to interpret how modeled scenarios position and mobilize their readership. Our analysis shows a marked shift in performative orientation. *Limits to Growth* combines a technocratic posture with an upstirring warning mode: it foregrounds epistemic novelty and dramatizes "overshoot and collapse" to generate awareness and trigger debate, while offering comparatively abstract guidance. *Earth for All*, by contrast, largely presupposes public awareness and deploys a hopeful, action-oriented mode: it frames a "Giant Leap" as feasible, centers wellbeing metrics, personalizes futures through narrative devices, and provides concrete policy roadmaps and calls for civic mobilization – while still relying on technocratic assumptions of agency within the modeling framework. We conclude that "performative modes" are a productive heuristic for Hermeneutic Technology Assessment, revealing how models' pragmatic force depends on audience presuppositions, affective address, and the unstable boundary between neutral projection and normative intervention.

Keywords: Hermeneutic Technology Assessment; Modeling for Policy; Model-Text-Conglomerates; Limits to Growth; Earth for All; Performative Modes

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Научная статья

Перформативные способы моделирования будущего: Сравнение двух докладов Римского клуба

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Аннотация

Прогностические модели все чаще функционируют не только как представления возможных вариантов будущего, но и как инструменты, направляющие действия и определяющие процесс принятия решений в настоящем, что подчеркивается в растущей литературе по моделированию для политики. Опираясь на недавние призывы к герменевтическому повороту в оценке технологий – особенно на утверждение Грюнвальда о том, что модели несут в себе неявные нарративы, ценности и предположения аудитории, – в данной статье исследуется аспект, которому уделялось мало явного внимания: аффективные и мотивационные способы, с помощью которых модели стремятся обеспечить прагматическую ориентацию. Мы вводим концепцию перформативных режимов, чтобы описать идеальные типичные способы, с помощью которых модели будущего призваны вмешиваться в настоящее (например, предупреждать, успокаивать, вселять надежду или рекомендовать действия), а не просто информировать аудиторию. Методологически мы разрабатываем герменевтический подход к конгломератам моделей и текстов и применяем его сравнительно к двум влиятельным докладам Римскому клубу: “Пределы роста” (1972) и его 50-летнему обновлению “Земля для всех” (2022). Мы реконструируем структуру каждого отчета, архитектуру моделирования, роль технологий и риторическую структуру, опираясь на тексты отчетов, контекстные материалы и восприятие, чтобы интерпретировать, как смоделированные сценарии позиционируют и мобилизуют их читателей. Наш анализ показывает заметный сдвиг в перформативной ориентации. “Пределы роста” сочетает технократическую позицию с воодушевляющим предупреждающим режимом: он выдвигает на первый план эпистемологическую новизну и драматизирует “перерегулирование и коллапс”, чтобы привлечь внимание и инициировать дискуссию, предлагая при этом сравнительно абстрактные рекомендации. Отчет “Земля для всех”, напротив, в значительной степени предполагает общественное сознание и использует обнадеживающий, ориентированный на действия режим: он представляет “гигантский скачок” как осуществимый, ставит в центр внимания показатели благополучия, персонализирует будущее с помощью нарративных приемов и предоставляет конкретные политические планы и призывает к гражданской мобилизации – при этом по-прежнему опираясь на технократические предположения о субъектности в рамках моделирования. Мы приходим к выводу, что “перформативные режимы” являются продуктивной эвристикой для герменевтической оценки технологий, показывая, как прагматическая сила моделей зависит от предположений аудитории, эмоционального воздействия и нестабильной границы между нейтральной проекцией и нормативным вмешательством.

Ключевые слова: Герменевтическая оценка технологий; Моделирование для политики; Конгломераты “модель-текст”; Пределы роста; Земля для всех; перформативные режимы

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INTRODUCTION

Predictive models play an increasingly crucial role as practical decision-making tools in modern societies. By anticipating future developments, they orient present action: for example, by highlighting future problems, evaluating the effectiveness of possible countermeasures, and identifying likely side effects or risks. In this sense, predictive models are, following a common conceptual distinction, never merely *models of* (representations), but also *models for* (action-guiding tools).[1] From various directions, scholars have increasingly drawn attention to this pragmatic dimension of models and made it the subject of philosophical inquiry.[2] Notably, Armin Grunwald (2023) has recently emphasized this point. In the context of a broader *hermeneutic turn* in technology assessment, he argues that models should be examined not only in terms of their predictive function but also with regard to their hermeneutic dimensions. The pragmatic orientation function of models, he suggests, is permeated by hidden narratives, implicit background assumptions, non-epistemic values, and biases. Models must therefore, in Grunwald's view, be deconstructed in terms of their apparent objectivity and interrogated for their underlying narrative structures. From a hermeneutic perspective, they must be understood both as expressions of their historical moment and as performative interventions into their respective present.

In what follows, we build on this idea by examining a specific aspect that, in our view, has so far received little explicit or differentiated attention – neither in current debates on hermeneutic approaches to technology assessment nor in the philosophy of modeling. We argue that models can seek to provide pragmatic orientation in fundamentally different affective and motivational ways, which we propose to call *modes of performativity*.[3] Our aim is to introduce and explore some of these modes. This does not deny that predictive models continue to perform a prognostic function and thereby provide informational value at a fundamental level. Yet to reduce their role to this informational value alone obscures the fact that the discursive function of modeling can take on different *performative flavors*.

The general idea of different performative modes of relating to the future seems quite intuitive when we consider how we think about the future in everyday life. In our daily routines, we constantly engage with the future in different ways: we reflect on what we will, can, or must do later today, over the weekend, during the summer, or even where we might find ourselves ten years from now. The future is filled with things we strive for and aspire to, things we hope for, and things we wish to avoid or fear. At times, we indulge

[1] The distinction has probably first been introduced by Wartofsky (1979). See also Janich (2002).
[2] For an overview of current philosophical debates on the practical dimensions of models, see: Winsberg & Harvard (2024). More recently, the topic of modeling for policy has also gained increasing attention within philosophical debates, see for example Kaminski et al. (2023).
[3] The notion of performativity used here should not be conflated with what is currently discussed as the *reflexive performativity* of models, i.e. the capacity of some models to performatively alter their target (for an overview of the ethical debate around it, see, for example, Ortmann (2025)). Although the Club of Rome reports examined here arguably exhibit such performative features in this narrower sense, this is not our primary focus; rather we are interested in their pragmatic dimension more broadly.

in unrealistic but joyful imaginings of what might be. In short, if we describe our thinking about the future solely as the provision of information to guide action, important nuances with regards to their actual *meaning* for us are lost. Rather, *the future* affects us in different ways that must also be understood in their emotional and motivational dimensions.

What holds at the individual level, we argue, also applies collectively and in relation to the future visions articulated through models. Such visions can be seen as adopting different modes in order to intervene performatively in their respective present. What we call performative modes are different ideal-typical ways in which models aim to provide practical orientation to an audience. The idea is that models do not merely deliver "sober information" that audiences must then make practical sense of on their own. Rather, models already position themselves with regard to *how* that information is intended to *affect* readers emotionally, *engage* them motivationally and thereby exert practical influence. In this sense, models already carry a specific *practical meaning*: they may aim to reassure, to shock, to remind, to warn, to instill hope, to spark debate, or to recommend specific courses of action. This dimension is expressed both in specific modeling decisions about what and how to model as well as in discourses surrounding these models.

In what follows, we explore this dimension by examining the various modes of intervention that models can enact, using as a case study two reports by the Club of Rome. The first is the initial and arguably best-known report, *Limits to Growth* from 1972. The second is a more recent successor, published on the occasion of its 50th anniversary: *Earth for All* (2022). Both reports construct global scenarios that chart possible future developments with respect to critical parameters. Beyond the obvious content-related contrasts – in terms of model complexity, the parameters considered, the number and type of scenarios etc. – what stands out is that the respective models assume dramatically different roles. Each report engages in distinct *pragmatic modes of intervention* in its present, addressing both political decision-makers and the broader public.

What makes the two Club of Rome reports particularly instructive for our analysis is that they do not consist of "pure" models alone. Instead, they are *model-text-conglomerates* addressed to a broad audience. While the models themselves remain central – without them, the reports would lack informational value and argumentative force – the accompanying texts supply the interpretive framing through which narrative elements can be traced. These texts render the rhetorical framing of the model results more explicit and thereby illuminate the performative modes the reports seek to adopt.[4]

[4] It may be useful to underscore why we understand the Reports to the Club of Rome as model-text-conglomerates. Although they appear as books, the modeling efforts cannot be separated from their textual presentation for the kind of hermeneutic analysis pursued here. The following discussion examines how epistemic and rhetorical elements intertwine and how modeling choices and narrative framings mutually shape one another. In speaking of *model-text-conglomerates*, we refer to hybrid epistemic formations in which formal models and textual narration are not merely juxtaposed but mutually constitutive. Models do not simply generate results that are subsequently described in prose; rather, their assumptions, variables, and projections actively structure the narratives through which these results are rendered persuasive and politically salient. Conversely, textual framings – through choices of emphasis, metaphor, temporal horizon, problem definition and so on – stabilize the epistemic authority of the models by presenting their outputs as coherent accounts of complex realities. This includes the insight that the textual parts of model–text conglomerates can disclose, and in some cases explicitly articulate, the performative intent guiding the

Moreover, supplementary texts, archived background materials on the reports' development and reviews further enrich our analysis.

Our aim, however, is not merely to provide illustrative examples of the various modes through which models can engage readers affectively and motivationally, nor simply to propose a preliminary set of categories along these lines. We also seek to demonstrate how productive it can be to treat such categories as heuristic tools for a hermeneutic engagement with future-oriented model-text-conglomerates. This approach enables us to *make explicit the assumptions embedded in the reports* – for instance, what is taken to be common knowledge or shared emotional dispositions among readers regarding future social and environmental challenges, and how politically realistic or demanding the proposed measures are portrayed by the reports. At the same time, this enquiry addresses what we regard as a blind spot in current debates on the pragmatics of models – for instance, in discussions on *modeling for policy*. While the pragmatic character of models is often acknowledged, it is usually reduced to their informative function, by which they are meant to *guide* action in a rather consequentialist manner.[5] In our view, however, the performative and affective dimensions of models open up an additional, more subtle layer of analysis.

To unfold our argument, we proceed as follows: after the introduction, we briefly outline the conceptual foundations of hermeneutic technology assessment and show how the hermeneutic shift can complement conventional approaches to evaluating technological developments and promises. We then turn to the Club of Rome and provide an overview of the two reports we aim to examine. By reconstructing the structure and context of each report, as well as the respective roles attributed to technology, we lay the groundwork for the central part of our analysis: a hermeneutic interpretation of each report's modes of performative intervention. The final section synthesizes our findings.

modeling decisions. In any way such a coupling is by no means specific to the Reports to the Club of Rome. Comparable configurations can be found across a wide range of contemporary policy-relevant knowledge practices, including epidemiological modeling during pandemics, climate modeling in assessments of global warming, or statistical and demographic models in social and economic reporting. Wherever models are used to analyze, aggregate, and project data, their outputs require narrative forms to be made legible and actionable for non-expert stakeholders. It is at this juncture – where modeled abstractions are translated into descriptive, prognostic, or prescriptive texts – that questions of framing and political implication arise. The Reports to the Club of Rome offer a particularly clear and analytically productive case of such model-text-conglomerates. Not only do they foreground modeling as a central epistemic resource, but the contrast between the two reports analyzed here makes especially visible how different modeling choices are accompanied by distinct narrative constructions of global futures and possible interventions.

[5] Even where the plurality of practical goals of modeling is emphasized, what is usually meant is that, depending on the specific *action* a model is intended to guide, different aspects of the world become relevant for the model and different degrees of uncertainty can be tolerated (cf., for example, Elliott & McKaughan (2014); Parker (2020)). This, however, does not address what we mean by different *performative modes* of modeling, which concern not *what* action a model guides, but the rhetorical embedding of the model that reveals *how* it aims to guide, orient, or motivate action. Winsberg & Harvard (2024, chap. 3) discuss the (ab-)use of models for rhetorical purposes. However, they also do not focus on different modes of rhetorical intervention, nor on how such modes and modeling decisions may mutually shape one another.

ENRICHING TECHNOLOGY ASSESSMENT WITH HERMENEUTICS

To situate our argument, it is helpful to briefly recall the conceptual foundations of both Technology Assessment and hermeneutics. *Technology Assessment* (TA) refers to the systematic reflection on the societal, ethical, and environmental implications of emerging technologies. From a philosophy of science and technology perspective, it rests on the insight that technological development is never value-neutral but deeply embedded in social contexts, interests and normative assumptions. TA seeks to make these dimensions visible and to support responsible decision-making under conditions of uncertainty. Interdisciplinary by nature, it functions as a practical interface between science, society, and policy by combining research, stakeholder engagement, and advisory work.[6]

Hermeneutics is a branch of philosophy concerned with the theory and practice of interpretation. It examines how understanding arises – not as the objective retrieval of facts, but through the situated interaction between interpreter and text, speech, or other forms of human expression. On this view, meaning is context-dependent and historically situated. Hermeneutics therefore resists isolating facts from their interpretive horizons and instead emphasizes the embeddedness of all understanding in historical, linguistic and cultural contexts.

Hermeneutic Technology Assessment (HTA) emerges at the intersection of these traditions. It responds to the limitations of classical consequentialist TA models – whether prognostic or scenario-based – that often struggle to provide guidance under conditions of high uncertainty and normative pluralism, as is typically the case with newly emerging sciences and technologies. Instead of attempting to assess the plausibility of future scenarios, HTA treats them as expressive *constructs rooted in the present*.[7] Its aim is to uncover the interests, needs, desires, and fears that shape how technological futures are imagined. In this way, HTA moves beyond narrow or deterministic views of technological development and instead aims at a more *self-reflective and autonomous engagement with sociotechnical possibilities*.[8]

For the sake of self-reflection, HTA considers the future as it appears in human conversations, popular culture, policy visions, calls for proposals and research applications, as well as in prototypes and proofs of principle. Its focus is on "the future" as it already exists in discourse – irrespective of whether clear paths from the present to that envisioned future can be identified. In this way, HTA aims to learn more about the

[6] For an introductory overview of technology assessment, see Grunwald (2010).
[7] Grunwald, 2015. See also: Grunwald & Nordmann (2023); Grunwald & Mehnert (2024).
[8] Proponents of HTA typically regard it as a broad methodological framework and refrain from prescribing strict procedural guidelines. What qualifies as "hermeneutic analysis" is usually left intentionally open, allowing for interpretive flexibility and contextual sensitivity. HTA should therefore be understood less as a fixed method than as a framework for orientation. This openness also reflects the field's current exploratory stage of development. As documented in the volume *Hermeneutics, History, and Technology. The Call of the Future* (Grunwald et al., 2023), central questions and points of contention remain unresolved. Rather than indicating a deficiency, this methodological indeterminacy can be seen as expressing HTA's critical ambition: to cultivate a reflective, non-reductive approach to technological futures that remains responsive to their specific complexity (Brenneis et al., 2025).

time in which such visions are articulated than about the accuracy of their predictions. Particular attention is given to how technological advancement is characterized and how stakeholders use language and other means to advocate for or against specific developments in their respective present. This hermeneutic shift in TA further underscores that assessments and debates about technology are far from "neutral." HTA highlights how discourses on technological futures are shaped by underlying values and assumptions – whether in high-level research programs or in everyday contexts. The future thus becomes a lens through which to analyze present-day constellations of knowledge and power, emotion and vision. While adding hermeneutics, it remains technology assessment. Yet the focus shifts from technologies and their potential consequences as such to the broader picture of how aspirations and cultural settings contribute to the ways in which technologies are embedded in the world – whether in the concrete practices of research and development or in imaginaries of what might be. As such, HTA aspires to offer more than future-oriented discourse analysis by also engaging not only with discourses but equally with the technologies themselves and the visions they engender.

The emergence of HTA is closely tied to critiques of speculative future scenarios in nanoethics and of classical TA with regard to NEST, most prominently those advanced by Alfred Nordmann and Armin Grunwald (cf. Liu, 2023). They argue that such scenarios are epistemically fragile and risk distracting from more urgent present issues. Instead, they propose interpreting such scenarios as "constructs that are expressive and embedded in their present," and advocate "reclaiming the present" through hermeneutic analysis. At the heart of this approach lies the recognition that 'the future' is not a fixed referent, but "a figure of discourse which amalgamates present-day hopes and desires, fears and anxieties, aspirations and anticipations" (Grunwald et al., 2023, p. xi). This perspective helps disentangle frequently conflated questions such as: "Where are we heading?", "How shall we live?", and "How will it be once the future has changed us?" HTA thus aims "to contextualize different aspects of a vision from various angles in order to learn something about us today and most importantly to demonstrate that each vision is just a possible vision among many other alternative visions" (Liu, 2023, p. 32). An important dimension of this is the *rhetorical and epistemic positioning of the audience*. Grunwald and Nordmann argue that "'[o]ur (technological) future' is entangled […] with discursively and institutionally sedimented habits of mind" (Grunwald & Nordmann, 2023, p. 39). Accordingly, hermeneutic analysis must also ask "who are the 'readers' of technological programs or prototypes, how are they constituted and provoked to change?" Hermeneutics mobilizes the critical subject "against the implicit 'we' of institutional and symbolic orders" and "produces a critical self-understanding of human entanglement in sociotechnological systems – and it thus contributes to hermeneutic visioneering assessment" (Grunwald & Nordmann, 2023: pp. 39–40).[9] In our own analysis, we build

[9] The term "visioneering" was introduced by Patrick McCray (2013) to describe the way visionary ideas about technological futures are intertwined with concrete practices of engineering, design and research. "Visioneers", regarding to McCray, not only imagine bold futures–such as space colonization or molecular nanotechnology – but also seek to make them appear credible and attainable by producing conceptual designs, prototypes and rhetorical frameworks that lend plausibility to their visions. In the context of HTA,

on this idea and examine precisely this performative engagement of the reports with their assumed readership, with particular attention to the role of models as integral elements of these model-text-conglomerates.

Since HTA is still characterized by an open-ended, exploratory approach rather than a strictly codified methodology, our own analysis remains tentative as well. This is especially true given that the kind of object we seek to examine–*model-text-conglomerates that illustrate future developments on a global scale* – has not, to our knowledge, yet been subjected to hermeneutic investigation. At the same time, the two reports we analyze appear particularly well suited to such an inquiry in the spirit of HTA. From our perspective, HTA is especially apt for examining a genre of texts that has sparked public debate and institutional response for decades: high-profile reports on the state of the world and possible futures. The most prominent and influential example of this genre is the first report to the Club of Rome, published in 1972 under the title *The Limits to Growth*. To this day, it is frequently cited in discussions of the future, ecology, resource management, and technological progress. As we will see, the report's performative intent – its ambition to engage its readership and the public at large – is striking, which makes it particularly suitable for examining different performative modes. As part of a comparative approach, we include the 50-year update *Earth for All* (2022) in order to trace shifts in how such reports are presented over time. With their *ensemble character* – combining modeling, simulation, and narrative elements – the Club of Rome reports are paradigmatic examples of how scientific, technological, and rhetorical means are fused to articulate futures.[10] They show how modeling is employed as a technology of futuring, and – most importantly for our purposes – how readers are addressed and mobilized. In both reports, different dispositions are ascribed to the intended audience. A central task of our hermeneutic analysis will therefore be to work out these differences: What can the reports reveal about the times in which they were written when read through the lens of HTA? What changed in the fifty years between the original and the update – in tone, structure, modeling, or rhetoric with respect to their engagement with readers? What kinds of shifts can be identified, and how might they be interpreted?

"hermeneutic visioneering assessment" adapts this notion: it denotes an interpretive practice that analyzes how such visions are constructed, rhetorically framed and institutionally embedded, aiming of understanding their performative effects in the present.

[10] Of course, the Club of Rome reports are not the only documents addressing global environmental problems on the basis of scientific projections that invite hermeneutic analysis. Similar dynamics can be observed in other high-profile documents such as the IPCC Assessment Reports (1990–2023) or the transition from the Millennium Development Goals (2000–2015) to the Sustainable Development Goals (2015–2030). These texts have shaped public debate and political priorities and are therefore equally suitable for hermeneutic examination. However, unlike these examples, the two reports we analyze display their performative dimension in a particularly salient way.

TWO REPORTS TO THE CLUB OF ROME: "THE LIMITS TO GROWTH" AND "EARTH FOR ALL"

In this section, we present a brief history of the Club of Rome and the two reports that form the focus of our analysis.[11] The Club of Rome is a global think tank founded in 1968 by the Italian industrialist Aurelio Peccei and the Scottish scientist Alexander King. Its aim has been to bring together scientists, economists, and former political leaders to address complex global challenges, particularly those concerning sustainability, environmental protection, and economic development. Today, the Club's work is organized into so-called Impact Hubs, which prioritize key areas such as Climate and Planetary Emergency, Reclaiming and Reframing Economics, Rethinking Finance, Emerging New Civilizations, and Youth Leadership and Intergenerational Dialogue (Club of Rome, 2025). The Club of Rome operates as a non-profit organization, funded primarily through membership fees, donations, and partnerships with institutions and governments. Its impact lies in shaping environmental and economic discourse, influencing policymakers, and contributing to international sustainability initiatives, including the UN's Sustainable Development Goals. The organization's most influential work remains the 1972 report *The Limits to Growth* (LtG) (Meadows et al., 1972), which used system dynamics modeling to warn of the risks of unchecked economic and population growth on a planet with finite resources. While its predictions have been debated, the report played a crucial role in promoting long-term, holistic thinking about global crises. To date, more than fifty reports to the Club of Rome have been published, with *The Limits to Growth* as the first and *Earth for All* (EfA) (Dixson-Declève et al., 2022) as one of the most recent ones. Some reports operate on a global scale, while others focus on specific topics.

At the beginning of the 1970s, issues such as the nuclear threat, population growth, and environmental pollution had created a sense of urgency and the conviction that society needed to decide about its own future (cf. Weart, 2008; Seefried, 2011; Vieille Blanchard, 2015; Andersson, 2018). The Club of Rome considered computer models the appropriate means to explore possible futures and to investigate how a transition from growth to a noncritical equilibrium state might occur. LtG warned of the possibility – or even the likelihood – of ecological overshoot and societal collapse. And *"overshoot and collapse"* soon became the signature phrase associated with the report. The authors argued that if humanity continued to pursue economic growth and exponential consumption without regard for finite natural resources and environmental costs, global society would exceed Earth's physical limits and face sharp declines in food and energy availability, rising pollution, a subsequent fall in living standards, and ultimately a dramatic reduction of the human population within the first half of the twenty-first century. Ann Johnson and Johannes Lenhard summarize the discursive contribution of

[11] For this overview of the Club of Rome and its reports we draw in particular on Bardi (2011), Schmelzer (2016), von Weizsäcker & Wijkman (2018), as well as on more recent discussions of LtG and its legacy (Turner, 2008; Hall & Day, 2009; Vieille Blanchard, 2010; Randers, 2012; Meadows, 2012).

the report succinctly: “The message was alarming: if the growth of the economy, pollution, and population continues, the world system will collapse in less than a century” (Johnson & Lenhard, 2024, p. 113). And this message *resonated widely*. LtG gained particular traction because, unlike earlier doomsday warnings, it was presented as a scientific prediction – grounded in computer modeling and rhetorically framed as a sober, technical analysis. This mode of presentation was crucial for its impact: it allowed the report to attract considerable attention from a broad readership and lent authority to its warnings. The book became a bestseller, selling 12 million copies in 37 languages, and remains the top-selling environmental title ever published. It also inspired numerous follow-up studies by a growing number of modeling groups.

The analysis in LtG was based on a then-novel computer model, *World3*. It was the first attempt to use a computer model to capture the complex global dynamics of human societies on a finite planet and to explore large-scale scenarios concerning population growth, industrial output, food, pollution, and other factors.[12] Using *World3*, the authors developed twelve scenarios, grouped into three categories. The “standard run” or business-as-usual scenario assumed that the economic, social, and physical patterns observed between 1900 and 1970 would continue unchanged into the future. Six subsequent “technological scenarios” started from the same baseline but introduced advances such as increased resource availability, higher agricultural productivity, reduced pollution, or limits on population growth. The final set of five “stabilization scenarios” explored outcomes in which either population growth or industrial output was stabilized. In these “stabilized world” scenarios, human welfare improved and remained at a high level. The overall message was that decisive actions could be taken to avoid collapse. Yet, as noted above, the key takeaway that resonated in public discourse was not the possibility of stabilization but rather the prospect of overshoot and collapse.[13]

[12] The roots of scenario thinking in scientific forecasting can be traced back to early population and resource projections such as Thomas Malthus’s Essay on the Principle of Population (1798) and William Stanley Jevons’s The Coal Question (1865), which already formulated conditional if–then statements about possible futures. In the mid-twentieth century, scenario techniques became more systematic in military and policy contexts. At the RAND Corporation in the 1950s, they were combined with operations research, probabilistic modeling, and game theory to explore nuclear strategy and what Herman Kahn (1962) famously called “thinking the unthinkable” – that is, systematically considering catastrophic yet conceivable outcomes such as thermonuclear war in order to devise strategic options. In the 1960s, scenario approaches spread into corporate and economic planning, most prominently through the scenario method developed at Shell (cf. Wack, 1985). These developments established scenarios as a way to link qualitative assumptions about social and technological change with quantitative forms of modeling, laying the groundwork for their subsequent integration into environmental and climate science.

[13] Over the past fifty years, debate has continued as to why the media and other commentators largely ignored the stabilization scenarios and instead emphasized the threat of collapse if growth followed its traditional trajectory.

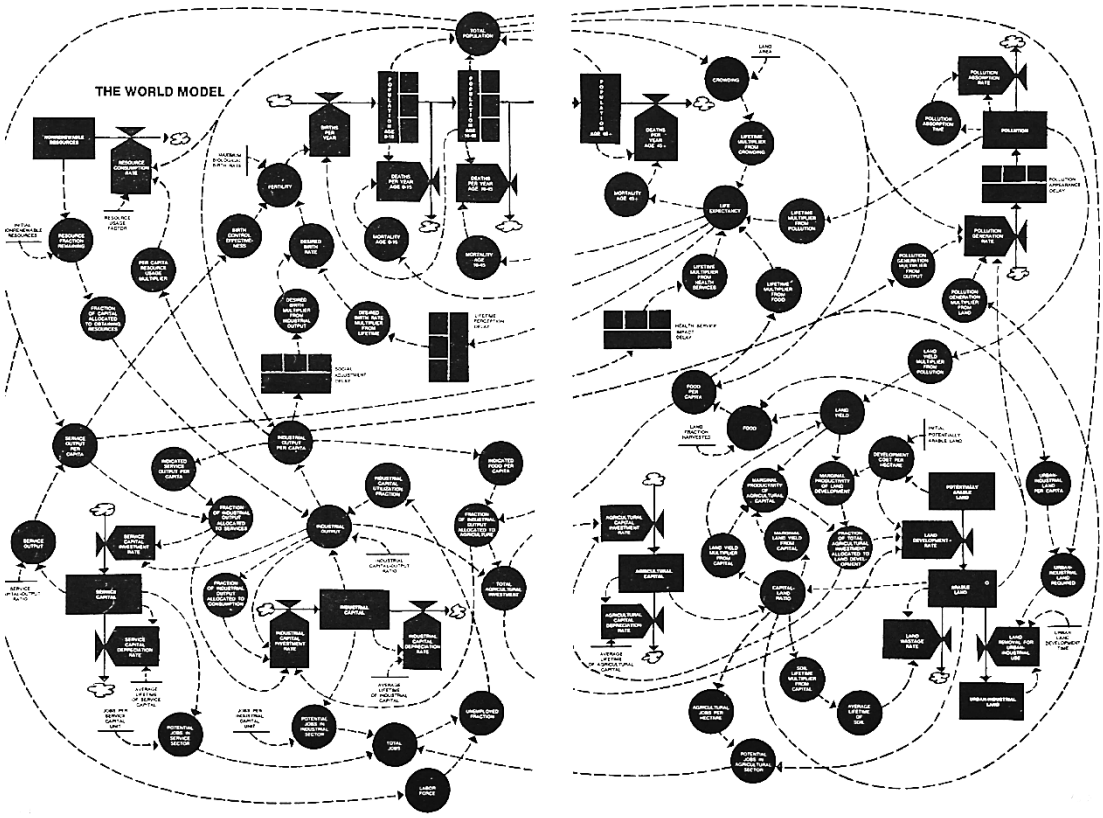

Figure 2: The World Model from World3 (Meadows et al., 1972, pp. 102–103

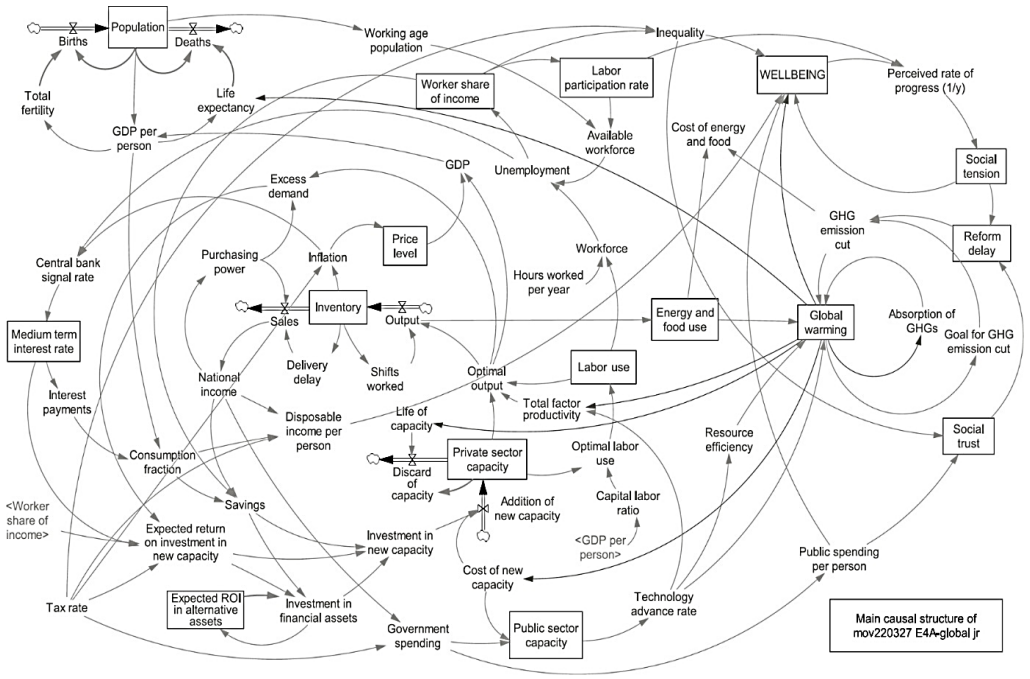

Figure 3: Main causal structure of Earth4All (Dixson-Declève et al., 2022, p. 178)

In 2022, the *Earth for All* (EfA) report was published as a 50-year update to LtG. Its central message is that the long-term potential of humanity depends on the ability of global civilization to achieve five extraordinary turnarounds within the coming decades. The report's main goal is to demonstrate that the kind of systemic transformation required within this short time span is indeed possible. One key difference from LtG lies in the number of scenarios. Whereas LtG explored a wide range of alternatives, EfA illustrates only two. The first, called "Too Little Too Late," assumes that societies respond to future challenges in the same incremental manner as in the past, through limited policy adjustments. The second, "Giant Leap," assumes that societies recognize the interconnected crises and initiate immediate, extraordinary action in five key areas. These extraordinary actions are presented as the "five turnarounds" and are explained in dedicated chapters, supported by insights from the underlying simulation model.

The EfA model – *Earth4All* (or: E4A) – itself is an elaborated version of *World3* and belongs to the family of system dynamics models. Its primary role is to provide consistent pictures of possible futures. Unlike *World3*, however, *Earth4All* incorporates additional "social" parameters such as wellbeing, social tension, and social trust. The authors employ the model to evaluate the potential consequences of alternative decisions, to identify which systemic changes are likely to have major effects and which will make only a minor impact, and to estimate the costs and levels of investment required to achieve certain wellbeing outcomes by specific points in time. At its core, the *Earth4All* model explores how to improve human wellbeing throughout the twenty-first century.[14] Its ambition is to chart a path toward a world in which wellbeing is higher than it would be without extraordinary action. To this end, the authors introduce an "Average Wellbeing Index" (AWI), which integrates five components into a single measure. The AWI increases with disposable income, public spending, and perceived progress, while it decreases with rising inequality and higher global temperatures. This *focus on wellbeing* is the defining feature of EfA and a central difference from LtG. Wellbeing serves as the pivotal reference point for the two scenarios derived from the model and presented in the book. The authors summarize them as follows:

> Too Little Too Late reflects our current trajectory, where societies keep boasting and bumbling about 'sustainability' while muddling through. In Too Little Too Late, most countries make piecemeal, incremental progress toward ending poverty and stabilizing the climate, but do not really deal with the elephant in the room: inequality. […] In this scenario, social trust declines as the richest 10% and bottom 50% continue diverging, while societies and nations turn against each other, competing for resources. There is too little collective action to limit the immense pressure on nature. Earth's life-supporting systems like forests, rivers, soil, and climate keep deteriorating, and some systems move closer or cross irreversible

[14] The authors of EfA and E4A emphasize the transparency of the model and make it accessible for scientific scrutiny (cf. Earth4All, 2025). Whereas LtG devotes an entire chapter to a detailed description of *World3* (Meadows et al., 1972, pp. 88–128), EfA presents the technical details of *Earth4All* only briefly in the main publication (Dixson-Declève et al., 2022, pp. 175–180) and refers readers to additional publications (cf., for example, Collste & Randers, 2022). Since its publication, *Earth4All* has been taken up and discussed in a number of scholarly contributions (cf. Crescenzi et al., 2024; Feder et al., 2024; Stoknes et al., 2025).

> tipping points. For those in poverty, Indigenous peoples, and wildlife, this is a steady 'stairway to hell.'
> As our second scenario, we chose Giant Leap, which illustrates the effects of the powerful and immediate implementation of the five extraordinary policy turnarounds. Its passage through the century is driven not by tinkering at the fringes but by fundamentally reconfiguring economies, energy systems, and food systems. It's a major upgrade. A reset. An essential reboot of civilization's guiding rules before the system crashes. Due to inertia in economies and in the climate, the main impacts of any action taken today are often not seen for years in economies and decades or centuries in the climate. We believe that nothing less than a 'giant leap' now is needed if humanity is serious about turning around from the current trajectory and getting on a new track to a sustainable world by 2050. The Giant Leap scenario spells out the details of a new type of economy fit for the Anthropocene – an economy that removes poverty, promotes social and environmental wellbeing, and measures its progress by how well people and the planet thrive." (Dixson-Declève et al., 2022, pp. 28–29)

As the ambition of the EfA project is to promote a (political) program that is intended to improve human wellbeing during the next 50 years, the focus of the book is on "5 Turnarounds" – transformational changes in the interconnected fields of poverty, inequality, empowerment, food, and energy. For each turnaround, the report lists three *socioeconomic levers as solutions for achieving a transformation* towards "wellbeing economies." The three levers differ according to their transformative impact and, at the same time, their likelihood – since more substantial changes in policies and lifestyles compared to current approaches appear less likely, as they must overcome stronger forces of inertia and resistance. It is quite remarkable how the EfA project is presented in a highly symmetric manner: the entire report follows a systematic structure, presumably developed in advance, to achieve rhetorical force and persuade its audience.[15] This *rhetorical strategy* is reinforced through narrative elements that accompany the scenarios and the approaches to the five turnarounds. Most prominently, the report tells the stories of four fictive girls living in different parts of the world, whose life trajectories are traced along a timeline spanning the 80 years till the year 2100.[16] These narratives personalize

[15] The rhetorical effect of structuring arguments or scenarios symmetrically – through an equal number of theses, categories, or points of reference – is well established. In classical rhetoric this is described as isocolon or, more generally, as parallelism, where balanced forms enhance clarity, memorability, and persuasive force (cf. Lausberg, 1998, pp. 320–321).

[16] Dixson-Declève et al., 2022, pp. 32–33: "To make these two scenarios tangible, we developed four characters – all girls, born on the same day in early August 2020 – and imagined their trajectory through each one. Shu was born in the Chinese city of Changsha; Samiha in Dhaka, Bangladesh; Ayotola in Lagos, Nigeria; and Carla in the United States. These are not real people but more like avatars that highlight what it is like to live in the Too Little Too Late and Giant Leap worlds. We chose four girls in order to better compare across regions, scenarios, and opportunities. Like 1.4 billion other people on Earth, Samiha and Ayotola were born into vulnerable informal settlements in their cities. And like 3 to 4 billion people on Earth, their families exist on less than $4 per day. Shu and Carla's families are better-off economically. Shu's mother is a teacher and her father an accountant in Changsha. Carla's parents moved to California

the abstract scenarios and exemplify, in concrete terms, how global transformations might affect individual lives – an approach that contrasts with LtG, which relied less on narrative illustration. In line with this progressive agenda, EfA also positions itself as a campaign. The main publication was launched with numerous endorsements and has been accompanied by a wide range of additional activities. Among them are deep-dive papers that elaborate on issues raised in the book, as well as country reports that address specific challenges and solutions in national contexts. Since 2022, such supplementary publications have been released continuously, providing a growing database for further discussion.[17]

In general, both reports are based on simulations derived from computer models and aim to convey complex messages about the state of the natural and social world to a broad public. Yet the models, as well as the overall ambitions, differ considerably. Whereas LtG devoted most of its pages to the presentation of scenarios, EfA frames itself as a scientific–political program centered on the five turnarounds.

THE ROLE OF TECHNOLOGY IN THE CLUB OF ROME REPORTS

Technology plays a double role in the reports to the Club of Rome: it is both a means of producing knowledge about possible futures and a central object within those futures themselves.

Firstly, the reports use *technologies of futuring, specifically simulation models*, to explore the dynamics between key parameters and to construct future scenarios. The models – *World3* in LtG and *Earth4All* in EfA – function as epistemic devices that organize existing knowledge and map out potential trajectories. Through modeling, they provide structured visions of how different pathways – ranging from collapse to sustainable transformation – might unfold depending on societal choices. Structurally, these computational models are embedded in the epistemic assumptions of their time. They encode contemporary understandings of system dynamics, economic growth, ecological limits, and intervention strategies. In doing so, they transform data and assumptions into coherent scenario narratives. To become meaningful within the reports, however, these modeled outcomes must be explained and embedded within broader argumentations. The reports thus extend the models' outputs into narratives that contextualize the scenarios and articulate their implications, thus leading to what we call model-text-conglomerates. By simulating interactions between population growth, resource use, technological change, and environmental degradation, the models generate a structured solution space for political deliberation and action. Modeling thus becomes a technique for opening up possibilities and confronting societies with the consequences

from Colombia for the economic opportunities in the United States. Her mother stays at home to look after the three children, and her father works in the restaurant industry. We will follow their journeys from 2020."

[17] The project thus presents itself as an ongoing and evolving endeavor rather than as the one-time publication of a report. This campaign-like character is also reflected on the EfA website, which hosts a variety of activities and resources – including suggestions for setting up book clubs and even a printable card game designed to spark local debate on transformation priorities.

of different political, economic, and technological pathways (cf. Edenhofer & Kowarsch, 2015, pp. 58–61). This constitutes the epistemic–technical dimension of technology's role. Moreover, the *interplay between modeling and text* is crucial, as both elements mutually reinforce one another. These model-text-conglomerates function as rhetorically – and thus pragmatically – shaped instruments of discourse, in which the scientifically grounded construction of the model and its narrative embedding can amplify each other's epistemic and persuasive force.[18]

Secondly, technology itself is an explicit *element within the modeled futures*. The reports incorporate assumptions about how technological systems might evolve over time, treating technological change not as an external variable but as an endogenous and socially shaped process. In LtG, for instance, technological progress is recognized as capable of delaying or mitigating collapse tendencies, yet ultimately insufficient without broader systemic transformations (cf. Meadows et al., 1972, esp. pp. 129–155). EfA similarly stresses the importance of renewable energy, agricultural innovation, and digital infrastructures, while highlighting that these alone cannot ensure sustainable outcomes without corresponding shifts in governance, values, and economic practices (cf. Dixson-Declève et al., 2022, p. 7–8, p. 168).[19] In this way, the scenarios show technology as both a driver of global challenges and a potential means of addressing them – a double-edged sword that can accelerate ecological decline or enable sustainable transitions, depending on how it is governed (cf. Vieille Blanchard, 2015).

Thus, technology operates on two interconnected levels within the reports: as a modeling tool that structures the exploration of futures, and as a dynamic factor within the scenarios that shapes the range of possible societal developments. In both respects, the reports illustrate that technological futures are neither neutral nor deterministic but contingent on political priorities and cultural imaginaries. The modeling approaches themselves form an integral part of this futuring practice: they do not merely represent external realities but are woven into the reports' agendas of raising awareness and fostering change. This is a point we seek to foreground with empirical material: The authority attributed to modeling derives from the transparency of its parameters, assumptions, and computational structures, which frames it as scientific and ostensibly "objective". Yet at the same time this "objectivity" is itself value-laden: decisions about system boundaries, variable selection, and causal linkages embody interpretive flexibilities that align the models with particular normative orientations. By considering these entanglements of modeling and futuring – particularly with regard to how the reports present their findings – we show that the Club of Rome reports are not simply scientific forecasting exercises but complex *assemblages of scientific modeling,*

[18] Because such conglomerates – at least when addressed to a broader public – are inevitably rhetorical constructions, a hermeneutic analysis can help identify where epistemic and rhetorical dimensions genuinely reinforce one another and where they risk devolving into mere strategies of influence aimed at shaping audience perceptions. Although this dimension is not examined in depth here, it is nonetheless directly related to the question of performative modes of modeling the future.

[19] While EfA acknowledges the importance of technological developments for most of the proposed turnarounds, its primary focus nevertheless lies on economic changes (cf. Dixson-Declève et al., 2022, pp. 163–164).

technological visioning, and normative orientation. They mobilize technologies of futuring to reflect on the conditions and possibilities of sociotechnical transformation – and, ultimately, to prompt political action. Understanding this entanglement requires a hermeneutic analysis capable of uncovering the tacit value commitments and narrative framings that shape the models' construction and interpretation. Such an analysis performs a hermeneutic disclosure: it reveals how ostensibly technical modeling practices are intertwined with imaginaries of desirable futures, thereby demonstrating how epistemic and normative dimensions co-constitute the reports' overall futuring work.[20] In the following section, we examine how a hermeneutic analysis can reveal the mechanisms through which the two reports construct and communicate their visions of possible futures, and how performative modes of presentation shape the projects.

THE HERMENEUTICAL ANALYSIS OF THE CLUB OF ROME REPORTS

A substantial body of scholarship has been written on LtG, and we can thus draw on a rich corpus of secondary literature for its contextualization. This is not the case for EfA. On the one hand, this is of course due to the simple fact that the report is fifty years younger, and only a limited number of academic engagements have emerged in the brief period since its publication. On the other hand – and this aligns with our broader argument – the context in which EfA appeared differs fundamentally from that of LtG: not only with respect to the global situation and the factors shaping the modeled scenarios, but also regarding communication environments, public discourse, and attention economies. It is precisely here, so our hermeneutic hypothesis, that an analysis of the intended performativity of modeling practices becomes analytically fruitful, as it allows us to understand how each report seeks to intervene in its respective historical moment.

It is important to note that a hermeneutic analysis of the two reports can take a variety of aspects into account. It can highlight many differences between the reports and what each reveals about its respective present – such as the different scenarios and parameters they select, the metaphors they employ, the narrative strategies they pursue, the authorities they cite, and so on. As we have indicated above, we concentrate on one particular dimension of the reports: their *different modes of performative intervention*, which we aim to work out in greater detail. To do so, we approach the reports as communicative acts directed toward the public (or specific segments of it) and demonstrate how they assume different purposes regarding what they intend to communicate and how they seek to communicate it. At a fundamental level, both reports – and the way they construct scenarios – can be understood as situated within the same existential condition. Each grapples with a central tension: on the one hand, the future is radically open, in the sense that it is not yet present and remains malleable. As Hannah

[20] Although in this paper we focus on the presentation of modeling results, one could also emphasize how modeling decisions are justified. Such analyses are typically constrained by the transparency with which modelers disclose their assumptions, as illustrated by the "Technical Note" on the Earth4All model (Collste & Randers, 2022).

Arendt (1951, 1958) famously pointed out, predictions of the future can suppress the possibility of change and thus risk becoming totalitarian forces. At the same time, this openness does not imply that all outcomes are equally probable; certain trajectories can simply be more plausible than others. There are epistemic reasons to favor some scenarios over others. This is also assumed in future scenarios like the two Club of Rome reports. In this sense, they both reject a naïve "anything goes" perspective. There are two basic dimensions in which both reports *restrict the radical openness of the future*.

(1) *Within each scenario*, the reports follow a (quasi-)deterministic if–then logic: if parameters treated as exogenous (x, y, etc.) develop in a certain way, then dependent variables (a, b, etc.) will unfold accordingly. While both reports acknowledge uncertainties and possible errors – and have been criticized for underestimating them – the structure of the scenarios nonetheless presupposes an underlying causal logic: if x, then y (cf. Grunwald, 2023, p. 175). These statements are not arbitrary; they are grounded in evidence generated through computer-based modeling. Thus, even where uncertainties are emphasized, the reports assume that sufficient epistemic reasons exist to justify their conditional estimates, thereby narrowing the full openness of the future in a reasoned and model-based manner.

(2) At the same time, the reports do not commit to a fully deterministic view, as they present a *spectrum* of *possible* futures. This scenario-based architecture preserves a degree of openness and malleability, since the *independent variables* – such as population growth or technological development in Limits to Growth – are explicitly treated as *changeable*. In this respect, the reports reflect a broader transformation in futures studies during the 1960s: a shift from forecasting a single future to constructing multiple alternative futures (cf. Andersson, 2018, p. 215).

Yet in doing so, the reports necessarily make choices: which scenarios to include and which possibilities to *exclude*. Through these choices, certain options for action are treated as so unrealistic that they are not considered further – even though, in principle, they could be altered through human decisions. As Andersson aptly notes, scenario selection is always a "problem of closed doors" (Andersson, 2018, p. 218). Such decisions are not merely technical but carry a profound existential dimension: "What was considered in the model as static or dynamic was not a mere technical issue but continued to reflect existential notions, as it put the searchlight on the question of what was changeable and not in the world system, and moreover, on what was the core variable of future change – human value change, technology, or the finite nature of resources in a planetary system" (Andersson, 2018, 185). It is precisely in this "existential" regard that LtG was heavily criticized for being overly deterministic and for underestimating society's capacity for adaptation (cf. Cassen & Cointe, 2022, p. 614). A substantial part of the criticism targeted the report's alleged underestimation of the positive potential of technological progress (cf. Vieille Blanchard, 2015, p. 107).[21] Moreover, critics objected

[21] A prominent critic was the American economist William Nordhaus, whose work led to the construction of an alternative model Dynamic Integrated Climate-Economy (DICE) in 1992. The model included much more optimistic assumptions about technological development. Among other things, Nordhaus postulated

that in all scenarios certain factors were treated as fixed and not acknowledged in their potential malleability. Sociologists and economists pointed out that the report neglected the possibility of immaterial changes within political and societal systems (cf. Hahn, 2006, p. 111). Karl Deutsch was among the most prominent critics of the missing societal dynamics in LtG (Deutsch et al., 1977, p. 27). For this reason, comparisons with Thomas Robert Malthus's underestimations of technological and societal development were common (Samuelson in Oltmans, 1974). Perhaps the most blunt expression of this type of criticism regarding the report's insufficient openness came from Ronald Reagan in his second inauguration speech in 1985, when he proclaimed: "There are no limits to growth and human progress when men and women are free to follow their dreams." (Reagan, 1985)

This points to a general tension that modelers must navigate when their models include developments that can be altered by human decisions and behavior within the target system: human action is, in principle, free and capable of taking unforeseen directions.[22] At the same time, one should not assume naïvely that all developments are equally possible. Given that both reports must make such "existential" choices, they inevitably display a constructive dimension. They construct images of the future by delimiting the field of possible developments and excluding others. Crucially, they do so with performative intent: their aim is to demonstrate likely future developments and, on that basis, to *motivate* certain forms of action. In this respect, the reports differ from earlier strands of futurology that were primarily concerned with utopian visions. Instead, they exemplify a shift in futurology between 1945 and 1955 toward scenario-building as a practice carrying a practical imperative. As Andersson puts it, such scenarios are "interventions into the present and attempts to shape coming times … designed to push human beings to act for the future in various ways" (Andersson, 2018, pp. 4–5). Bearing in mind that modeling decisions can themselves influence how people behave – and thereby form or change the model's own target system – only increases the complexity of such decisions. This is what makes the two reports a distinctive type of text: they do not merely offer epistemic claims about what will (conditionally) *happen* in the future, but also present themselves as normative interventions in the present *intended to shape* that future. Both position themselves as *scientific texts animated by normative imperatives*.

It is therefore reasonable that both reports rely on a similar basic model architecture: scenario-building that examines how changes in certain independent variables causally affect dependent variables within a complex system – where at least some independent

the invention of a "backstop technology" by 2010 which would make it possible to produce an unlimited supply of pollution-free energy (cf. Vieille Blanchard, 2015, pp. 109–110).

[22] Closely related is the more recently discussed issue of the performativity of models. This refers to the phenomenon that models can affect their own target system by altering people's behavior in response to model predictions – something akin to a self-fulfilling prophecy. A precondition for such effects is that the model makes claims about human behavior that are not strictly deterministic but allow for change. The additional possibility that human behavior may change because of a model's prediction introduces a further layer of complexity: it raises new questions about how such potential feedback effects should inform decisions about model construction and scenario design (cf. Ortman, 2025).

variables are assumed to be subject to human influence. However, the reports *differ significantly in the specific pragmatic roles their models are meant to perform*. It is this performative dimension of the two reports that we will examine in the following, in order to introduce several distinct performative modes. Of course, one could also conduct a hermeneutic analysis of the two reports with respect to differences in their content – that is, the different selection of scenarios and the different choices concerning independent and variable parameters. This, however, is not our focus here. Instead, we will address questions such as: *What does each report seek to accomplish by presenting certain "futures" to its audience? And how does it pursue this aim?*

The practical efforts of each report differ in kind: each is embedded in a distinct horizon of meaning, makes different assumptions about its audience, and operates with different expectations regarding how it can affect that audience. They make different assumptions about what their readership already knows, what it needs to be informed about, and how it imagines and emotionally responds to ecological future scenarios. Accordingly, each report engages its readership in a different manner. It is this underlying dimension that we aim to explore in the following, and which we seek to render more explicit.[23]

COMPARISON REGARDING PERFORMATIVE MODES OF THE CLUB OF ROME REPORTS

We can start our analysis by citing the following central passages that capture nicely the *difference in tone and general intention of the two reports*. The following passage is quite illustrative in this regard for the LtG report:

> The project was not intended as a piece of futurology. It was intended to be, and is, an analysis of current trends, of their influence on each other, and of their possible outcomes. Our goal was to provide warnings of potential world crisis if these trends are allowed to continue, and thus offer an opportunity to make changes in our political, economic, and social systems to ensure that these crises do not take place. (Meadows et al., 1972, pp. 185–186)

The following two passages capture the tone and ambition of the more recent EfA report:

[23] Of course, it would neither be easy nor fruitful to separate the representative and performative dimensions of the two reports too strictly. Quite the contrary, it is plausible to assume that the two are intertwined. Not only do the results of the model runs affect what is performatively reasonable to pursue; the performative intent also shapes the role of the model itself and, consequently, modeling choices – especially regarding which scenarios are considered and what is assumed about the development of future parameters that are not merely uncertain but also depend on voluntary human decisions (cf. Winsberg & Harvard, 2024, esp. pp. 42–43). At the very least, the performative orientation of a report will influence where its authors place emphasis, how they frame future developments, and which aspects they highlight (cf. Oltman, 2025). Yet even though these two dimensions do not operate independently, our focus here will be on the performative dimension.

> This is a path of possibility, infused with stubborn, urgent optimism. Earth for All does not gloss over the facts or current context, nor does it offer a utopian vision for the future. What this book shows is that it is possible to avoid risking social tensions, human suffering, and environmental destruction by making five extraordinary turnarounds...” (Dixson-Declève et al., 2022, p. xvii)
>
> […] these extraordinary turnarounds can be achieved by 2050, within a single generation. But action needs to start now. Our future will be vastly more peaceful, more prosperous, and more secure if we do everything in our power to stabilize Earth this decade than if we do not.“ (Dixson-Declève et al., 2022, p. 7)

These two quotes already convey quite effectively some of the key differences between the two reports. In a nutshell, we would highlight that LtG refers to future scenarios in order to:

(1) Increase public awareness of potential and problematic future developments
(2) Warn of potentially catastrophic outcomes
(3) Initiate public debate and political action to shape future trajectories

LtG basically sets out to issue a stark warning about global development that, at the time, was not widely recognized. At the same time, it offered abstract guidance on the general directions that should be pursued to prevent the looming catastrophes it projected. In this way, as we would like to emphasize, the report overall combines a technocratic perspective with an effort to raise public awareness – a somewhat curious mixture of expert authority and public mobilization. By contrast, the EfA report strikes a rather different tone and, consequently, its model plays a fundamentally different performative role. Its reference to future scenarios is embedded in a distinct communicative context, aiming primarily to:

(1) Confirm, elaborate, and emphasize findings on future developments
(2) Generate hope regarding the feasibility of positive future scenarios
(3) Provide specific, action-oriented guidance for both policy-makers and the broader public

While it can be assumed that LtG saw the main problem in a lack of public awareness or belief in the projected problems, EfA appears to take such general awareness largely for granted. We argue that therefore the model fulfils a different practical function and suggest that, like LtG, EfA also has a technocratic side–albeit one that differs in several important respects. More than LtG, EfA seeks to mobilize a broader audience, not just policy-makers, toward concrete action. At the same time, EfA demonstrates a stronger sensitivity to the emotional disposition of its audience, particularly to an assumed sense of despair in light of the political obstacles to realizing the proposed policy initiatives – a difficulty of which the report’s authors seem acutely aware. It is important to note that this is only a rough characterization. For instance, EfA is not devoid of informative elements, nor does LtG refrain from offering broad policy suggestions or occasionally adopting a hopeful tone. Nonetheless, the two reports clearly place their primary emphasis on different aspects. In the following sections we flesh out these differences in more detail and situate them in their historical context.

THE LIMITS TO GROWTH REPORT: TECHNOCRATIC AND UPSTIRRING

A general impression of what LtG and its authors sought to achieve is effectively captured in the subtitle of a review published in the German weekly *Die Zeit*, which described the report as a "bomb in paperback format" (von Randow, 1972, our translation). Its main goal was to raise broad public awareness of what it presented as a global existential problem. And, judging by its impact and the reactions it provoked, it is fair to say that it succeeded. This mode of intervention can, at a basic level, be understood as an effort to inform the audience about realistically possible future developments. The report was widely perceived – and also frames itself – as providing substantial informational value; that is, it was regarded as delivering highly novel and relevant insights. Of course, the core diagnosis was not entirely new: earlier discussions had already warned of population growth, including the idea of a "population bomb," the title of Paul Ehrlich's bestselling 1968 book. The 1960s also witnessed the emergence of early critiques of economic growth and the rise of modern environmentalism (cf. Seefried, 2011, pp. 8–9; Vieille Blanchard, 2015, p. 100).

What LtG presented as relatively new, however, were insights into how the complex interactions among various factors of the world system could unfold in the future. This enabled the authors to offer quantitative estimates of the scale of the problems the world was heading toward and of the extent of change required to avert catastrophe. LtG was the first report to *draw strikingly unambiguous conclusions on the basis of the most extensive system analysis available* at the time (Hahn, 2006, p. 102; Vieille Blanchard, 2015, p. 103). As the report itself emphasizes, these novel findings were made possible by "*new* information processing tools" (Meadows et al., 1972, p. 21, own emphasis)–namely, the systems dynamics approach and the use of computer models–which allowed the authors to "gain *insight* into the limits of our world system" (Meadows et al., 1972, p. 185, our emphasis).[24] That the authors understood their work as informing the public about something genuinely new is evident throughout the report. They speak of "insights" and new "knowledge" they had gained and felt compelled to share. Unsurprisingly, this self-understanding is reflected in how the report was received. Even though it was heavily contested and its assumptions sharply criticized, the predominant tone of the reception praised its informational value. Political scientists Jänicke et al. referred to it as "the most dramatic and, for environmental politics, most influential information event" (Jäckel et al., 1999, as quoted in Hahn, 2006, p. 7). It is therefore

[24] Indeed, as Ann Johnson and Johannes Lenhard argue, "Limits to Growth is an exemplar of a newly emerging culture of prediction that has both an iterative and a numerical character" (Johnson & Lenhard, 2024, p. 113). It had only one prominent predecessor in Forrester's "World Dynamics" (1971; cf. Johnson & Lenhard, 2024, pp. 122–124), yet the approach was not widely known in detail outside expert circles. While LtG models the subcomponents of the world system in greater detail, its main tendencies broadly coincide with those of Forrester's more coarse-grained model. The relative novelty of this methodology – and the fact that its standards of validity had not yet been firmly established – was one important dimension along which the report became contested (cf. Johnson & Lenhard, 2024, p. 115; Vieille Blanchard, 2015, p. 106).

hardly surprising that the report generated widespread resonance and had the tangible effect of prompting large parts of the public to engage more seriously with environmental policy issues. In this sense, LtG also serves as a prime example of the dual function that simulations can fulfill: they are instruments for generating new knowledge and, at the same time, means for illustrating and communicating that knowledge (cf. Scheer, 2017). By fulfilling this dual role, the report seeks to raise the audience's awareness of possible futures – not just any futures, but ones that are epistemically grounded. The informational value of the report lies centrally in the causal if–then logic that it systematically pursues within each scenario, as outlined above.

On a further level, the report does not simply provide information; rather, it provides information about what it explicitly frames as a serious global problem. Above all, it serves as a *strong warning*. While it presents twelve scenarios – some of which lead to a positive outcome, a "stabilized world" – its emphasis clearly lies on negative outcomes, particularly the "standard run" scenario, in which the world continues its current path and ultimately faces "overshoot" and "collapse."[25] The warning tone pervades the entire report, especially its introduction and conclusion, where negative future scenarios serve to depict a catastrophic future if "trends are allowed to continue" (Meadows et al., 1972, p. 186). As Club of Rome founder Aurelio Peccei emphasized as a main motivation for the study: "What we needed was a stronger tool of communication to move men of the planet out of their ingrained habits. This is the reason for the MIT study and the book. Its conclusions are preliminary, but it is a key which permits every layman to enter the labyrinth of the fantastic problems towering over mankind" (quoted in Vieille Blanchard, 2015, p. 106). In this sense, the main future projection in LtG is constructed as a warning. The future is depicted as increasingly bleak if current trends persist, and is presented in a way that *appeals to the audience to relate to it consciously and actively*. Here, the future becomes a looming threat associated with "doing nothing," calling on the audience to act rather than remain locked into present behavioral patterns. To achieve this, the warning scenario is constructed as following a seemingly "natural" trajectory – one that emerges directly from existing trends – while at the same time remaining open to intervention. This approach stands in sharp contrast to the tradition of "futurology," which the report explicitly rejects.[26]

It is therefore not surprising that LtG was primarily received as a warning as well, regardless of whether individual reviews were favorable or critical. This emerged from an assessment commissioned by the *Volkswagen Foundation* of international press reactions (Hahn, 2006, p. 106). To cite just one example, *Die Zeit* published a positive review in 1972 that emphasized the report's pessimistic tone as marking a broader shift in scientific thinking about the future: "In the past, futures researchers mainly occupied

[25] This was also regarded as the most robust outcome of the model simulations. As Johnson and Lenhard explain: "This is exactly what Forrester and the LtG study highlighted: with exponential population growth, a collapse will happen, quite independently from data about other parts of the dynamics that are not available anyway. From the start, the robustness of this behavior was taken for granted" (Johnson & Lenhard, 2024, p. 129).

[26] For an overview on the scholarship on future studies and the concept of "futurology" cf. Gidley (2017, pp. 63–81) and Gidley (2021).

themselves with issuing optimistic forecasts about unimaginable prosperity, an excess of leisure, and victory over old age and disease. Today, their prognoses are mainly gloomy" (von Randow, 1972, our translation). Frequently, however, the report was misread not simply as a warning but as a "harbinger of the apocalypse" (Andersson, 2018, p. 177)– that is, as presenting an overly deterministic vision of an inevitable future. A particularly sarcastic review in *Der Spiegel*, entitled "Doomsday Visions from the Computer," referred to the authors as "Cassandra-like figures" who proclaim that "the end of the world is near" (Der Spiegel, 1972, our translation). Although such interpretations exaggerate the report's claims and overlook the fact that it explicitly presents multiple scenarios rather than a single prediction, it is telling that the report was often read this way.[27]

As described above, the report can be regarded as a performative intervention in its present. It issues a warning about impending catastrophe with the aim of initiating preventive action. At the same time, it offers broad indications of what must be done to avoid the catastrophic scenarios it outlines. Yet the *practical guidance* it provides remains relatively abstract, pointing only in general directions – such as curbing population growth or fostering technological improvements – measures that follow directly from the scenario results. Both recommendations are framed, as Andersson notes, as "new tools of a technocratic world management" (Andersson, 2018, p. 186). Beyond these broad orientations, the proposed steps remain largely preliminary and do not include concrete policy measures. For example, in the concluding commentary, the Executive Committee of the Club of Rome calls for "the creation of a world forum where states, men, policy-makers, and scientists can discuss the dangers and hopes for the future global system" and coordinate "joint long-term planning" (Meadows et al., 1972, pp. 194, 196). The *abstractness of these proposals* aligns with the report's primary function as a warning: its main aim is to highlight a looming threat in order to spark debate and stimulate political action. Had detailed, ready-made solutions already been provided, the term predicament in the subtitle would have been less apt. The reception of the report reinforces this impression. As historian Elke Seefried (2011) has shown, LtG was cited across a wide political spectrum – from leftist groups to Christian conservatives – each drawing very different conclusions and policy proposals from it. The Conservation Society in Great Britain, for instance, invoked the report to support calls to limit consumption and advocated for "sharing and rationing of the scarcer nonrenewable resources" (Seefried, 2011, p. 21). Meanwhile, economists and politicians from both Social Democratic and Christian Democratic parties used LtG to critique the paradigm of quantitative economic growth, instead promoting a more qualitative, sustainable understanding of growth. What many of these proposals shared, however, was – as Seefried notes – a distinctly

[27] In fact, the authors of the study could have made different modeling decisions and treated the robustness of the projected dynamics of "overshoot and collapse" less rigidly. They might, for instance, have constructed more optimistic scenarios – ones that, while perhaps not highly probable, would nevertheless not have been impossible, even without assuming major technological breakthroughs. There was conceptual room for such alternatives. However – and this must remain speculative – these more optimistic scenarios might have weakened the report's communicative force by diluting its central warning message.

technocratic conception of planning, that is, an approach that treated societal problems as if they were technical ones and their solutions as if they were technical solutions requiring specialist knowledge and an elitist group to implement them.

Interestingly, the report can be read as *simultaneously addressing two audiences*. On the one hand, it appears to speak directly to policymakers, informing them about the nature of the problem and roughly outlining measures to be taken. On the other hand, it also addresses a broader public – presumably in an effort to foster public understanding and, in doing so, help legitimize potential political action.[28] Through two of its central performative aims – raising awareness of a looming problem through warning, and offering guidance on how that problem might be addressed by manipulating key parameters (such as population growth) – the report invokes the "future" in a double sense. A concise characterization of its performative dimension might therefore be: it is both technocratic and up-stirring at the same time.

THE EARTH FOR ALL REPORT: HOPEFUL AND ACTION-ORIENTED

Fifty years later, the EfA report follows the same basic logic as LtG, in that its scenario-based "futures" must also be understood as performative interventions in the present. Yet the nature of this performative effort differs considerably. A first striking feature is that EfA presents its scenarios far less as groundbreaking or revelatory. Regarding the problems it addresses, the report does not claim to offer *surprising* new insights. As it states, "We know the pain points" (Dixon-Declève et al., 2022, p. 1). Rather than introducing unknown risks, the report synthesizes a wide range of already public data and studies, serving primarily to frame an urgent problem that is assumed to be at least partly familiar to its audience. Even in terms of proposed measures – the "five turnarounds" – the authors acknowledge: "These five turnarounds are not particularly new […]. But what we have attempted through Earth4All is to connect them up in one dynamic system, to assess if *together* they can create sufficient economic momentum to push the global economy off the destructive course" (Dixon-Declève et al., 2022, p. 5–6, original emphasis).

The future scenarios presented in EfA are thus situated within a context of already well-known mechanisms and trends. By 2022, the challenges it addresses can no longer be assumed to be unfamiliar, nor does the report aim to create public awareness of a previously unrecognized problem. Epistemologically, its scenarios appear to serve three main functions: (a) to corroborate already known developments and proposed measures, (b) to provide greater detail regarding the magnitude of specific problems and the potential effectiveness of coordinated responses, and (c) to keep well-known issues on the public and political agenda by presenting them within a coherent, systemically

[28] Legitimizing potential political action is another pragmatic function of models we will only name here in passing. But one might even argue that it is this dimension of pragmatic rhetorics where the framing of the report as a report to policymakers can build some tension an create a sense of urgency, with readers being fully aware that its primary addressees are those in positions of authority.

integrated framework. This third function is crucial: although the turnarounds themselves are not radically new, the report adds value by bringing them "together" to assemble dispersed knowledge into a unified and actionable narrative, thereby reaffirming the urgency of sustained political commitment.[29]

In contrast to LtG, EfA adopts a distinctly more *hopeful tone*. This manifests in two key ways: first, the report places far greater emphasis on the possibility of a positive developmental trajectory; and second, it consistently conveys that such positive scenarios are not mere aspirations but are, in fact, *realistically achievable*. The future is thus not presented as a set of abstract alternatives but explicitly framed as a range of viable options. The authors describe the turnarounds as "as policy road maps" and "not an attempt to create some impossible-to-reach utopia" (Dixson-Declève et al., 2022, p. 5). This difference is underscored by the reports' respective subtitles. While LtG appeared under the subtitle *The Predicament of Mankind* – also the title of the project from which it emerged – EfA carries the more action-oriented and reassuring subtitle *A Survival Guide for Humanity*. What was the most prominently discussed and received scenario in LtG – the "standard run" leading to overshoot and collapse – finds its counterpart in EfA's "Giant Leap" scenario, the reports central scenario. Rather than highlighting inevitable catastrophe, it focuses on the measures required and the positive outcomes that could result. It is presented in the greatest detail and, as noted earlier, is accompanied by the life stories of four imagined girls, thereby creating a vivid, emotionally accessible vision of a desirable future.[30]

[29] One may hypothesize that this reduced informational novelty – combined with a more saturated public discourse on global ecological crises – helps explain why later reports by the Club of Rome, including EfA, have attracted significantly less public attention than the original LtG.

[30] The contrast becomes evident when the two scenarios are compared directly. With regard to the "Too Little, Too Late" scenario, the authors present the following visions for the year 2050: „Shu, Samiha, Ayotola, and Carla celebrate their thirtieth birthdays in 2050. Shu is now a hydrology engineer working on major projects to protect China's water supply, but floods are frequent in some areas and droughts in others. This threatens food security and the economic security of hundreds of millions of people. Mass migration in mid-century creates a housing, employment, and food crisis that escalates into a conflict. Carla is an office manager in a successful architecture business but decided to leave the extreme heat of southern California and moved north to Seattle. But she now feels the fires and heat are following her. Her brother has the same job and qualifications yet is paid much more than her. Because of her six-figure student loans and expensive rent, she lives paycheck to paycheck. In Bangladesh, Samiha has three children but lost her job in the clothes factory as the city of Dhaka is progressively being abandoned to the flash floods by the people with the means to move inland. Means or not, Samiha knows that she will also soon have no choice, and will have to try to escape the increasingly frequent floods and heatwaves. She often wonders where she will be in a year. Ayotola left school at fourteen and married the son of a family friend. They have four children, but can only afford to send the boy to school. Ayotola does some sewing at home to make money for fish, meat, or beans to go with their ugali. The women have no experience of living on a planet without climate extremes." (Dixson-Declève et al., 2022, pp. 40–41) The "Giant Leap" scenario, by contrast, adopts a markedly different vision, tone, and rhetoric: "Shu, Samiha, Ayotola, and Carla are now thirty years old. They have all finished university degrees and are at the early stages of their careers. They do not expect to have the same career throughout their lives. Instead, they see opportunities to have several careers in different sectors. They'll retrain when they need to or want to, supported by an active state. Every month they receive a universal basic dividend. This provides a level of economic security that allows them to take more risks. Thanks to a government relocation program and her universal basic dividend, Ayotola and her parents were able to move away from Lagos, threatened by the floods and rising waters. She works as an

Die Zeit again identifies this shift as part of a broader cultural development. According to a recent review, the more hopeful orientation in EfA reflects "a broader shift in the current zeitgeist, influenced by psychological findings that constant predictions of catastrophe tend to paralyze people" (Pinzler, 2022, our translation) – often discussed under the notion of apocalypse fatigue or climate fatigue (cf. for example Nordhaus & Shellenberger, 2009). Beyond these psychological considerations, this shift can also be traced to developments within futures studies beginning in the 1980s and 1990s. During this time, predictive techniques came to be understood not only as rational instruments for informing decisions but also as "aids to the imagination, as they seemed to allow for concrete representation of possible world futures, and they could be used therefore in subversive manner" (Andersson, 2018, p. 182). This hopeful orientation comprises not only a focus on positive possible outcomes but also an emphasis on their *realizability*. "Our goal with Earth for All is to show you that this [systemic transformation] is indeed fully possible" (Dixson-Declève et al., 2022, p. 1). We suggest that this emphasis on hope should be read as a response to an assumed sense of hopelessness – one that was not apparent in LtG. Unlike its predecessor, EfA repeatedly addresses what it assumes to be fears and doubts within its audience, as reflected in a passage framed by rhetorical questions: "Why are actions to prevent pandemics or climate disruptions so shockingly inadequate? Are economic systems driving industrial societies in a direction that's impossible to change?... Is societal collapse inevitable? Or can we find a way to value and invest in our collective future here on Earth?" (Dixson-Declève et al., 2022, p. 2).

As many observers note, contemporary attitudes toward climate change and other global social and environmental problems are marked by a pervasive sense of hopelessness. This pessimism does not stem from a lack of knowledge or awareness–an absence that LtG arguably took to be central[31]–nor from the belief that the challenges are technically insurmountable. Rather, it arises from the perception that meaningful systemic change is politically unattainable. What dominates is a form of fatigue and powerlessness. It is precisely this affective disposition that EfA seeks to address through its optimistic tone. The report must therefore be understood as speaking to an audience that is intellectually engaged and emotionally invested yet simultaneously prone to resignation or doubt regarding the possibility of meaningful change.

accountant, specializing in wellbeing indicators, and has decided to have one child. In Seattle, Carla has trained as an architect and designs passive homes for community housing, while her partner is a corruption analyst. Samiha is now a food engineer, developing saltwater-resistant grains to increase yields. In her free time, she tutors children at the community center. Shu has chosen not to have kids, expending her time on social networks, and busy with the marketing and managing of huge fleets of shared electric carpools. Floods and storms are a regular occurrence, but measures have been taken to mitigate their effects – green spaces and trees in strategic locations – and new urban and sewage infrastructure make the city livable." (Dixson-Declève et al., 2022, pp. 49–50) Comparable visions are outlined for the years 2080 and 2100, which highlight an even more pronounced contrast (cf. Dixson-Declève et al., 2022, pp. 45, 53).

[31] Additionally, early systems-dynamics models emerged in a period marked by comparatively optimistic views of global change, when future-oriented science was often imagined as a kind of "midwife" helping to deliver a better future (Andersson, 2018, p. 17).

Naturally linked to its more optimistic tone, the E4A report is also significantly more action-oriented than LtG, offering *specific steps for achieving the systemic turnarounds* it advocates. This marks a broader trend observable in later reports following LtG. While LtG primarily sought to spark public debate and deliberately refrained from specifying concrete policy measures, EfA aims to present a clear roadmap for "rebooting" the global economic system – an ambition underscored by its subtitle, *A Survival Guide for Humanity*. In this context, the report's future scenarios are explicitly *constructed around policy options*, which function as independent variables in the modeling process. The scenarios serve not only to illustrate potential outcomes but also to test and validate actionable policy pathways. In this way, the logic of scenario construction shifts from raising awareness of problems to evaluating the feasibility of measures intended to address them. The report thus seeks to reduce the radical openness of the future by *outlining a realizable and desirable trajectory* for global development. This guiding dimension is closely tied to the report's hope-generating thrust. The proposed measures are not merely presented as necessary steps; in presenting them, the report also communicates that these steps are indeed achievable. Hope is produced not simply by depicting positive outcomes but by demonstrating their *practical attainability*.

At this point, it is useful to examine more closely how EfA constructs agency regarding the future. Within its scenario descriptions, the report frequently presupposes the existence of a collective agent capable of taking action. This agent is most often identified with governments, but at times more ambiguously with "nations," or with an abstract "we" presumed to be responsible for implementing the proposed measures.[32] In depicting its scenarios, the report often frames the realization of policy options as a matter of decision or will. One passage makes this especially explicit: "Now we understand that governments can adjust the stocks and flows on the gameboard – *if they want to* activate the five extraordinary turnarounds we describe in this book" (Dixson-Declève et al., 2022, p. 2, our emphasis). Such metaphors – "gameboard," "lever" – imply that the levers of change merely need to be pulled, rendering agency as something readily available.

This construction of agency follows the internal logic of the modeling framework, in which policy interventions are treated as independent variables that can be adjusted at will. From the modeler's perspective, such variables are easily manipulated, which can obscure the real-world difficulties of implementing them. It is therefore not surprising that the report rhetorically assumes a collective agent that is already capable of acting – especially within the context of its scenario-building. In this sense, despite its affective

[32] The final chapter – "A Call to Action" – identifies four forces that may help trigger social tipping points conducive to the proposed transformation: social movements, a new economic logic, technological developments, and political action. Two passages from this chapter vividly illustrate how EfA engages with its readers' potential sense of powerlessness and seeks to cultivate hope: "If you feel the scale of the transformation is daunting, join the club. Perhaps you feel it is like pushing a boulder up a hill. Well, here we have some good news. You will have to push a boulder, for sure, but what if you have to push the boulder downhill instead of uphill? What if we just need to get the damn thing moving and the force of gravity will help us after that?" "Given these social tipping points, the boulder we need to push may only require a large shove to really get it moving, with its own unstoppable momentum. And when we push the boulder, we may have a lot of hands pushing with us." (Dixson-Declève et al., 2022, pp. 167, 169)

orientation toward hope and engagement, the report also exhibits a technocratic outlook. At the same time, this technocratic assumption of agency is complicated when the report moves beyond scenario presentation to reflect on the structural and political conditions that hinder implementation. Here, the authors explicitly acknowledge that they do not wish to adopt a tone of naïve optimism. They identify significant "barriers" to the realization of the proposed turnarounds and openly address the question of why the metaphorical "lever" is not being pulled.[33] In these passages, the report adopts a markedly different tone, acknowledging the "daunting challenges" of overcoming what it describes as a collective action problem in "turning around our economy" (Dixson-Declève et al., 2022, p. 29).

This problem dimension – absent in LtG in this explicit form – is continually reflected upon throughout EfA. It culminates in an explicit call for action, in which the authors urge the broader public to help generate political pressure. Among the measures proposed are joining social movements, voting for supportive political parties, and demanding citizens' assemblies dedicated to economic system transformation (Dixson-Declève et al., 2022, pp. 167–170). In this respect, EfA is considerably more activist in its intended mode of intervention. Like its hopeful tone, this activist thrust is shaped by an awareness of political inertia and societal fatigue. The report seeks to counter these forces by *fostering public hope and mobilizing civic engagement as a form of political leverage*. For this reason, EfA frequently oscillates between contrasting tones – hopeful and cautionary – within its discussion of future challenges, a dynamic not found in LtG in the same way. This contrast, however, should not be understood as a contradiction. Rather, it reflects the report's effort to operate on two distinct levels: on the one hand, to describe positive and realizable future scenarios, and on the other, to acknowledge the structural and political barriers that make their realization difficult.

CONCLUSIONS

Modeling is a human practice carried out with specific practical aims in mind. Models are built to have an effect – they are intended to intervene in the world – and these intended effects shape not only the modeling decisions themselves but also the ways in which model results are presented and communicated. Questions such as which scenarios receive emphasis, what is omitted, and how results are framed are closely tied to a model's pragmatic function. As Armin Grunwald has argued, models may carry an "unrecognized semantic overflow, a 'meaning in disguise' to be undisclosed" (Grunwald, 2023, pp. 184–185). In this paper, we have sought to highlight one aspect of this potentially hidden meaning beyond the mere informational content of models: their performative modes –

[33] For several of the turnarounds, the report also discusses barriers to the proposed solutions. This is the case for the poverty turnaround (Dixson-Declève et al., 2022, pp. 69–71), the equality levers (ibid.: 90–91), the transformation of the food system to benefit both people and the planet and the energy turnaround (Dixson-Declève et al., 2022, pp. 121–123, 137–144).

that is, the ways in which they are designed or communicated as performative interventions. Models can operate through a variety of performative modes: they may raise awareness, issue warnings, generate hope, or guide action. This list is by no means exhaustive, and further modes could certainly be identified.

The two Club of Rome reports we examined – *Limits to Growth* and *Earth for All* – served as case studies for exploring these performative dimensions. These particular cases are especially suitable for such analysis because their models are embedded within extensive accompanying texts that explicitly articulate the underlying performative intentions and explain how the modeling results contribute to the messages conveyed in the reports. In other contexts, where such textual framing is absent, interpretive efforts must be more speculative and rely more heavily on reconstructing the model construction process itself. This applies not only to future-oriented models but also more broadly to scientific discourses on future developments. One may assume, for example, that performative intent plays a role in organizing and framing scientific reports such as those by the IPCC, although it certainly is much less prominent. Attending to the performative orientation of these reports also brought into focus the assumptions they make about their audiences. What emotional or affective dispositions do the modelers presuppose? How do they seek to influence, motivate, or mobilize their readers? Describing such models merely as "informative" tools masks these nuances and fails to capture the full range of their pragmatic and rhetorical functions.

Certainly, this also raises questions of modeling ethics that relate more generally to how scientists should frame future scenarios. Should scientific authorities aim for a maximally sober and neutral dissemination of mere information to remain neutral? Or do they have an obligation to engage the public more performatively, for example by explicitly issuing warnings? These are questions that have long been asked in the realm of science communication.[34] There are no straightforward answers to them. What the hermeneutical analysis of the two reports has shown, however, is that the distinction between description and projection, or analysis and narration is often difficult to sustain in practice. Precisely in contexts where models are mobilized to render uncertain futures intelligible and actionable, epistemic claims and rhetorical strategies become closely intertwined, making the boundary between neutral information and performative intervention inherently unstable.

REFERENCES

Andersson, J. (2018). *The Future of the World: Futurology, Futurists, and the Struggle for the Post–Cold War Imagination*. Oxford University Press.

Arendt, H. (1951). *The Origins of Totalitarianism*. Harcourt Brace.

Arendt, H. (1958). *The Human Condition*. University of Chicago Press.

Bardi, U. (2011). *The Limits to Growth Revisited*. Springer. https://doi.org/10.1007/978-1-4419-9416-5

[34]See, for instance, Pielke (2007) for an important point of reference.

Brenneis, A., Nguyen Duc, V. A., & Wiengarn, J. (2025). Unraveling the Call of the Future – Review of Armin Grunwald, Alfred Nordmann, and Martin Sand: Hermeneutics, History, and Technology: The Call of the Future. *Jahrbuch Technikphilosophie*, (pp. 231–244). Nomos. https://doi.org/10.5771/9783748944935-231

Cassen, C., & Cointe, B. (2022). From The Limits to Growth to greenhouse gas emissions pathways: Technological change in global computer models (1972–2007). *Contemporary European History*, *31*(4), 552–569. https://doi.org/10.1017/S096077732200042X

Club of Rome (2025). https://www.clubofrome.org/

Collste, D., & Randers, J. (2022). The Earth4All model of human wellbeing on a finite planet towards 2100 (Technical note). https://www.clubofrome.org/wp-content/uploads/2022/09/220916_E4A_technical-note.pdf

Crescenzi, P., Gambosi, G., Nasti, L., Rossi, A. & Natale, E. (2024). A Sensitivity Analysis of the Earth for all Model: Getting the Giant Leap Scenario with Fewer Policies. *Journal of Industrial Ecology 28*, 1481–1492. https://doi.org/10.1111/jiec.13582

Der Spiegel (1972). https://www.spiegel.de/kultur/weltuntergangs-vision-aus-dem-computer-a-c4ca78e4-0002-0001-0000-000042944961

Deutsch, K. W., Fritsch, B., Jaguaribe, H., & Markovits, A. S. (1977). *Problems of World Modeling: Political and Social Implications*. Ballinger Publishing Company.

Dixson-Declève, S., Gaffney, O., Ghosh, J., Randers, J., Rockström, J., & Stoknes, P. E. (2022). *Earth for all: A Survival Guide for Humanity. A Report to the Club of Rome*. New Society Publishers.

Earth4All (2025). https://earth4all.life/the-science/

Edenhofer, O., & Kowarsch, M. (2015). Cartography of Pathways: A New Model for Environmental Policy Assessments. *Environmental Science & Policy, 51*, 56–64. https://doi.org/10.1016/j.envsci.2015.03.017

Elliott, K., & McKaughan, D. (2014). Nonepistemic Values and the Multiple Goals of Science. *Philosophy of Science, 81*(1), 1–21. https://doi.org/10.1086/674345

Feder, C., Callegari, B. & Collste, D. (2024). The System Dynamics Approach for a Global Evolutionary Analysis of Sustainable Development. *Journal of Evolutionary Economics, 34*, 351–374. https://doi.org/10.1007/s00191-024-00866-6

Gidley, J. M., (2017). *The Future: A Very Short Introduction.* Oxford Academics. https://doi.org/10.1093/actrade/9780198735281.001.0001

Gidley, Jennifer M., (2021). Futures Studies: An Evolving Radical Epistemology. In: S. Kemp, & J. Andersson (eds.), *Futures* (pp. 135–147). Oxford Academic. https://doi.org/10.1093/oxfordhb/9780198806820.013.8

Grunwald, A. (2010): *Technikfolgenabschätzung – eine Einführung*. Edition sigma.

Grunwald, A. (2015). Die hermeneutische Erweiterung der Technikfolgenabschätzung. In: *TATuP. Journal for Technology Assessment in Theory and Practice, 24*(2), 65–69. DOI: https://doi.org/10.14512/tatup.24.2.65

Grunwald, A., Nordmann, A. & Sand, M. (2023). Preface. In A. Grunwald, A. Nordmann & M. Sand (Eds.), *Hermeneutics, History, and Technology: The Call of the Future* (pp. x–xii). Routledge.

Grunwald, A. (2023). The Hermeneutic Perspective on Modeling in Technology Assessment. In A. Grunwald, A. Nordmann & M. Sand (Eds.), *Hermeneutics, History, and Technology: The Call of the Future* (pp. 172–192). Routledge.

Grunwald, A. & Nordmann, A. (2023). Hermeneutic Technology Assessment: Why it is Needed and what it Might be. In A. Grunwald, A. Nordmann, & M. Sand (Eds.), *Hermeneutics, History, and Technology: The Call of the Future* (pp. 37–41). Routledge.

Grunwald, A. & Mehnert, W. (2024). Hermeneutic Technology Assessment. In: A. Grunwald (Ed.), *Handbook of Technology Assessment* (pp. 281–290). Edward Elgar Publishing Limited.

Hahn, F. (2006). Von Unsinn bis Untergang: Rezeption des Club of Rome und der Grenzen des Wachstums in der Bundesrepublik der frühen 1970er Jahre [From Nonsense to Downfall: Reception of the Club of Rome and the Limits to Growth in the Federal Republic of Germany in the early 1970s]. Freiburg. http://www.freidok.uni-freiburg.de/volltexte/2722/

Hall, C. A. S., & Day, J. W. (2009). Revisiting The Limits to Growth after Peak Oil. *American Scientist*, *97*(3), 230–237. https://doi.org/10.1511/2009.78.230

Janich, P. (2002). Modelle und Modelliertes. In C.F. Gethmann & S. Linger (Eds.), *Integrative Modellierung zum Globalen Wandel* (pp. 48–70). Springer. https://doi.org/10.1007/978-3-642-55979-2_2

Johnson, A., & Lenhard, J. (2024). *Cultures of Prediction: How Engineering and Science Evolve with Mathematical Tools*. MIT Press.

Kahn, H. (1962). *Thinking about the Unthinkable*. Horizon Press.

Kaminski, A., Gramelsberger, G. & Scheer, D. (2023). Modeling for Policy and Technology Assessment: Challenges from Computerbased Simulations and Artificial Intelligence. *TATuP Journal for Technology Assessment in Theory and Practice, 32*(1), 11–17. https://doi.org/10.14512/tatup.32.1.11

Lausberg, H. (1998). *Handbook of Literary Rhetoric. A Foundation for Literary Study*. Brill.

Liu, A. W.-K. (2023). On the Road to Hermeneutic technology assessment – A historic-systematic reconstruction. In A. Grunwald, A. Nordmann & M. Sand (Eds.), *Hermeneutics, History, and Technology: The Call of the Future* (pp. 3–36). Routledge.

Malthus, T. R. (1798). *An Essay on the Principle of Population*. J. Johnson.

Meadows, D. H. (2012). *Thinking in Systems: A Primer*. Chelsea Green Publishing.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. III. (1972). *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. Universe Books.

Ortmann, J. (2025). Performative Paternalism. *European Journal for Philosophy of Science, 15*(25), 1–29.

Parker, W. (2020). Model Evaluation: An Adequacy-for-purpose View. *Philosophy of Science, 87*, 457–477. https://doi.org/10.1086/708691

Pielke, R. (2007). *The Honest Broker: Making Sense of Science in Policy and Politics*. Cambridge University Press

McCray, P. (2013). *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future*. Princeton University Press.

Nordhaus, T. & Shellenberger, M. (2009, November 17). Apocalypse fatigue: Losing the public on climate change. *Guardian*. https://www.theguardian.com/environment/2009/nov/17/apocalypse-public-climate-change

Pinzler, P. (2022, August 31). Soziale Probleme lösen – und Naturschutz ist die Folge [Solving Social Problems – and Nature Conservation is the Result]. *Die Zeit*. https://www.zeit.de/politik/deutschland/2022-08/krise-klima-club-of-rome-wachstum-kritik-armut

Randers, J. (2012). *2052: A Global Forecast for the Next Forty Years*. Chelsea Green Publishing.

Reagan, R. (1985). Second Inaugural Address. https://www.ens.psl.eu/sites/default/files/bl_sujets_oraux_anglais_10062024.pdf

Oltmans W. (1974). *On Growth*. Capricorn Books.

Scheer, D. (2017). Between Knowledge and Action: Conceptualizing Scientific Simulation and Policy-Making. In Resch, M., Kaminski, A. & Gehring, P. (Eds), *The Science and Art of Simulation I: Exploring – Understanding – Knowing* (pp. 103–118). Springer. https://doi.org/10.1007/978-3-319-55762-5_8

Schmelzer, M. (2016). *The Hegemony of Growth: The OECD and the Making of the Economic Growth Paradigm*. Cambridge University Press.

Seefried, E. (2011). Towards the Limits to Growth? The Book and its Reception in West Germany and Britain 1972-73. *German Historical Institute London Bulletin, 33*(1), 3–37.

Stoknes, P. E., Collste, D., Cornell, S. E., Callegari, B., Spittler, N., Gaffney, O. & Randers, J. (2025). The Earth4All Scenarios: Human Wellbeing on a Finite Planet towards 2100. *Global Sustainability, 8*, e22. https://doi.org/10.1017/sus.2025.10013

Turner, G. M. (2008). A Comparison of The Limits to Growth with Thirty Years of Reality. *Global Environmental Change*, *18*(3), 397–411. DOI: https://doi.org/10.1016/j.gloenvcha.2008.05.001

Vieille Blanchard, E. (2010), Modelling the Future: an Overview of the 'Limits to Growth' Debate. *Centaurus*, *52*, 91-116. https://doi.org/10.1111/j.1600-0498.2010.00173.x

Vieille Blanchard, E. (2015). Technocornucopian futures versus doomsday futures: World models and The Limits to Growth. In J. Andersson & E. Rindzeviciute (Eds.), *The struggle for the long term* (pp. 92–115). Routledge.

von Randow, T. (1972). So geht die Welt zugrunde. In: *DIE ZEIT* 11. https://www.zeit.de/1972/11/so-geht-die-welt-zugrunde [19.12.2025]

Wack, P. (1985). Scenarios: Uncharted Waters Ahead. *Harvard Business Review, 63*(5), 73–89.

Wartofsky, Marx (1979). Models*: Representation and the Scientific Understanding*. D Reidel Publishing Company.
Weart, S. R. (2008). *The Discovery of Global Warming*. Harvard University Press
von Weizsäcker, E. U. & Wijkman, A. (2018). *Come on! Capitalism, Short-termism, Population and the Destruction of the Planet*. Springer.
Winsberg, E., & Harvard, S. (2024). *Scientific Models and Decision Making*. Cambridge University Press.

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Tacit Knowledge and Secrecy in the Patent Office

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Abstract
The patent system can be seen as an institutional mechanism designed to align the interests of inventors and the State regarding inventions and innovation. Individual inventors seek to protect their technological rights to maximise profits and establish monopoly power, while society aims to promote the sharing of this knowledge to prevent it from remaining an industrial secret. Accessible information not only reduces efforts' duplication but also encourages further innovation. Therefore, patents are intended to serve as a bridging tool between industrial secrecy and the socially beneficial sharing of knowledge that drives scientific and technological progress. However, the issue is more complex, as much of the knowledge contained in patent documents incorporates implicit features. Often, critical types of information necessary for the commercialisation or industrial application of patented inventions cannot be effectively conveyed through the structure of a patent document, nor can they be easily articulated as clear propositions or narratives. This challenge is compounded by the fact that inventions are not directly replicated or tested at patent offices; their evaluation relies solely on submitted documentation and, at best, drawings. As a result, it can be argued that some level of secrecy is an inherent aspect of the patent system. The degree of this secrecy can vary depending on the technological nature of innovations across different sectors and over time. We argue that there is an urgent need for more efficient patent evaluation systems that can better address these informational challenges.

Keywords: Information; Knowledge; Patent documents; Patent offices; Examiners; Trade secrecy

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Научная статья

Неявное знание и конфиденциальность в патентном ведомстве

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Аннотация
Патентную систему можно рассматривать как институциональный механизм, предназначенный для согласования интересов изобретателей и государства в области изобретений и инноваций. Индивидуальные изобретатели стремятся защитить свои технологические права для максимизации прибыли и установления монопольной власти, в то время как общество заинтересовано в содействии распространению этого знания, чтобы предотвратить его сохранение в качестве промышленного секрета. Доступность информации не только снижает дублирование усилий, но и стимулирует дальнейшие инновации. Таким образом, патенты призваны служить связующим инструментом между промышленной тайной и социально полезным обменом знаниями, который движет научно-техническим прогрессом. Однако проблема является более сложной, так как значительная часть знаний, содержащихся в патентных документах, включает неявные (имплицитные) характеристики. Зачастую критически важные типы информации, необходимые для коммерциализации или промышленного применения запатентованных изобретений, не могут быть эффективно переданы посредством структуры патентного документа, равно как и с легкостью сформулированы в виде четких положений или описаний. Эта проблема усугубляется тем фактом, что изобретения не воспроизводятся и не тестируются непосредственно в патентных ведомствах; их оценка основывается исключительно на представленной документации и, в лучшем случае, чертежах. В результате можно утверждать, что определенный уровень конфиденциальности является неотъемлемым аспектом патентной системы. Степень этой конфиденциальности может варьироваться в зависимости от технологической природы инноваций в различных секторах и с течением времени. Мы утверждаем, что существует настоятельная необходимость в более эффективных системах патентной экспертизы, способных лучше решать эти информационные проблемы.

Ключевые слова: Информация; Знание; Патентные документы; Патентные ведомства; Эксперты; Режим коммерческой тайны

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INTRODUCTION

Economists, historians, and social scientists have demonstrated that, although the core principles behind patent systems remain somewhat idealised – such as fostering technological innovation and encouraging the disclosure of technologies – they differ in their practical application, in how they are codified by different societies, and in how each patent system develops over time. This variation is rooted in several fundamental tensions among various stakeholders, as discussed in studies by Heller and Eisenberg (1998), Boldrin and Levine (2008), and Galasso and Schankerman (2015). How these tensions are resolved will greatly influence the future direction of each patent system.

The main debate among these concerns the justification and beneficiaries of the exclusivity of the protected invention, rather than the technological and commercial information within the documents, that is, the question of whether or not it is appropriate to disclose the inventions. The most central issue lies in viewing the patent as a right to commercial exploitation, rather than simply as a document (Ashtor, 2022; Figueroa and Lemus, 2023; Freilich, 2017). What we want to emphasize is the existence of informational tensions that could be a source of conflict. This would simply arise in this dichotomy between the drafting of patents in the form of documents and their commercial exploitation.

Informational tensions are an increasingly established subject of study, and more is known about them. From the perspective of the holder, the rationale for patents typically involves seeking profit and gaining a competitive advantage, but if necessary, this profit seeking is achieved and maximised through secrecy. This is because the commercial and technological information contained in the patent "can make a competitor's second-generation invention and patent more powerful" (Sáiz and Amengual, 2018, p. 975), so, as the saying goes, the closer the patent is to a trade secret, the better for the patentee. This seems to be one of the most preferred positions for patent holders (as shown in detail by Scotchmer and Green 1990)[1]: having an ideal situation where the patent offers both the benefits of trade secrecy and patent exclusivity.

The aim of this paper is to evaluate the debate surrounding some of these informational tensions, particularly disclosure and secrecy. We will do this by reviewing relevant literature, reconsidering some concepts commonly used in the discussion, and proposing what we call the "paradox of novelty," which is crucial for understanding these informational tensions. Our main argument is that many information problems – such as lack of visibility in that information – actually occur at the patent office.

The rest of the paper is organised as follows: the following section highlights the epistemic gaps that often exist between the information presented in patent applications and the actual knowledge required for commercial purposes found in the final patent documents. The third section examines the role of patent office examiners and their

[1] However, this does not imply that there is no response from the State; in fact, there is a move to "raise" trade secret (see Denicoló and Franzoni, 2003), meaning to make it "patent" or clear.

expertise in bridging these epistemic gaps to achieve the social objectives of the patent system. In the fourth section, we analyse how patent trolls can undermine the social goals of the patent system. Finally, in the last section, we present concluding remarks and propose potential avenues for further research on this topic.

INFORMATION AND KNOWLEDGE

Some scholars have examined these tensions by analysing patent documents as a linguistic object (Myers, 1995). They appear to confirm that many applicants attempt to combine at least two major strategies (coinciding with the situation described above) in their choice of language (cf. Arinas, 2012):

covering as much intellectual property as possible without impacting the ownership of other inventions.

and providing the minimum information about the invention that the patent office "tolerates", trusting that once granted, there will be no complaints from other inventors.

These two strategies are, as we have mentioned, undoubtedly motivated by business and economic incentives. However, there are also epistemic and informational limits.

It is observed that some individuals fail to assert sufficient ownership due to ignorance or fear, while others claim too much ownership driven by ambition or ignorance. Vague language can partly help address these issues, a point also recognised by some scholars studying patent language (Myers, 1996, p. 6).

This inquiry demonstrates how issues with access to information and lack of visibility of that information occur at the patent office, rather than as the result of strategic or malicious actions by inventors or lawyers. In this context, we consider the shift from the linguistic challenge of patent documents to the informational problem that arises from aggregating millions of these documents, supporting José Bellido's idea that "it is important to question not only how patents became documents, but also how they became information" (Bellido, 2023, p. 429).

We make this argument without precluding the fact that entrepreneurs, inventors, and lawyers often attempt, before reaching the office and the examiner, to draft their applications in a vague, imprecise, or opaque manner (whether deliberately or due to epistemic constraints).[2] Bronwyn Hall and Dietmar Harhoff have noted something interesting in this area: the "benefits of [patent disclosure] may be limited by careful drafting of the patent", as they highlight, but also because "essential (tacit) know-how"

[2] But not only inventors and their lawyers. Patent offices and state bureaucrats have once again collaborated in transferring a certain opacity from these motley patent documents to their statistical and computerized visualization throughout the patent system, sometimes emphasizing sheer quantity over the true service of these patents to further innovation and the progress of science. As Eva Hemmungs Wirtén (2023) explains regarding the celebrations in 1961 for the granting of 3 million patents by the United States Patent and Trademark Office (USPTO), "to control the narrative of a situation where patents are increasingly distanced from a public which is allegedly the recipient of the enabling information these documents are supposed to contain, he (David L. Ladd, 38th Commissioner of Patents of the U.S.) needs to remember, reframe, and retell the history of the system by reducing it to numbers, periods, symbols and statistics" (p. 234).

(Hall & Harhoff, 2012, p. 4) often does not appear. The advantage of disclosure faces another tension, which is not only economic or strategic in nature but also epistemic and informational. From an epistemic perspective, secrecy or lack of information is closely linked to types of knowledge that, while vital for commercialising or industrially applying patented inventions, cannot be effectively expressed in a patent document, nor even as propositions or narratives. This kind of knowledge is referred to in philosophical literature as "tacit knowledge" (Polanyi, 1958). It can be transmitted through example, experience, or practical application of the process or product, usually representing the aspect reserved for economic negotiation and technological transfer.

Consider the case of pharmaceutical formulations. A patent for a biologic drug, such as a monoclonal antibody, might specify the amino acid sequence and potentially claim binding to specific protein residues. However, the patent cannot fully convey the tacit manufacturing knowledge essential for production or distribution: the precise cell culture conditions, the required purification techniques, the methods for preventing aggregation, or the critical ratios between stabilising excipients that prevent particle formation. A competitor reading the patent could understand what was invented but might take years to learn how to manufacture it reliably – knowledge that remains partly tacit despite the disclosure. The competitor would spend years researching those limits, aspects not directly relevant to the patent protection (which essentially seeks novelty) but ultimately vital to the manufacturing process.

The pharmaceutical industry exemplifies these epistemic constraints particularly well. We will explore this further in the upcoming sections, especially when we introduce the "novelty paradox."

What can be confidently stated for the moment is that, considering these reasons, it is impossible to understand secrecy without taking into account the epistemic constraints and, above all, the economic interests of entrepreneurs, inventors, and innovators. Here, it would be appropriate to clarify and emphasise another final distinction, which relates to patents and property in general. As Joseph Gortych notes:

Unlike real property such as real estate, which is tangible and can be surveyed complete with stakes in the ground, intellectual property is intangible. Trying to define the metes and bounds of intangible property is very difficult using words alone. As the American commonsense philosopher Josh Billing (2014) once said, 'There's a great power in words, if you don't hitch too many of them together'" (p. 93; italics ours).

Generally, we believe that the patent system, as a historical and institutional framework, fundamentally addresses these tensions. This is why every invention granted a patent should, at least in principle, have a certain degree of novelty, and all patented inventions are required to disclose a minimum level of technological and commercial information.

SECRECY AND THE ROLE OF EXAMINERS

Secrecy has another significant aspect that must be addressed, particularly regarding the role and responsibilities of examiners within the patent system. The element of secrecy in the work of examiners shows that many processes at the Patent Office occur behind closed doors (see Acosta, 2023). In this context, we will focus on secrecy as a feature of the examiner's role and how it influences what examiners are able and willing to disclose.

Some scholars, such as Dev Gangjee, have examined how courts and administrative bodies define the boundaries of trademark ownership, concentrating on how they make the interaction between manufacturers and consumers more tangible (Howe and Griffiths, 2013). The analysis of patents and examiners, however, has its own unique features, distinct from those of trademarks or copyright, because its core focuses on the intention to show (or, in the case of the examiner, to uncover) the novelty of an invention, device, or technology. Nonetheless, the drafting aimed at demonstrating this novelty, as is well known, is filled with secrets.

Following the example of pharmaceutical formulations, we understand that while chemical structures can be described precisely, the exact conditions required to obtain specific polymorphic forms often depend on tacit procedural knowledge. For example, the patent disputes over paroxetine methanesulfonate involved crystalline forms where the 'know-how' of crystallisation – temperature ramping rates, seeding protocols, solvent ratios – was as valuable as the disclosed structure itself (Dunitz and Bernstein, 1995).

Similarly, in biotechnology, patent documents for CRISPR gene-editing systems can describe guide RNA sequences and target sites, yet the optimisation of delivery methods, off-target effect minimisation, and cell-specific protocols remain largely tacit, learned through extensive laboratory practice (Liu et al., 2017).

The gap between what patents disclose and what practitioners need to know is particularly acute in these fields. And we could provide far more examples of tacit knowledge as well as concealment on the part of patent applicants and inventors. However, examples of secrecy and tacit knowledge would not even end here, since we must also examine the examiner's countervailing interests and the epistemic and informational limitations inherent to this other side of the patent bargain, the one of the patent office and the State.

However, we believe that the work undertaken by the examiners in their offices and the methods they employ to perform this detection with sufficient expertise are just as, if not more, concealed in secrecy. This is achieved without overly relying on the applicant's euphemisms (or, conversely, on their lack of claims).

And this secrecy is not necessarily a deliberate concealment by the examiner, but rather a characteristic of an activity like theirs, which is not transparent, not open to the public, and, in some cases, not even accessible to researchers. The mediation between this activity and the secrecy inherent in the applications themselves creates a paradox, a

fascinating challenge for their work. Here we call it the "paradox of novelty." This paradox involves the following contradictory situation regarding the detection of novelty: if, on the one hand, examiners accurately understand an invention they are evaluating, then there is a likelihood that it is already part of the state of the art, and therefore not novel. But, if, on the other hand, examiners cannot understand all the details or mechanisms of the invention, the likelihood that it is original is higher, but their ability to discern the veracity or the industrial application is obviously reduced.

These challenges may be compounded by the fact that such inventions are not physically replicated or reproduced at the patent office, but are simply assessed from documents and, at best, from drawings. As Hyo Yoon Kang (2015) rightly points out, "patent law evaluates the inventiveness of the object of property right, without necessarily engaging in exercises of scientific verification" (p. 31). Moreover, this situation appears especially notable in certain fields, such as chemistry or pharmacy, due to the highly intangible nature of the invention (as suggested by Gupta et al., 2010).

Having explained this, a possible, perhaps the most pessimistic, consequence is to see patent examiners as fundamentally unable to recognise the novelty of inventions and, therefore, to understand many – if not all – aspects of the analysed artefacts or technologies. Their role would be entirely administrative or bureaucratic, rather than technical.

Like any good paradox, the difficult question of how they accurately detect novelty, and by extension, the nature of the work carried out by examiners, cannot be completely solved. However, we believe that if patent examiners did not require knowledge at all (perhaps only knowledge of the administrative procedures, but not of the technical content), then patent systems and the innovation they protect would be entirely flawed. The existence of patents would be a miracle. We would not be able to explain how, although broadly imperfect, patent systems remain attractive to many inventors, buyers, companies, and others.

Also, if that were the case, then the specialisation of examiners would not matter, and it would be the same for an examiner to assess a chemistry invention or a mechanical engineering invention... And, although this has been the case in the past, we know it is not currently happening anywhere. There is, in fact, a growing trend towards specialisation within Offices (see Whalen, 2018).

This is why we should recognise an epistemic component in the expertise of examiners. However, if we look closely, this "novelty paradox" also assumes the ability to read patent documents, to detect which parts claimed as novel are actually innovative and which are vague or overly broad.

We find it very challenging to articulate the process of acquiring this skill, but we can rely on what the historian Kara Swanson (2020) once said: "The best source of expertise for patent examiners is not formal credentials, but practical, mechanical experience" (p. 31; italics ours). Among other things, this also involves resting on professional conventions. For example, their guidelines usually operate alongside even

less explicit conventions, such as internal communications or inter-office approval meetings. Many of these semi-codified methods of evaluating problems, combined with their prior credentials and experience (many as scientists), enable them to screen, analyse, and assess technologies independently, and potentially circulate the resulting knowledge. However, that knowledge is always, like all human-generated knowledge, influenced by their experience and competence, their particular ways of seeing and knowing, and it is not an entirely objective or neutral representation: they are subject to biases, lack of objectivity, moral concerns, or prejudices of all kinds.

In conclusion, regarding the concept of the social contract of patents, the balance rests on a deceptively simple premise: that linguistic disclosure benefits the public. Inventors describe their innovations, society gains access to this knowledge, and future practitioners build upon it. However, this mediation between language and technological practice is profoundly imperfect and unequal. Patents, in a sense, require a linguistic compromise: they must be precise enough to define property rights, yet broad enough to safeguard commercial value. This, in turn, creates systematic gaps between what is disclosed and what must be practised.

To address one final aspect concerning the informational nature of the patent, particularly the novelty requirement, we will continue linking it to secrecy through the notion of the "junk patent".

JUNK PATENTS AND SOCIAL COSTS

In addition to the epistemic difficulties underpinning the novelty paradox, some scholars have observed that many of the various problems discussed earlier stem from different inefficiencies. One consequence of patent offices granting patents that do not meet the requirements for patentability, or that simply fail to provide a clear description of the invention, is the emergence of "junk patents".[3]

Although many of these shortcomings may occur during the patent examination process, they often involve counterparts in the private sector. A significant portion of applicants for "junk patents" are not ordinary inventors, who may submit inventions of poor quality or suffer from the inefficiency of the office in handling their legitimate claims. There has been an aggressive intrusion into the patent system by agents known as "patent trolls", who are applicants for some of these junk patents. Essentially, patent trolls aim to flood the system with junk patents, which do not necessarily address any specific

[3] It would be useful to cite two of these patents. The first is that of the stick patent. In 2002 the USPTO granted a patent to an "apparatus for use as a toy by an animal, for example a dog, to either fetch carry or chew, includes a main section with at least one protrusion extending therefrom that resembles a branch in appearance. The toy is formed of any of several materials such as rubber, plastic or wood, including wood composites, and is solid" (Ross, 2002). The second example is even more surprising. The Spanish Patent and Trademark Office granted in 1999 (under the protection of a repealed law, prior to substantive examination) a patent to a "procedure for obtaining *paella*" (Sánchez Navarro, 1999). Fortunately, after the fulfilment of the 20 years of validity of the patent in 2019 we can enjoy this tasty dish without fear of being criminally charged.

technical problem, in order to hinder progress in research by inundating it with prior art and threatening potential infringers with litigation.

Low-quality patents with questionable patentability advantage trolls because they create uncertainty about the scope of protection, making it more difficult for the company against which the patent is asserted to determine if they are genuinely infringing third-party rights (often, these types of patents even remain under unknown ownership).

In the U.S., for example, since patents enjoy a presumption of validity, companies targeted by trolls often face high costs defending against infringement lawsuits or initiating invalidation proceedings (Cohen, et al., 2019). Additionally, inventions are kept secret during the initial stage of the patent registration process, so companies implementing the relevant technology are sometimes not even aware that a troll is holding a patent.

Scholars agree the U.S. system is well suited to the aggressive strategies of patent trolls and the subsequent issuance of junk patents (Mayergoyz, 2009). As a result, the differences between patent systems emerge once again. These features of the US include higher defence costs, which may persuade defendants to settle for a substantial amount, higher damages awards, and the presence of appeals that can threaten to shut down the production of entire product lines across the country (Bessen et al., 2011). Therefore, if an appeal is successful, a previously lucrative product can quickly lose its value, and the manufacturer's revenue stream can cease almost immediately.

Additionally, when litigating against trolls, especially in the U.S., it has been shown that the litigation burdens fall more heavily on the producer than on the non-practising entity (Boscheck, 2016), because the producer typically must disclose more documents and information, particularly regarding the manufacturing and marketing process, resulting in higher discovery costs, whereas a non-practising plaintiff has less information to disclose. Furthermore, in the U.S. as well, trolls have low operating costs and do not need to anticipate legal fees to file a lawsuit, as U.S. law allows for "contingency" fee agreements, meaning that lawyers are only paid if they win the case (La Belle, 2015). Producers, on the other hand, cannot benefit from contingency fees and must use their own resources to defend themselves, redirecting funds that would have gone to production to these costly legal proceedings.

These so-called "patent trolls" are ready to exploit various weaknesses in the system, including certain dysfunctions in the patent system's dynamics, operating even beyond the weakened formal and legal boundaries, thereby enabling opportunistic behaviour.

Fortunately, in Europe the situation differs. Some argue that the "loser pays" rule in European jurisdictions helps discourage frivolous lawsuits and, in general, litigation in Europe is more complex. Patent holders must sue potential infringers in several European countries to seek damages, which are comparatively lower, and any resulting injunction is limited to the designated states.

Bonadio and Contardi (2021) conclude that, rather than encouraging innovation, patent trolls create uncertainty in the invention and innovation process by taking legal action against those trying to produce goods and technology.

It is therefore not surprising that this may pose a theoretical challenge for an inquiry into the role and values of patent examiners and offices. However, we can see that it seems to involve an empirical and political challenge, and a philosophical thesis about the role of patent offices, patent examiners, and about epistemic and moral values within the framework of the social contract does not claim, and cannot claim, to solve it.

Moreover, as we have already noted, this issue is especially common in the U.S (particularly in sectors that are not even patentable in Europe, such as software).

A final study worth mentioning is that of Lisa Oullette (2012), who has produced one of the most extensive works on the effects and impacts of disclosure made by patents. Her research highlights several key points. First, she conducts a literature review on the subject and concludes that there are differences between the two "utilitarian" arguments. One argues that patents provide incentives that, among other things, prevent competitors from appropriating innovations and reward inventors. We can recognise this argument as part of the reward theory, following Machlup and Penrose (1950). The other argument, which is properly that of the social contract or quid pro quo, suggests that patents provide sufficient incentive for "disclosure" to occur (Oullette, 2012, p. 540). Secondly, she examines what arguments serve as criticisms of each position. The author focuses on those affecting the first, as it is the more controversial of the two. At one point, she also considers the second defence, that of the contract, and notes that it can be undermined by the low value of information contained in patent documents. Here, she analyses and develops empirical studies, focusing on surveys and interviews with scientists – particularly nanotechnologists – to determine how much value they attribute to other inventions and whether these serve as precedents for their work. Oullette's conclusion is revealing: "The nanotechnology patent literature is extensive, but most nanotechnology researchers are academics or basic researchers who publish in traditional scientific journals. I find that even for these researchers, patents contain useful, non-duplicative technical information, but my survey data suggest that patents could be even more informative".[4]

Therefore, we will assume that disclosures through patents and the dissemination of inventions facilitate numerous technological innovations and form a significant part of modern scientific output. We argue that it is the reward theory, rather than the concept of quid pro quo, that has been challenged. Furthermore, we recognise that we are not aware of any author who has denied that this disclosure and diffusion act as precedents for certain scientific and technological developments.

[4] Now, even if Lisa Oullette were wrong and contemporary patent systems were indeed entirely devoid of informational value, this inquiry would still serve at least to draw attention and to point out the best systems to work on, in order to make the social contract of patents a more effective framework.

In summary, secrecy is intrinsic to patents. It manifests in many different forms and means, driven by political, epistemic, informational, and especially economic influences. Nonetheless, this does not necessarily diminish our dedication. We must recognise that while secrecy is related to patents, it should never be confused – almost to the point of merging – with them. Patents and (trade) secrecy are distinct entities. As historian Petra Moser (2013) notes, "secrecy emerged as a key mechanism for protecting intellectual property. The effectiveness of secrecy vis-à-vis patents varies according to the technological characteristics of innovations in different sectors and over time. In industries where secrecy was effective, inventors were less likely to use patents. Advances in scientific analysis, which reduced the effectiveness of secrecy, increased inventors' reliance on patents" (p. 40).

Patents aim to close the gap between industrial secrecy and the socially beneficial sharing of knowledge that drives scientific and technological progress. However, as we demonstrate, the reality is more complex, as much of the information in patent documents possesses implicit qualities. Often, essential details needed for commercialising or industrially applying patented inventions cannot be effectively conveyed through the patent document's format, nor can they be easily expressed as clear statements or narratives. This challenge is exacerbated by the fact that inventions are not physically tested at patent offices; their assessment depends solely on the submitted documentation and, at best, related illustrations. Furthermore, the self-interest of patent applicants, combined with an understanding of the system's weaknesses, can undermine the social goals of the patent system.

Overall, we argue that a certain level of secrecy is an inherent aspect of the patent system, with its degree differing depending on the technological nature of innovations across various sectors and over time. We contend that there is an urgent need for more effective patent evaluation systems that can sufficiently address these informational challenges.

CONCLUDING REMARKS

Does the patent system ultimately disseminate knowledge or merely define property boundaries while concealing essential know-how? The answer varies significantly across technological fields, as we have just discussed. Software and business methods can be largely codified through language; in contrast, pharmaceutical manufacturing and biotechnological techniques require tacit expertise that patents cannot fully capture. Recognising these field-specific limitations is vital for assessing whether the social contract remains viable or needs fundamental recalibration. Our contribution is to emphasise that considering the secrecy associated with the patent office is inevitably necessary for these reflections.

To strengthen our arguments, it is crucial to conduct a more detailed investigation into representative patent cases involving tacit knowledge and assess their impact on

subsequent innovation. Additionally, a valuable direction for future research is to explore the links between our arguments and recent advances in information economics and value creation in contexts characterised by incomplete information. We cannot afford to overlook these gaps–or, worse, to assume the patent system has already addressed them. Tackling the unavoidable tensions between language and technology, disclosure and secrecy, individual property and collective knowledge, can help to reimagine patent institutions that are fit for the real complexity of modern innovation.

REFERENCES

Acosta, B. (2023). Impartiality at the Patent Office. *Public Integrity*, *26*(5), 594–605. https://doi.org/10.1080/10999922.2023.2268810

Arinas, I. (2012). How Vague Can Your Patent Be? Vagueness Strategies in U.S. Patents. *HERMES – Journal of Language and Communication in Business, 48*, 55-74. https://doi.org/10.7146/hjlcb.v25i48.97426

Ashtor, J., H. (2022). Modeling Patent Clarity. *Research Policy*, *51*(2), 104415. https://doi.org/10.1016/j.respol.2021.104415

Bellido, J. (2023). Patents In Miniature: The Effects of Microfilm as an Information Technology, 1938–68. *Technology and Culture, 64*(2), 407–433. https://doi.org/10.1353/tech.2023.0056

Bessen, J., Ford, J., L., & Meurer, M., J. (2011). *The Private and Social Costs of Patent Trolls* [Working Papers 1103]. Boston University School of Law. http://www.bu.edu/law/faculty/scholarship/workingpapers/2011.html

Billing, J. (2014). *Josh Billings, Hiz Sayings*. Literary Licensing, LLC.

Boldrin, M., & Levine, D., K. (2008). *Against Intellectual Monopoly*. Cambridge University Press.

Bonadio, E., & Contardi, M. (2021). *Los Troles De Patentes: Una Historia de Exceso de Ejercicios de Derechos de Propiedad Intelectual* [Patent Trolls: A History of Excessive Exercise of Intellectual Property Rights]. *Revista La Propiedad Inmaterial*, *32*, 37-70. https://doi.org/10.18601/16571959.n32.02

Boscheck, R. (2016). Patent Trolls: In Search of Efficient Regulatory Standards. *World Competition*, *39*(1), 67-84. https://doi.org/10.54648/WOCO2016005

Cohen, L., Gurun, U., G., & Kominers, S., D. (2019). Patent Trolls: Evidence from Targeted Firms. *Management Science, 65*(12), 5461-5486. https://doi.org/10.1287/mnsc.2018.3147

Denicoló, V., & Franzoni, L. A. (2003). The Contract Theory of Patents. *International Review of Law and Economics, 23* (4), 365-380. https://doi.org/10.1016/j.irle.2003.07.002

Dunitz, J. D., & Bernstein, J. (1995). Disappearing Polymorphs. *Accounts of Chemical Research*, *28*(4), 193-200. https://doi.org/10.1021/ar00052a005

Figueroa, N., & Lemus, J. (2023). The Benefit of the Doubt: Patent Examination Under Strategic Obfuscation. *Management Science*, *70*(9), 5853-5870. https://doi.org/10.1287/mnsc.2023.00140

Freilich, J. (2017). Patent Clutter. *Iowa Law Review, 103*, 925-983.

Galasso, A., & Schankerman, M. (2015). Patents and Cumulative Innovation: Causal Evidence from the Courts. *The Quarterly Journal of Economics*, *130*(1), 317–369- https://doi.org/10.1093/qje/qju029

Gortych, J.E. (2014). *Consider a Spherical Patent: IP and Patenting in Technology Business*. CRC Press. https://doi.org/10.1201/b16603

Gupta, H., Kumar, S., Roy, S. K., & Gaud, R. S. (2010). Patent protection strategies. *Journal of pharmacy & bioallied sciences*, *2*(1), 2–7. https://doi.org/10.4103/0975-7406.62694

Hall, B. H., & Harhoff, D. (2012). Recent Research on the Economics of Patents. *Annual Review of Economics, Annual Reviews,* *4*(1), 541-565. https://doi.org/10.1146/annurev-economics-080511-111008

Heller, M., & Eisenberg, R., S. (1998). Can Patents Deter Innovation? The Anticommons in Biomedical Research. *Science*, *280*, 698-701. https://doi.org/10.1126/science.280.5364.698

Hemmungs Wirtén, E. (2023). Patents of Persuasion: Tempo-metrics and the Shaping of Knowledge About Knowledge. *Journal for the History of Knowledge, 4*, 215-238. https://doi.org/10.55283/jhk.12419

Howe, H. R. & Griffiths, J. (2013). *Concepts of Property in Intellectual Property Law*. Cambridge University Press.

Kang, H., Y. (2015) Patent as Credit. When Intellectual Property Becomes Speculative. *Radical Philosophy, 194*, 29-37.

La Belle, M. (2015). The Local Rules of Patent Procedure. *Arizona State Law Journal*, *47*(63). https://arizonastatelawjournal.org/wp-content/uploads/2015/06/La-Belle_Final_Corrected.pdf

Liu, C., Zhang, L., Liu, H., & Cheng, K. (2017). Delivery Strategies of the CRISPR-Cas9 Gene-editing System for Therapeutic Applications. *Journal of Controlled Release*, *266*, 17-26. https://doi.org/10.1016/j.jconrel.2017.09.012

Machlup, F., & Penrose, E. (1950). The Patent Controversy in the Nineteenth Century. *The Journal of Economic History*, *10*(1), 1–29. https://doi.org/10.1017/S0022050700055893

Mayergoyz, A. (2009). Lessons from Europe on How to Tame U.S. Patent Trolls. *Cornell International Law Journal*, *42*(2), 264.

Moser, P. (2013). Patents and Innovation: Evidence from Economic History. *Journal of Economic Perspectives*, *27*(1), 23–44. http://dx.doi.org/10.1257/jep.27.1.23

Myers, G. (1995). From Discovery to Invention: The Writing and Rewriting of Two Patents. *Social Studies of Science, 25*(1), 57-105.

Myers, G. (1996). Strategic Vagueness in Academic Writing. In E. Ventola, & A. Maurannen (Eds.), *Academic Writing: Intercultural and Textual Issues* (pp. 3-18). John Benjamins Publishing Company.

Ouellette, L., L. (2012). Do Patents Disclose Useful Information? *Harvard Journal of Law and Technology*, *25*(2), 545-607.

Polanyi, M. (1958). *Personal Knowledge: Towards a Post-Critical Philosophy* (M. Jo Nye, Ed.). University of Chicago Press.

Ross, E., L. (2002). *Animal Toy*. (US Patent n: 6,360,693 B1). United States Patent and Trademark Office. https://patentimages.storage.googleapis.com/7d/c2/a6/10a1fcd1ee5ca8/US6360693.pdf

Sáiz, P., & Amengual, R. (2018). Do Patents Enable Disclosure? Strategic Innovation Management of the Four-Stroke Engine. *Industrial and Corporate Change, 27*(6), 975–997. https://doi.org/10.1093/icc/dty018

Sánchez Navarro, M., D. (1999). *Procedimiento para la obtención de un plato de paella de arroz de gran estabilidad* [Procedure for Obtaining a Highly Stable Rice Paella Dish]. (Patente española n. ES2161177B1). Oficina Española de Patentes y Marcas. https://www.oepm.es/pdf/ES/0000/000/02/16/11/ES-2161177_B1.pdf

Scotchmer, S., & Green, (1990). Novelty and Disclosure in Patent Law. *The RAND Journal of Economics, 21*(1), 131-146

Swanson, K., W. (2020). Making Patents: Patent Administration, 1790–1860. *Case Western Law Review, 71*(2), *777*-818.

Whalen, R. (2018). Boundary spanning innovation and the patent system: Interdisciplinary challenges for a specialized examination system, *Research Policy, 47*(7), 1334-1343. https://doi.org/10.1016/j.respol.2018.04.017

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Book review

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Research article

Back to "Reality":A Review of Cheng Lin's *RoboHumanities: Imaginations, Narratives, and Ethics regarding Robots*

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Abstract

Cheng Lin's *RoboHumanities: Imaginations, Narratives, and Ethics regarding Robots* is the first Chinese monograph to systematically examine the core cultural concept of the "robot" from a literary studies perspective. Accordingly, the book aims to fill a relevant research gap and to establish an interdisciplinary humanities framework. The author adopts a research methodology that combines conceptual history and interdisciplinary analysis. Through etymological examination and cultural-historical tracing of the term "robot" and related concepts (such as "automaton" and "android"), the work clarifies the conceptual evolutionary trajectory and advocates for a present-oriented, near-future thought experiment designed to guide the public in daily ethical reflection on technology. Furthermore, assuming a pragmatic "Back to Reality" stance, the author attempts to balance visions of the far future, the near-future application of technology, and current social reality, while deepening the discussion through a multi-dimensional subdivision of robots into body-simulating, intelligence-simulating, and life-simulating types. The review concludes that, although the work has limitations in covering the global diversity of robotic cultures and in the empirical grounding of certain analyses, it successfully applies literary research methods to the field of techno-humanities. It clearly demonstrates the unique pathways and the necessity for humanities scholars to engage in interdisciplinary dialogue, thereby laying a solid foundation for the positioning and international conversation of RoboHumanities research.

Keywords: RoboHumanities, Robot, Science fiction studies, Conceptual history, Interdisciplinary Research

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Научная статья

Вернемся к “реальности”: Обзор книги Чен Линя “Робогуманитаристика: воображение, нарративы и этика в отношении роботов”

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Аннотация
Книга Чен Лина “Робогуманитаристика: воображение, нарративы и этика в отношении роботов” – первая китайская монография, систематически исследующая ключевое культурное понятие “робот” с точки зрения литературоведения. Соответственно, книга призвана восполнить актуальный пробел в исследованиях и создать междисциплинарную гуманитарную основу. Автор использует исследовательскую методологию, сочетающую концептуальную историю и междисциплинарный анализ. Благодаря этимологическому анализу и культурно-историческому прослеживанию термина “робот” и связанных с ним понятий (таких как “автомат” и “андроид”), работа проясняет концептуальную эволюционную траекторию и выступает за мысленный эксперимент, ориентированный на настоящее и ближайшее будущее, призванный помочь общественности в повседневных этических размышлениях о технологиях. Более того, придерживаясь прагматичной позиции “возврата к реальности”, автор пытается сбалансировать представления о далеком будущем, применении технологий в ближайшем будущем и текущей социальной реальности, углубляя дискуссию посредством многомерного разделения роботов на типы, имитирующие тело, интеллект и жизнь. В заключение обзора отмечается, что, несмотря на ограничения в охвате глобального разнообразия роботизированных культур и в эмпирическом обосновании некоторых анализов, работа успешно применяет методы литературного исследования в области техногуманитарных наук. Это наглядно демонстрирует уникальные пути и необходимость участия ученых-гуманитариев в междисциплинарном диалоге, тем самым закладывая прочную основу для позиционирования и международного обсуждения исследований в области робочеловечества.

Ключевые слова: Робогуманитаристика, Робот, Исследования научной фантастики, Концептуальная история, Междисциплинарные исследования

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Cheng Lin's *RoboHumanities: Imaginations, Narratives, and Ethics regarding Robots* was published in December 2025 (Cheng, 2025). As the first Chinese academic monograph written from the perspective of literary studies, this work offers a specialized exploration of the "robot" as a key concept in literature, culture, and daily life. As noted in the foreword, the book treats the robot in analogy to a bat – a creature that simultaneously possesses both "bird-like" and "beast-like" qualities. The former serves as a metaphor for technological frontiers, while the latter alludes to the cultural traditions embedded within robotics. Indeed, the Chinese school of RoboHumanities represented by Cheng Lin consistently seeks a balance among distant-future imaginations, the near-future applications of cutting-edge inventions, and the realities of present-day social life. Methodologically, the author has developed a distinct personal style characterized by "returning to the present." Unlike the applied ethical focus found in contemporary fields such as social robotics, or the radical tendency in posthuman studies – which has gained considerable traction over the past decade – to envision robots as potentially erasing species boundaries, the author advocates for a kind of near-future thought experiment rooted in the mundane. By tracking the trajectories of emerging technologies, clarifying how contemporary ideas have evolved across civilizations and temporalities, and analyzing speculative narratives in literary and artistic works, the author guides readers towards a grounded, quotidian ethical reflection on advanced technologies.

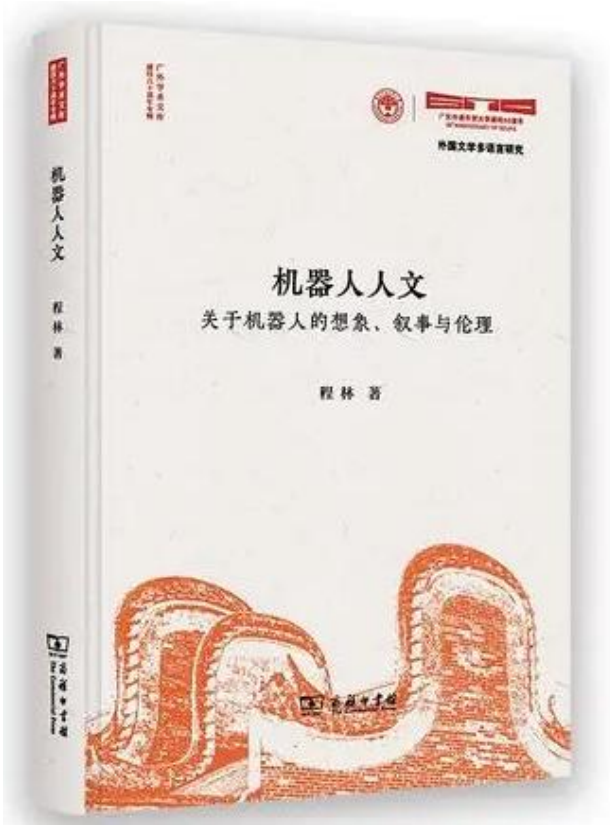

Figure 1. Book Cover of "Robot Humanities: Imagination, Narrative and Ethics of Robots" by Cheng Lin

The field of RoboHumanities research is often misconceived as the domain of philosophers of technology, sociologists, and economists, with literary scholars playing a limited role. In this work, Cheng Lin meticulously traces the conceptual history of the “robot” through the methods of literary studies, thereby filling a notable gap in traditional scholarship. Conceptual history is, in essence, cultural history. This foundational work serves as crucial prehistory and a frame of reference for contemporary RoboHumanities research, yet it has long remained underexplored. Building upon his background in philology, the author consistently maintains that different concepts or formulations open up distinct interpretive spaces. He conducts a cross-temporal excavation of key concepts related to robotics, examining varied conceptions of the “robot” and notions such as the “uncanny valley.” Furthermore, the book concludes with a glossary that concisely defines over forty techno-humanistic concepts associated with robotics. The term “robot” has become significantly worn through daily usage; this study serves to dispel the fog arising from improper linguistic appropriation and restore historical clarity – a particularly necessary endeavor in a contemporary world where misconceptions about the “robot” have long been perpetuated.

Taking the widely used Western concept “robot” as an example, Cheng excavates the discrepancy between its Czech etymological origins and the contemporary understanding of “robot.” Using the capabilities commonly associated with robots today as a guiding thread, he examines within cultural history older, yet underexplored terms such as “automaton,” “android,” and “Maschinenmensch,” as well as more recent terms like “hubot,” “gynoid,” “humanoid,” and the Chinese concept “芯机人” (xinji ren) – none of which can be adequately encompassed by the outdated notion of “robot.” The author separately analyzes the native Chinese concepts related to robotics and the process of situating imported terms, disentangling and clarifying their origins with meticulous care. Through such observations, the connection between the Chinese concept of “机器人” (jiqiren) and the European tradition of “automaton” becomes apparent. The author reveals that the term “机器人,” commonly used in Chinese, did not emerge as a translation of “robot” (in fact, it appeared earlier than “robot”), but was originally used to describe humanoid automata exhibited in Berlin around 1911.

The Cultural and Historical Sections share a consistent methodological approach, situating the concept and even the technology of the robot within the broader contexts of literary history, intellectual history, and indeed cultural and civilizational history. The Historical Section, in particular, most vividly demonstrates the dual-faceted interdisciplinary endeavor undertaken in this work. On the one hand, the author possesses a deep understanding of the cultural history of robotics; on the other, fully elucidating the development of this specialized technological history and its complex position within the technological artifacts of each era remains somewhat challenging. This may well be an inherent difficulty in research characterized by high precision, narrow focus, and vast temporal-spatial scope. Users of robots need not master the technology of robot manufacture, which means their judgments about robotic technology can easily fall into purely humanistic perspectives, neglecting the internal logic of technological development itself. The author has consistently sought to liberate science fiction imagination from being a mere synonym for futuristic prophecy. However, the author's

understanding of the actual developmental levels of various robotic technologies remains to be deepened. A clear distinction is not made between what has already occurred, what is achievable in the near future, and what remains technically improbable. Relying solely on media studies, cultural studies, literary studies, and conceptual history can only partially accomplish this objective. This is precisely the enduring challenge of dialogue between the two cultures – a concern since the time of C.P. Snow – that remains imperfectly resolved today. The notion of a polymathic administrator, as envisioned by Joe Moran in *Interdisciplinarity*, appears the fear that cultural studies may ultimately turn out to be animated by Kantian nostalgia for an all-inclusive, humane education, a desire that has characterized the human sciences since their inception (Moran, 2002, pp. 80-81). We can hardly expect every researcher to be a generalist. In this light, Cheng Lin's attempt to employ expressive logic acceptable to other disciplines in analyzing issues and articulating viewpoints represents a noteworthy and innovative effort.

Many passages in this book display recognizable stylistic influences from other disciplines, such as philosophy of technology and media studies. This allows the author to proceed with ease from textual origins, ranging widely yet deftly. For instance, the "Mechanical Turk" can be approached as a technological artifact and cultural phenomenon that fascinated Europe; as a literary motif that attracted writers such as Hoffmann, Bierce, and Edgar Allan Poe; and as a scientific subject of interest to foundational figures in computing and artificial intelligence research, including Alan Turing, Arthur Samuel, John von Neumann, John McCarthy, Claude Shannon, and Herbert Simon. If the section titled "Artificial Intelligence: The Chess-Playing Machine of 1770" were placed alongside papers by historians of science and technology, readers might well struggle to distinguish which was written by a literary scholar and which by a historian of technology. Similarly, the chapter on "Robotics Culture and Cross-Cultural Robotics" would fit seamlessly into a collection of essays by sociologists or philosophers of technology. This blending of research perspectives and even linguistic style offers a rather clear answer to a question that is particularly pressing today: how can humanities scholars participate in interdisciplinary discussions – especially since the necessity of their involvement in such debates is now self-evident. At its core, this book is about putting cross-cultural and cross-disciplinary dialogue into practice, precisely as Cheng Lin defines the concept of "RoboHumanities":

> The author defines RoboHumanities as a field of humanistic inquiry related to and intersecting with robotics [...] In a broad sense, RoboHumanities encompasses both phenomena centered on humans and those centered on robots. It includes research that observes robots as objects of study, while also examining the potential impact of the existence of robots and AI on humanity and the humanities. It scrutinizes both the phenomenon of machines imitating humans and the phenomenon of human mechanization. At the same time, RoboHumanities should not be confined to academic questions alone; it must also engage with reality. At a time when contemplating human-machine relations has become a defining issue of our age, research in RoboHumanities should prepare people for the arrival of a human-machine coexistence society. The robot itself is an interdisciplinary

> phenomenon; imagination and narrative are its fundamental components, integral to its entire technological lifecycle, not merely optional appendages. (Cheng Lin, 2025, p. 17)

Cheng points out that research in RoboHumanities should also address the issue of human mechanization, as well as the question of whether robots or AI may in the future become a form of subjectivity capable of "creating" cultural phenomena. He further hopes that existing RoboHumanities research can extend into the broader field of AI-humanities research, with which it shares significant overlap. In the author's view, phenomena within RoboHumanities – or robotic culture – can be divided into two categories: "first, humanistic and cultural phenomena centered on humans yet related to robots; second, cultural phenomena centered on robots themselves." This book focuses primarily on the former. As for the content of RoboHumanities research, the author maintains that it "includes both studies based on existing cultural phenomena, texts, and works, as well as theoretical research derived therefrom, or guiding research oriented toward present and future concerns, such as setting objectives and directions for the evolution of human-machine relations" (Cheng, 2025, p. 19).

It is perhaps precisely due to his philological background and his call for interdisciplinary engagement that, despite the inclusion of a Theory Section, the author adopts a stance that verges on de-theorization. His language is plain, clear, and descriptive, with restrained and even deliberately distanced use of terminology and metaphor. This posture aligns with the book's overall style of staying close to lived reality, yet the inductive reasoning and precise expression grounded in concrete phenomena may, in certain contexts, be perceived by readers as lacking theoretical depth. Nevertheless, although the sections in this part are not tightly interwoven by strict logical connections, each addresses one of five key issues in robotics research: i) the imitation of humans by robots and the uncanny valley effect arising from boundary-crossing; ii) the imitation of intelligence by robots and how to comprehend such intelligence distinct from human wisdom; iii) the imitation of life by robots (i.e., the simulation of human life forms) and its impact on human-machine interaction/integration models; iv) the legislative challenges concerning robots, including their utility, limits, and self-negating tendencies; and v) the possible future of robots, along with the thought-experimental potential of everyday robotic science fiction. the section v) essentially summarizes internationally influential viewpoints in RoboHumanities research and offers a critical analysis of their current relevance. The perspectives drawn upon come from psychologists such as Ernst Jentsch, engineers like Masahiro Mori and Hiroshi Ishiguro, scientists including Alan Turing, and writers such as Isaac Asimov. "Bio-simulative machines" and "eveyday science fiction" are the author's original formulations: "bio-simulative machines" encompass both non-embodied machines like DeepSeek and embodied machines as seen in works such as the movie *Blade Runner* (Scott, 1982). He observes how technological realities, once mere futuristic imaginings, now most powerfully challenge long-held human conceptions. Meanwhile, "everyday science fiction" serves as a thought-experimental space for considering the problems that such imminent or already-arriving technologies may provoke. The author defines it as "the world-building and

thought experiments that focus, within near-future daily spaces, on the relationship between humans and various human-simulating machines or intelligent technologies" (Cheng, 2025, p. 114).

This *return-to-reality* approach resonates with another era of unprecedented convergence between science and the humanities. In the late nineteenth century, H.G. Wells (1934/2017) – one of the two widely recognized fathers of science fiction – proposed that the best way to create was to introduce elements beyond daily experience into real life while perfecting their logical details, an idea later summarized by Darko Suvin as the "gradually introduced new reality" (Suvin, 1979, p. 208). Hugo Gernsback intentionally revisited Wells's concept in the inaugural editorial of *Amazing Stories*, the manifesto of science fiction's golden age, treating it as a precursor to the notion of science fiction itself (Gernsback, 1926, p. 3). Wells, who saw himself primarily as a scientist, regarded this kind of gradual future imagination as part of "popular science," a means to make new scientific ideas more accessible to his readers and to explore possible futures shaped by technocracy. In our current moment of renewed calls for interdisciplinary integration, humanists' approach to technology through "everyday science fiction" likewise carries transformative significance. This genre allows them to navigate between language and concepts, grasp technological frontiers more swiftly, engage more readily in international dialogue, and participate more deeply in the transformation of humanities education for the technoscientific age.

The Theory Section also attempts to correct a common tendency in RoboHumanities research – namely, the unreflective conflation of humans and robots within "robot"-related humanistic inquiry. Fundamentally, this section interprets the relationship between humanoid robots and humans as one of similarity in appearance and function, yet difference in nature and principle. Regardless of what human traits – such as emotion, gender, or cognitive abilities – a humanoid machine may acquire, researchers must maintain the capacity to discern: these are not merely upgraded versions of existing human attributes, but novel creations that require fresh analysis, induction, definition, and development. In the short term, forcing new entities into outdated frameworks may reduce the time cost for public understanding. In the long run, however, it risks leading RoboHumanities research into error. Such an undesirable tendency ought to be checked before it becomes entrenched and difficult to reverse.

While posthumanist scholars, driven by political agendas or certain transcendental pursuits, regard robots as independent subjects and symbols of erasing species boundaries, the author adopts a notably pragmatic and restrained approach. He focuses instead on the existing and potential future relationships between robot designers/manufacturers and user expectations, as well as the past patterns, present conditions, and near-future projections of human-robot interaction. This inclination influences his selection of cultural and artistic materials, manifesting in his emphasis on and advocacy for "everyday science fiction." The sections on gender, emotion, and ethics represent both the cutting edge of current RoboHumanities research and points to the keen public interest in the daily application of robots. Nevertheless, the author's temporal focus remains firmly on the present and the real. Questions of how to design robots involve their fundamental settings, which are closely tied to evolving social perceptions of gender and changes in

the context of the social division of labor. This can be seen as the ethical identity preparation before robots enter society. Questions of how to interact pertain to the ethical dilemmas already arising in the present and near future as robots take on social roles – whether in the form of sex robots, virtual companions, griefbots, or elderly-care robots. New issues continuously emerge precisely through their sustained interaction with humans. These areas represent the "blue ocean" [1] depicted in robotics/artificial intelligence industry reports across various countries, and a surge in related technologies driven by market demand is foreseeable. This, however, reflects the inherent complexity of the robot topic itself and that it is not a purely cultural construct. In daily life, the instrumental nature of robots is more conspicuous than in the philosophical reflections they inspire. Their development is factually influenced by political-economic factors such as manufacturing costs, sales data, and national policy directions. The author's attempt here is admittedly limited: his analysis of consumer demand remains somewhat idealized and philosophical, and lacks sufficient attention to economic factors. Yet he still observes these consumption phenomena and attempts to outline, analyze, and project their broader landscape.

Foundational to Lin Cheng's recent perspective on RoboHumanities is the author's earlier work on classical Western robot imagery as "servants, mirrors, and others." He maintains that current developments in the field, despite their rapidly evolving forms, do not involve a qualitative transformation of this foundational imagery. Nevertheless, on the one hand, the author continually refines his observations and categorizations. For instance, he offers a decomposition of the "mirror" function by dividing robots into body-simulating, intelligence-simulating, and life-simulating types. The virtual companion hybridizes these three functions and further branches into variants such as "active human-machine romance," "passive human-machine romance," and "mixed active-passive human-machine romance." On the other hand, the author consistently attends to the daily application prospects of robots and their variations across national contexts, ensuring that each subdivided variant remains open to further variation. For example, regarding the classic motif of the "machine wife," he not only examines its differing portrayals in American, Japanese, and Chinese cultural works but also traces its evolving image within the same cultural milieu. In the discussion of griefbots, the author focuses on the impact of robots on the deceased and their families in post-mortem scenarios, as well as the connection between such technologies and recent transcendent and seductive imaginings of digital immortality.

Upon its publication, Lin's book promptly attracted attention from scholars and writers in such fields as science fiction studies, philosophy of science, and cultural studies. Philosopher of technology Liu Yongmou remarked it regarding Robots conceptualizes

[1] The term was coined by W. Chan Kim and Renée Mauborgne in their 2005 landmark book, *Blue Ocean Strategy*. They use the metaphor of "oceans" to describe the entire market universe. "Blue oceans ... are defined by untapped market space, demand creation, and the opportunity for highly profitable growth. In blue oceans, competition is irrelevant because the rules of the game are waiting to be set." (Kim & Mauborgne, 2005, p. 4)

"RoboHumanities" as a field of problematology rather than a mere sub-discipline of literary and artistic theory. Even strictly from the perspective of science fiction criticism, RoboHumanities engenders numerous novel inquiries and theoretical insights that merit significant scholarly attention (Liu, 2025). Renowned science fiction scholar Wu Yan commented that the book "fills a gap in the study of AI narratives" and represents "a comprehensive integration of science fiction into a humanities monograph on intelligence" (Wu, 2025). Although in the Chinese-speaking world such evaluations often praise the work generously as being the first of its kind, they do highlight some commendable fundamental qualities of the book – such as its unpretentious language, its commitment to clarifying historical contexts, its concern with current points of keen public interest, its apprehension about near-future changes, and its appeal both to specialized researchers and an educated public After all, this is, indeed, a first-of-its-kind work, and we can look forward to further exploration and development.

For the time being, one can note with relative certainty that amidst all the technological euphoria, Lin Cheng calmly grounds the discourse in reality, unveiling the humanistic dimension of robotics research.

REFERENCES

Cheng, L. (2025). *Ji qi ren ren wen: Guan yu ji qi ren de xiang xiang, xu shi yu lun li* [Robot humanities: Imagination, Narrative and Ethics of Robots]. The Commercial Press.

Gernsback, H. (Ed.). (1926). *Amazing stories: Vol. 1, No. 1*. Experimenter Publishing Company.

Kim, W. C. & Mauborgne, R. (2005). *Blue Ocean Strategy. How to Create Uncontested Market Space and Make Competition Irrelevant.* Harvard Business School Press.

Liu, Y. [@buhaoweirenshi]. (2025, December 22). *Ji qi ren ren wen: Hui shi yi ben you ren mai you ren kan de shu* ["RoboHumanities" will be a Book that People Buy and Read]. [WeChat post]. WeChat. https://mp.weixin.qq.com/s/SUcs59TW4SuoJn8A8Xh65Q

Moran, J. (2002). *Interdisciplinarity*. Routledge.

Scott, R. (Director). (1982). *Blade Runner* [Film]. The Ladd Company; Warner Bros.

Suvin, D. (1979). *Metamorphoses of Science Fiction: On the Poetics and History of a Literary Genre*. Yale University Press.

Wells, H. G. (2017). Preface to "Seven Famous Novels"; Preface to The Scientific Romances of H.G. Wells. In R. Latham (Ed.), *The Scientific Romances. Science Fiction Criticism: An Anthology of Essential Writings* (pp. 13-16). Bloomsbury Academic. (Original work published 1934)

Wu, Y. (2025). Preface. In *RoboHumanities: Imaginations, Narratives, and Ethics Regarding Robots* (pp. i-vi). Commercial Press.

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