

Technology and Language



Pan Deng and Kevin Liggieri

Kevin Liggieri and Laura Kurz

Pavel Kotelnikov and Sergei Kurakov

Fugong Zhang and Yuanzhao Wang

Alexander Markov and Anna Sosnovskaya

Victoria Lobatyuk

Shi Liang

Lars Gustafsson

Stefan Gammel

Arthur Wei-Kang Liu

Karina Vida

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6:3 The Language and Poetics of Machines

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Special Topic:
The Language and Poetics of Machines
Guest editors
Pan Deng and Kevin Liggieri



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Editorial introduction

The Language and Poetics of Machines

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Abstract

The intelligibility of mechanical processes lends a peculiar expressive power to the machine. It is manifested throughout the history of human culture from Heron of Alexandria to La Mettrie and contemporary conceptions of cellular machines. The machines of Karl Marx, Ernst Kapp, Eduard Jan Dijksterhuis, or Lewis Mumford reflect the development of Western thought, while the perpetuum mobile or the soft machines of nanotechnology represent unattainable dreams of reason. And then there are the machines of Jean Tinguely, Tomi Ungerer, or Rube Goldberg that whimsically undermine the notions that machines need to be useful. All of this may refer to a compositional grammar of mechanical elements which was proposed by Christopher Polhem in the 16th century and elaborated 300 years later, e.g., by Franz Reuleaux or Carl Bach, and subsequently reflected by Anson Rabinbach or Georges Canguilhem. However, the language of machines and machine language is never free of power relations, especially in the 20th century. Machine language partly reflects and stabilizes topographical and gendered differences. This special issue gathers several key works to explore the theme of “Machines and Language.” We examine this topic through three dimensions: gender, capital, and culture. Our goal is to investigate the ongoing tension between technological discourse and humanistic thought. By viewing the machine through the prism of language, we reveal a complex spectrum of power, desire, and meaning.

Keywords: Language; Poetics; Machines; Gender; Capital; Culture

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Редакторская заметка

Язык и поэтика машин

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Аннотация

Понятность механических процессов придаёт машине особую выразительную силу. Она проявляется на протяжении всей истории человеческой культуры, от Герона Александрийского до Ламетри и современных концепций клеточных машин. Машины Карла Маркса, Эрнста Каппа, Эдуарда Яна Дейкстерхейса или Льюиса Мамфорда отражают развитие западной мысли, в то время как вечный двигатель или “мягкие” машины нанотехнологий – недостижимые мечты разума. Кроме того, существуют машины Жана Тэнгли, Томи Унгерера или Руба Голдберга, которые причудливо подрывают представления о том, что машины должны быть полезными. Все это может относиться к композиционной грамматике механических элементов, которая была предложена Кристофером Полхемом в 16 веке и разработана 300 годами позже, например, Францем Рело и Карлом Бахом, и впоследствии отражена Энсоном Рабинбахом и Жоржем Кангилемом. Однако язык машин и машинный язык никогда не свободны от властных отношений, особенно в XX веке. Машинный язык частично отражает и стабилизирует топографические и гендерные различия. В этом специальном выпуске собраны несколько ключевых работ, раскрывающих тему “Машины и язык”. Мы рассматриваем эту тему в трёх измерениях: гендер, капитал и культура. Наша цель – исследовать продолжающееся напряжение между технологическим дискурсом и гуманистической мыслью. Рассматривая машину через призму языка, мы раскрываем сложный спектр власти, желания и смысла.

Ключевые слова: Язык; Поэтика; Машины; Гендер; Капитал; Культура

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The intelligibility of mechanical processes lends a peculiar expressive power to the machine. It is manifested throughout the history of human culture from Heron of Alexandria to La Mettrie and contemporary conceptions of cellular machines. The machines of Karl Marx, Ernst Kapp, Eduard Jan Dijksterhuis, or Lewis Mumford reflect the development of Western thought, while the perpetuum mobile or the soft machines of nanotechnology represent unattainable dreams of reason. And then there are the machines of Jean Tinguely, Tomi Ungerer, or Rube Goldberg that whimsically undermine the notions that machines need to be useful. All of this may refer to a compositional grammar of mechanical elements which was elaborated in the 19th century, e.g., by Franz Reuleaux or Carl Bach, and subsequently reflected by Anson Rabinbach or Georges Canguilhem. However, the language of machines and machine language is never free of power relations, especially in the 20th century. Machine language partly reflects and stabilizes topographical and gendered differences.

It should be noted that in the 20th century, machine thinking was mostly reduced to language and not physicality. Unlike the courtly automatons of the 18th century and the work machines of the 19th century, it is no longer a question of whether the machine looks human or moves like a human (performs work). Material form plays no role in modern large language models and AI applications.

Thus, our access to modern machines is also predominantly linguistic. We teach machines to communicate and think through language. With the help of the imperative and procedural programming language C, for example, universality, simplicity, and transferability (performance and portability) could be achieved to a new degree. Due to the easy compilability of the source code and the smooth and fast execution of the program code, the language was as popular with programmers of earlier personal computers as it is with the current “Internet of Things” or in robotics. To this day, the C programming language has made it possible to network devices and design a technical “environment” that extends into our living rooms. The language used today in smartphones, emails, chats, blogs, social media, and even scientific publications was generated by computer codes. Although today's computer language appears, in form and function, to be part of face-to-face communication or written on paper, invisible processes of encoding and decoding take place behind the anthropophilic interface. In the assignment of programming commands, letters, and compilations, humans as writers and readers are left out.

Machine language shapes therefore our actions and our world. But language is also always diverse, it can mechanically endorse but also criticize mechanized human models and world models (e.g. in the form of poetry).

In the technical discourse, literature offers the experimental possibility of showing, just how abstract and artificial assumed distinctions (man-machine, organism-technology, man-woman) are. Alongside a hard deconstruction of the sciences, the cultural narrative of mechanization in literature offers a conceptual and ontological subversion, whose reception can stimulate its readers to think further as well as to reflect critically on traditional concepts such as ‘human’, ‘gender’, ‘life’. The fragile conditions of the human individual’s identity are thus revealed. This discursive relationship can only be described in relations, as the scholar of communication, Vilem Flusser (1989), points



out: “we have to work out an anthropology that regards man as a knot, the point at which several fields traverse each other.” (p. 52). This knot should not only be seen in terms of neurological data, but also epistemologically. The human being stands between anthropological, human-scientific, biotechnological, and informational networks of knowledge that condition one another, constitute one another, provoke one another, and subvert one another.

So language itself can be understood as technologies and “machines”. So, for example, Deleuze and Guattari (1980/2005) treat books as “abstract machines” that can join with other books to produce “machinic assemblages” (p. 4). This notion of a technologization of books (bibliotechnics) as a medium in itself must remain a suggestion, and will not be further explored here.¹

This special issue gathers several key works to explore the theme of “Machines and Language.” We examine this topic through three dimensions: gender, capital, and culture. Our goal is to investigate the ongoing tension between technological discourse and humanistic thought. By viewing the machine through the prism of language, we reveal a complex spectrum of power, desire, and meaning.

The first dimension is gender. Here, technology and its language are never neutral. In their contribution *The Gendered Language of Technology*, Kevin Liggieri and Laura Kurz reveal the hidden and profound power dynamics at play. Through a historical study of the education sector from the 1950s to the 1980s, they show that technical language itself is a gendered “apparatus” (dispositif). Concepts such as “the machine is a male domain” and the binary of “hard” versus “soft” sciences created social biases. These biases not only promoted the idea that “women are not good at technology” but also systematically excluded non-male subjects from the field through curriculum design and media discourse. Liggieri's and Kurz's research warns us that the roots of the digital gender gap lie deep within language. Language does not just describe reality; it constructs it. When we discuss “machines,” terms that seem objective are often already embedded with historical and social gender attributes. This process reinforces existing power structures. Therefore, promoting gender equality in technology requires a profound revolution in “language awareness.” We must deconstruct biased terms and create more inclusive narratives.

The second dimension is capital. If gendered language sets invisible boundaries for the user, then the logic of capital gives the machine itself a contradictory fate. In their paper *The Dialectics of Labour, Machinery and Capital*, Fugong Zhang and Yuanzhao Wang use Marx's insights to analyze the core conflict of the machine under capitalism. It begins with “Beckmann's dilemma”: the paradox that machines can both liberate labor and harm workers' interests. The authors argue that the conflict between workers and machines does not come from the machine's technical nature. Instead, it is a result of its “capitalist application.” Driven by capital, the machine is transformed from a tool of potential liberation into a means of exploitation. It becomes a “competitor” to the worker

¹ Donna Haraway (1991) also undertakes the mechanization of text and language, since, for her, cyborgs can represent “text, machine, body and metaphor” (p. 212). What humans have in common with writing is that they can be copied by means of modern biotechnology: in the beginning was the copy (see Haraway, 1999).



and creates a surplus population to drive down wages. The core contribution of this research is its strict separation of the "machine itself" from its "capitalist application." This challenges the myth of technological determinism. It proves that the "dual nature" of technology is not inherent to technology itself. Rather, it lies in the specific social relations behind it. Thus, any discussion of ethics in the age of AI will remain superficial if it ignores a critical examination of the logic of capital.

The third dimension is culture. Beyond the shaping of gender identity and the logic of capital, what role does the machine play in the broader cultural landscape? How does it change our artistic perception, philosophical thought, and even our understanding of meaning itself?

Alexander V. Markov and Anna M. Sosnovskaya, in *The Language of Machines from Baroque Automata to Digital Hybrids: The Poetics of Technological Evolution*, provide a grand theoretical framework for understanding the machine's cultural attributes. They define the machine as a non-neutral "dark object," a node forming "alliances" with other things, a "hyperobject" that embodies the spirit of an era, and a system with its own internal logic and "language." Their foundational article argues that machines do not simply reflect our psychology; they have become "accomplices" in producing new systems of knowledge (Markov & Sosnovskaya, 2025).

This "accomplice" relationship is evident in history and the present. The research by Pavel Kotelnikov and Sergei Kurakov on the scientific restoration of Franz Reuleaux's collection of mechanisms is more than an act of heritage preservation; it is a dialogue with history. Reuleaux pioneered the description of mechanical elements in an abstract language of "geometric constraints." These century-old models are a solid epic of "machine linguistics." Repairing them allows this pre-digital technical language of order, motion, and logic to resonate again today (Kotelnikov & Kurakov, 2025).

Turning to the arts of the early 20th century, Victoria Lobatyuk's (2025) *Avantgarde Machines: On the Integration of Technology and Art* describes how Russian avant-garde artists worshipped technology. For the Constructivists and Futurists, the gears and sounds of machines were not cold industrial noise. They were inspiring notes for a new era's symphony. Technology became a new artistic language—a sacred force for reorganizing society and creating a new aesthetic, giving the material world a unique theatricality and a poetic soul.

And so we must face the ultimate question: When machines create on their own, where does the meaning of their "language" come from? In his paper *Electronic Fuji and Artificial Intelligence Creation – How is the study of machine poetics possible?* Liang Shi offers an insightful analogy (Shi, 2025). He compares AI creations to ancient Chinese "spirit writing" (扶乩, fú jī). Fú jī is a traditional Chinese and East Asian divination practice where participants summon spirits or deities through rituals. The spirits then "possess" the participants to write messages. So AI creation and Fuji produce text without a conscious creator. Yet both require external forces (a temple or a tech platform) for interpretation and are given a kind of transcendent authority. This comparison reveals a profound point: the meaning in machine creation may not come from the machine's own mind. Instead, it is constructed through human interpretation and interaction. The "poetics"



of the machine is essentially a projection of human fears about losing subjectivity and our deep desire for meaning.

A poetic text completes this special issue. Lars Gustafsson's *The Machines – Poem and Comment* (Gustafsson, 2025). The poem offers a philosophical provocation by intimating a mechanistic worldview that appears to involve four core theses: first, that grammar itself is a machine; second, that humans and machines jointly participate in a mechanical existence that simulates life; third, that this symbiotic relationship does not keep any secrets; and fourth, that this “secretless” community offers a peculiar consolation. One might say that all the papers in this special issue revolve around these theses. Three contemporary philosophical interpretations explore the poem in different ways. One traces the evolution and reconstructs Gustafsson's implicit argument (Gammel, 2025). Another challenges his views from the perspective of critical hermeneutics (Liu, 2025). The third provides a historical echo, using it to examine the crisis we currently face with Artificial Intelligence (AI) (Vida, 2025).

All three critical essays first acknowledge the common foundation of Gustafsson's thought. This foundation is his mechanistic definition of the nature of language. Gustafsson drew on the theories of Noam Chomsky. He defines grammar as a machine that selects communication's strings of words from countless possible combinations. This definition gives language an impersonal, objective, and independent aura. In this view, it is as if language itself thinks inside the human body, while the human individual is merely an instrument that gives voice to this vast and formless mechanical process. Consequently, humans are depicted as mechanical puppets or cybernetic devices, programmed by their own language and logic. This perspective ultimately leads to a radical conclusion: it rejects the core modernist concept of a “language wall.” In Gustafsson's view, language is entirely transparent. It can exhaust our entire being and completely express our thoughts. This process leaves behind no unreachable, private remnants of meaning (Gustafsson, 2025).

Stefan Gammel's *The Machines and Beyond* focuses on Gustafsson's own eventual overcoming of his radical interpretation (Gammel, 2025). Gammel points out that in his subsequent poetry, Gustafsson fundamentally transformed the “secretless consolation” he had sought. This transformation first appears as a “moral rupture.” In his poem ‘The Wright Brothers Visit Kitty Hawk,’ the poet introduces a moral dimension. The emergence of concepts like guilt and responsibility becomes a “critical bridge” that shatters the purely mechanical unity. These emotions separate humanity from an amoral mechanical theater, allowing humans to re-emerge as subjects capable of moral judgment. Gammel also notes that Gustafsson himself confirmed in private correspondence that he later changed his view of humans as machines. Ultimately, this transformation culminates in the poem ‘Polhem's Ore Hoist.’ In this poem, a purely mechanistic philosophy gives way to the triumph of organic life and nature's instinctual knowledge. The remains of the machine, such as the old hoist, eventually decay into dust. Meanwhile, humanity completes a profound transition from a mechanical community to an organic one by “participating in natural knowledge.”

Unlike Gammel's approach of tracing this intellectual evolution from within, Arthur Wei-Kang Liu's *Remarks on Gustafsson's ‘The Machines’ – Hermeneutics of*



Machines adopts the external stance of critical hermeneutics. He challenges the limitations of Gustafsson's mechanistic worldview (Liu, 2025). Liu argues that while this perspective can inspire deep self-reflection, it risks falling into a mode of ideological narrowing, or *Engführung*. He identifies the limitation of syntactic reductionism in Gustafsson's theory. Gustafsson gives absolute priority to syntax (grammar), which leads to an oversimplified understanding of both machines and language. To argue this point, Liu cites Chomsky's famous example: "Colorless green ideas sleep furiously." This sentence is syntactically perfect, yet it is semantically meaningless. This powerfully demonstrates that syntactic correctness alone does not guarantee comprehensibility; semantic correctness is equally essential. Therefore, Liu firmly argues that understanding language – and by extension, machines – is fundamentally a hermeneutic practice. This practice must simultaneously integrate three dimensions: syntax, semantics, and pragmatics. If any one dimension is missing, misunderstanding is inevitable.

Karina Vida's *Language After the Human – A Distant Echo to Lars Gustafsson's 'The Machines'* brings this discussion into the contemporary context. She views Gustafsson's discourse on "external language" as a profound echo to the current linguistic crisis sparked by generative AI (Vida, 2025). Vida's analysis begins with the evolution of the concept of the "machine" itself. Gustafsson was concerned with obsolete, massive, and even "homeless" industrial machines. These machines possessed a kind of honest mechanical nature. In contrast, our machines today are small, anthropomorphic interfaces, such as Alexa or Siri on our phones. They are, as she notes, "in keeping with our age" because of how human-like they are. Vida's core argument is that Gustafsson's grammar machine was "secretless," whereas modern AI is a "pretender." The text generated by AI is based on probability; it does not originate from a human intentional act. This means that although a machine can "speak," it lacks authentic experience, internal needs, active will, and a physical body. This ability to "pretend" has triggered a deep existential crisis. The capacity of machines to fluently generate language threatens to diminish the value, weight, and emotional resonance of human writing. Facing this linguistic flood caused by AI, Vida concludes with a call to action: human authors must re-establish the unique value of human writing by adhering to authorial intent, exercising critical judgment, and upholding ethical responsibility.

In conclusion, the articles in this special issue all point to one core insight: The "machine" is always entangled with "language," whether it is shaping gender identity, executing the logic of capital, or generating cultural meaning. Every innovation in technological discourse challenges, reshapes, and ultimately enriches our humanistic thought. In the future symphony composed by humans and machines, we are listeners, critics, and indispensable co-creators. We therefore would like to conclude with Goethe's famous words on poetry:

Poetic content, however, is the content of one's own life; no one can give it to us. They may obscure it, but they cannot cause it to wither. Everything that is vanity, that is, self-satisfaction without foundation, will be treated more harshly than ever before. (Goethe, 1963, p. 361)



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Research article

The Gendered Language of Technology

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Abstract

The aim of this article is to examine the partly unquestioned notions of how to ask about technology use and gender in a socio-cultural historical community of the 1950s-1980s with a focus on education. For in this defined historical and systematic framework, the connection between technology - language - gender, which is central to industrialized nations, becomes apparent for the first time. Accordingly, two problematization discourses come into particular focus: 1) Historically: How have different meanings of gender and technology manifested in Western discourse in the 20th century and thus continued into the present? 2) Philosophically: How have self-perceptions of gender in individuals been shaped by technology-related language? Where can we recognize interpretative sovereignties in the linguistic images and terminologies and what are the conditions and premises for this? Without the perspective on scientific history, philosophy and continuity, the current digital gender gap, as decidedly highlighted by the D21 initiative, cannot be understood and problematized in its complexity and historicity. The aim is to use a dual approach to contextualize and reflect on ideas of technology and gendered characteristics in linguistic images, as otherwise 1) language determines our approach to technology too hastily and 2) language can only be used in a standardized way. Self-attributions of actors in technology-related language images are historically contingent and systematically processed. Language use can become as a self-fulfilling prophecy and manifest (self-) conceptions such as “women understand less about technology” or “women cannot use technology” and thus expose people and entire groups to discriminatory social practices.

Keywords: Gender; Language; Quantification; Computer education; Gender gap

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Научная статья

Гендерный язык технологий

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Аннотация

Цель данной статьи – рассмотреть частично не подвергавшиеся сомнению представления о том, как исследовать использование технологий и гендер в социокультурном историческом сообществе 1950–1980-х годов, уделяя особое внимание образованию. В рамках этой определенной исторической и систематической модели впервые становится очевидной связь между технологиями, языком и гендером, которая является ключевой для индустриальных стран. Соответственно, особое внимание уделяется двум дискурсам проблематизации: 1) Исторически: как различные значения гендера и технологий проявились в западном дискурсе в XX веке и, таким образом, сохранились в настоящее время? 2) Философский аспект: как язык, связанный с технологиями, повлиял на гендерное самовосприятие людей? Где мы можем распознать интерпретационный суверенитет в языковых образах и терминологии, и каковы условия и предпосылки для этого? Без учёта научной истории, философии и преемственности современный цифровой гендерный разрыв, как это решительно подчеркивается инициативой D21, невозможно понять и проблематизировать во всей его сложности и историчности. Цель состоит в том, чтобы использовать двойной подход для контекстуализации и осмысления идей технологий и гендерных характеристик в языковых образах, поскольку в противном случае 1) язык слишком поспешно определяет наш подход к технологиям и 2) язык может использоваться только стандартизированным образом. Самоатрибуция акторов в языковых образах, связанных с технологиями, исторически обусловлена и систематически обрабатывается. Использование языка может стать самоисполняющимся пророчеством и манифестом (само)концепций, таких как “женщины меньше разбираются в технологиях” или “женщины не умеют пользоваться технологиями”, и, таким образом, подвергать людей и целые группы дискриминационным социальным практикам.

Ключевые слова: Гендер; Язык; Количественная оценка; Компьютерное образование; Гендерный разрыв

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THE DIGITAL GENDER/LANGUAGE GAP

One of the largest non-profit networks for the digital society, consisting of business, politics, science and civil society, Initiative D21, presented a study on the digital gender gap in January 2020, radically revealing the problem of gender and digitalization: There are serious differences between men and women in terms of access to digitalization, usage behaviour, skills and openness to technology. Even if it is not possible to speak of the woman as a collective singular with regard to socio-demographic aspects such as age, profession, education and place of residence, the study by Initiative D21 clearly shows that in all age groups and social classes, women are the “digital outsiders” in percentage terms, while men are the “digital pioneers” (Initiative D21, 2020). A closer look at the methodological approach of the study reveals that this result is based on statistical data collection, which is mostly carried out using questionnaires. The data therefore is based on external attribution and self-attribution of skills and traits realized through language.

The study was not so much about observing specific actions or skills in the field of technology. Rather, self-assessment, external attribution and meanings of gender-typical characteristics of technology use were queried in the empirical setting of the questionnaire. The answers were then labeled according to certain gendered terms and concepts. These self-assessments are expressed by the respective answers of the men and women surveyed in the study. The men and women use specific terminology for themselves and others when dealing with technology. This conveys the image of a fixed reality that is always based on language. Of course, this in no way means that the gender gap is only constructed or even fictitious, but rather that the gender gap is consolidated and reproduced by certain linguistic images and biases that are inscribed in the questionnaires and narratives, because they contain preconceived (mostly male) ideas of “technology” and “gender.”

Language not only determines our socio-economic world, but also our technical world (Nordmann, 2020). At the same time, our language is becoming increasingly technical. We speak of information, gene codes, likes, values, feedback, performance, etc. (Kay, 2000). The above example illustrates the problem that this technical language not only has an ontological and anthropological level, but also a gendered level. Technical language (semantics, images, metaphors) only addresses certain individuals and not others. The combination of language and technology leads to the exclusion of non-male subjects.

The aim of this article is to examine the partly unquestioned notions of how to ask about technology use and gender in a socio-cultural historical community of the 1950s-1980s with a focus on education. For in this defined historical and systematic framework, the connection between technology - language – gender, which is central to the Western world, becomes apparent for the first time. Accordingly, two problematization discourses come into particular focus: 1) Historically: How have different meanings of gender and technology manifested themselves in Western discourse in the 20th century and thus continued into the present? 2) Philosophically: How have self-perceptions of women and men been shaped by technology-related language? Where can we recognize interpretative sovereignties in the linguistic images and terminologies and what are the conditions and



premises for this? Without the perspective on scientific history, philosophy and continuity, the current digital gender gap, as decidedly highlighted by the D21 initiative, cannot be understood and problematized in its complexity and historicity.

The aim is to use a dual approach to contextualize and reflect on ideas of technology and gendered characteristics in linguistic images, as otherwise 1) language determines our approach to technology too hastily and 2) language can only be used in a standardized way. Self-attributions of actors in technology-related language images are historically contingent and systematically processed. Language use can become as a self-fulfilling prophecy and manifest (self-) conceptions such as “women understand less about technology” or “women cannot use technology”) and thus expose people and entire groups to discriminatory social practices.

The historically established self-assessments and attributions can only be adequately reflected upon and criticized if they are historically contextualized and philosophically reflected upon regarding technologized language. The dual approach of the present project therefore focuses on the genesis and validity of the instrument “language.” The effectiveness of historical attributions must be demonstrated by particularly analyzing definitions and narratives inside technology discourse, some of which change and some of which remain constant. We have chosen schools as an analytical framework, as technology use is still linguistically gendered and quantified in schools and secondary education today. By deconstructing language in its historical contingency and its gender-specific attributions, one can fundamentally foster new ways of speaking and thus create gender-sensitive role models for technological competencies. This article thus attempts to point out the genderedness of technology education and reflect upon alternative approaches to tackle the disadvantage of girls and women. Historical critique yields productive philosophical impulses for thinking new gender-diverse role models that imagine a technologized world beyond the (gender) binary.

This paper therefore highlights in which ways a strong cultural gendering of technology as male came to be and how it contributed to women being denied access both educationally and socially, especially in the context of West German schools shortly after the introduction of the computer in education (cf. Steber, 2010, p. 125; cf. Faulstich-Wieland & Dick, 1989, pp. 37-39; 40). On the other hand, the paper will elaborate on how gendered binary self-images of male and female actors have been reproduced by specific uses of technology and stabilized through curricula (cf. Morgan, 1996, p. 119; cf. Rosenbichler & Vollmann, 1991, p. 20; cf. Zinnecker, 1975; cf. Weidenmann & Krapp, 1989, p. 631), while casting aside gender experiences and expressions beyond the binary.

Regarding the procedure, we begin with the state of research around gendered language practices regarding technology. Following this, we give some important definitions of terms and the presentation of our analytical framework. In the following section, we will then give an overview of gendering through and the genderedness of language in technology discourse before moving on to the relation of gender and technological semantica in the 1970s and 1980s. Therefore, we will present empirical gender social research by researchers such as Jürgen Zinnecker and Hannelore Faulstich-Wieland and Anneliese Dick and contrast it with the discourse of technophobia and techno-distance. Both these terms are central to the connection to the gendering of



technology-related language. Finally, we will discuss the scientific validity of the perceived female technophobia and techno-distance from a discourse-historical perspective.

DEFINITION OF TERMS: GENDER, LANGUAGE, AND TECHNOLOGY

One of the terminological cores of our analysis is the concept of gender. There are a multitude of approaches and theories around gender and sex. Gender and sex are now used synonymously, but many prefer gender as sex has a connotation related to a strictly biological connotation. It is contested whether a differentiation between sex and gender is even useful (see Smith 2010, p. 331; see Butler, 1993). Gender is therefore a category that is constructed on various levels from self-perception as well as external attributions, connotations, historically grown expectations and the actions of subjects. These processes construct a gender identity (cf. Herwartz-Emden & Braun, 2010, p. 231; cf. Paulitz et al., 2015; cf. Faulstich-Wieland et al., 2004; cf. Butler, 2019). In this respect, gender roles and self-perceptions emerge in interaction with a subject's environment. Belief systems, role expectations and socialization (family, education sector, media, peers) play a crucial role in this (Herwartz-Emden & Braun, 2010, p. 231). When children enter the school system, usually via elementary school, they experience “explicit and implicit expectations of gender-typical behavior” (Herwartz-Emden & Braun, 2010, p. 231, translated by us). However, families and the personal environment already intervene in the gender concept and impose their own expectations on a child, which makes life a gendered experience from the moment a subject's gender is declared after birth. The school system tends to reinforce gender knowledge that has already been taught and learned at home. In our work, we assume that gender and gendering/genderedness are fed by various social, interactional, historical, performance-related, linguistic and historically evolved ideas of what constitutes gender. Gender is therefore to be understood as a co-constructed concept of identity (cf. Oudshoorn & Pinch, 2003).

From a discourse-theoretical perspective, we understand language as a historical knowledge formation and dispositif (Foucault, 1977/1980, 2004). The language used shows what was historically speakable in the respective knowledge formation. Language is a formation system of knowledge segments. The epistemes, which are the subject of our discussion, are understood as a strategic dispositif that allows to filter from among all possible statements those that are acceptable within the discursive constraints – by this we don't necessarily mean scientific theory, but the creation of a certain scientificity based on which statements of truth or falseness are made. The episteme is the dispositif that allows us to distinguish not only between truth and falseness, but scientifically qualifiable from unqualifiable information (Foucault, 1980).

We want to understand language precisely as a “dispositif” because, according to Giorgio Agamben, the “dispositif” itself represents a heterogeneous totality which includes everything imaginable, whether linguistic or non-linguistic: discourses, institutions, buildings, laws, police measures, philosophical tenets, etc. (Agamben, 2009, p. 14). The power of the respective dispositif lies in seizing, directing, determining,



inhibiting, shaping, controlling and securing the gestures, behavior, opinions and speech of living beings.

When we talk about technology, we don't want to reduce it to individual things like computers; rather, technology forms networks, systems, or interconnected artifacts. As a rationalized and objectified form of problem-solving, technology was and remains a central element of social practice and, since at least the middle of the 20th century, has been instrumental in the constitution of the social sphere and thus gender (Oudshoorn & Pinch, 2003). *Homo faber* is closely linked to *homo* (etymologically understood as “man”).

In Western androcentrism, the term “technology” encompasses both the skillset and knowledge about technical artefacts, thus implying an interdependent relationship of theory and practice. The compound term “technology” particularly shows how rationality, technology, and gender are intertwined, since rationality and *logos* in particular have historically had masculine connotations. Thus, as Fox Keller writes, there is the “widespread and deeply rooted superstition that portrays objectivity, reason, and spirit as masculine, and subjectivity, emotion, and nature as feminine” (Fox Keller, 1986, p. 13). “Technization” generally refers to “the spread of available techniques and technologies in social systems” and is thus closely linked to quantification and rationalization. Moreover, the terminological division into “hard” and “soft” sciences further proves this point of making up gendered dichotomies to categorize and hierarchize knowledge (cf. Paul & Wenk, 2020, p. 232). The measurable, “hard” sciences, which have male connotations and are often entrusted with machines, were thus given a higher status and taken with greater seriousness.

THE GENDERED LANGUAGE OF COMPUTER USAGE

As the history of science has been able to demonstrate since the debates on “science in context” (Shapin, 1996), knowledge does not exist in a vacuum but is determined by its historical context and therefore political. Ideas about gender have been cemented in research over the centuries. They have had an impact on our lives, which have been increasingly mechanized and computerized since the 1950s. Even though women always participated in the computerization of the world (for example, the “ENIAC girls”), they were usually denied the influence or importance of their work and/or their (primarily male) surroundings failed to mention their intellectual labor and contributions. This process was always also about the power relationship of naming. Whoever controlled the terminology controlled the discourse. The men were the signifiers, the women the signified. In the 1950s programming was considered “women's work” (see Terras & Nyhan, 2016). Men in the computer industry preferred to deal with hardware whereas women were mostly employed as “operators” or “assistants” at the keyboard of the “computer” – a term that even at the beginning was still used pejoratively for women as assistants for calculations. Programming was considered “clerical work” whereas the machine itself was perceived as a male domain (cf. Wajcman, 1991, pp. 29, 31-33).

During the software boom in the 1980s, the interest in software development and programming, which had previously been dismissed as simple “women's work”,



increased drastically and was thus upgraded to an occupation of expertise while also becoming economic, epistemological and linguistic increasingly male-dominated and male-centered. This reflects the contingency of gendered ideas in society. In this case, it demonstrates how gendering as a powerful language instrument corresponds to market economy interests and dynamics.

In addition, the lack of gender-sensitive language theories in the 1950s and 1960s brought about the issue that women had very little confidence in their technological skills in the decades after WWII.

For our analysis we want to focus now on the topic of technology education and the extent to which gendered language and terminology have an impact on the gendered and cognitive performance-related self-perception and external perception of learning subjects throughout recent history. Education is an institutionalized form of directed learning and is usually practiced based on curricula. Curricula are not just written down instructions, but also contain ideology-driven ideas about intelligence, health, biology, gender and sexuality. In educational research, the term “hidden curriculum” was coined in 1968 by US researcher Philip W. Jackson and then adopted in German educational discourse under the term “heimlicher Lehrplan” (e.g. in Zinnecker, 1972 and Zinnecker, 1975). This concept entails the favoring of boys’/mens’ areas of interest, giving them an advantage in terms of language and knowledge (cf. Ranftl-Guggenberger, 1991, p. 196). By virtue of prior knowledge through encouragement from families, boys convey a higher level of competence and intelligence and are in turn affirmed by teachers in their knowledge-level and self-confidence (Ranftl-Guggenberger, 1991, p. 196). Boys speak the technical language that is required for exams or other schoolwork. At the same time, they identify themselves as speakers and founders of discourse in this technical language. Minority groups such as girls and women, people with disabilities and immigrants are usually disadvantaged. The fact that teachers classify and evaluate pupils according to language attributions has been highlighted in the context of the “hidden curriculum”.

TECHNOLOGY EDUCATION, TECHNOLOGIZED LANGUAGE AND GENDER IN THE 1970s AND 1980s

One of the first researchers in the German-speaking world to deal with the construction and history of gender role expectations by educational institutions was the education researcher and social pedagogue Jürgen Zinnecker. He made use of an interdisciplinary approach and researched childhood, youth and school (cf. Büchner & Zeiher, 2011, p. 1). In his work, he interpolated axioms of childhood pedagogy with feminist theory and psychology (p. 2). When he began his research in the 1970s, pedagogy in German-speaking countries was dominated by North American pedagogical approaches (cf. Mey, 2001, p. 7), first by behaviorism, then by cognitive psychology (cf. Epler, 2013; cf. Lück, 2009, pp. 80, 117, 179). In 1972, Zinnecker published “Emanzipation der Frau und Schulausbildung,” a work that was widely received in educational science. In it, he examines the educational situation of girls and women in terms of their education opportunities from a Marxist-feminist perspective, making him the first person in West Germany to approach this problem from this viewpoint (cf.



Zinnecker, 1972, p. 30; cf. Faulstich-Wieland et al., 2004, p. 9). For Marx, language is an important characteristic of human societies. For him, its significance lies in the fact that people form their understanding of their world and themselves in language. At the same time, language takes a back seat to physically productive activity and its social organization; it is subordinate and dependent. „Die Ideen werden nicht in der Sprache verwandelt, so dass ihre Eigentümlichkeit aufgelöst und ihr gesellschaftlicher Charakter neben ihnen in der Sprache existierte, wie die Preise neben den Waren. Die Ideen existieren nicht getrennt von der Sprache.“ (Marx, 1953, p. 80)

In “Emanzipation der Frau und Schulausbildung” (1972), Zinnecker compiles an empirical and historical meta-study to demonstrate how gender and genderedness are co-constructed and reproduced in the world of education and technology. Zinnecker's sources are strongly oriented towards surveys (e.g. UNESCO; cf. Zinnecker, 1972, p. 49) as well as data and statistics collected on women, e.g. female students, trainees and pupils (pp. 50–60; 66–82; a comprehensive summary of various studies can be found on pp. 115–117 and p. 119, as well as on the evaluation behavior of teachers cf. pp. 125; 128). The data he examines in his meta-study is from the Weimar Republic, the Federal Republic of Germany, the German Democratic Republic, Austria, the United States, Great Britain and the Netherlands. Zinnecker researched how teachers display gender-specific language assessments of boys and girls (p. 119; 128), transfer and graduation rates by gender (p. 115–116), socio-economic background (class) (p. 156) as well as career, training and promotion prospects (p. 213). Zinnecker sees a preference for girls with “inconspicuous behavior”, which is positively confirmed by the social environment and leads to restraint in learning situations, thus disadvantaging them, especially in regard to the social demands of the job market (p. 226).

In addition, men were encouraged to pursue technological education and professions, while women were expected to follow socially and care-oriented career paths (Zinnecker, 1972, p. 217). This made it difficult for them to detach themselves from the reproductive role to assert themselves on the labor market and in science and demanded adaptation to “masculine” behaviors and language, which were not allowed to conflict with the expectations of femininity (pp. 178–180). This “social character for its part is a reified expression of the prevailing division of labour between the sexes”, according to Zinnecker (p. 203, translated by us). He points out how the gender-related division of labor as a capitalist dynamic affects the educational context (pp. 203–208).

This is manifested through narratives of the (supposed) “nature” of women and men that are enshrined in the (hidden) curriculum (cf. Zinnecker, 1972, pp. 83–91). In “Emanzipation der Frau und Schulausbildung”, Zinnecker questions narratives of gender essentialisms and considers them to be justifying the dynamic of capitalism.

TECHNOCAPITALISTIC LABELING: “TECHNO-DISTANCE” AND “TECHNOPHOBIA”

In the 1980s, the home computer boom allowed middle and higher income households to buy computers at affordable prices (cf. Haefner et al., 1987, pp. 28; 64). Lower-income households often shared a single computer if they possessed one, which



had a negative effect on familiarity with computers and reinforced differences (p. 23). The self-perception of girls regarding technology, which problematically was labelled as “techno-distance” and/or “technophobia” in educational discourse, is also reflected in the choice of training and study subjects: from the post-war period until the late 1980s women tended to focus on caring, bureaucratic or manual professions and were (and still are) involved in domestic, caring and educational tasks that are mostly invisible and unpaid (cf. Böhmer, 2017, pp. 64, 97). Meanwhile, men dominated technical subjects, universities and entire fields of research as well as language and labeling. These labels have always been associated with socio-economic hierarchies and pay gaps. Despite being overqualified, many women opted more frequently for “typically female professions, which are both less well paid” and more precarious (Paseka, 1991, p. 165, translation by us; cf. Ranftl-Guggenberger, 1991, p. 191) and trusted each other’s technological skills less (cf. Zwick & Renn, 1998, p. 63).

How language creates the world and self-awareness, but also socio-economic structures, is well illustrated by the example of the terms “technophobia” and “techno-distance”. During the increasing computerization of the 1980s, both terms emerged in the technology and education discourse. It was postulated both in newspapers and in research that many women had a fear-based, distanced or uninterested attitude towards technology (cf. Haefner et al., 1987, p. 209; cf. Kahle, 1989, p. 96; cf. Schelhowe, 1999, p. 50 and Baumert, 1992, p. 83 for a problematization; Ranftl-Guggenberger, 1991 for an overview of Austria). The term “Technikdistanz” implies an (inherent) distance between women and computers. As has been previously shown, the reasons for this don’t lie in some supposed essence of women, but in their socialization and lesser access to computers than men. Distances created by predominantly male in-groups in relation to technology, in particular around the computer, create linguistic demarcations to laymen, which further play into what is negotiated as “distance from technology” in women (cf. Haefner et al. 1987, p. 273) and reinforces prejudices.

For various reasons, computer science in particular has been a male-dominated field of research since its inception (cf. Haefner et al. 1987, p. 209). For example, Haefner et al. argue that men tend to think rationally, while women tend to think verbally, thus explaining men’s preoccupation with rationalization processes through machines (p. 209). The authors go on to say that women are aesthetic-minded beings by nature and therefore have less interest in technology and a greater distance to technology. They state that women in information technology have often been assigned the “waste product[s] of male work” (p. 210). Despite recognizing these dynamics, the authors fail to mention the interdependence of these circumstances. Instead, they read an essentialist interpretation out of the technical disadvantage of women and thus exemplify the technology education discourse of the 1980s.

This example showcases how an essentialization of the presumably “different” relationship between women and technology was generated with specific language choices and narratives in scientific discourse. Some authors argue on an emotional-psychological level by postulating a fear of failure, embarrassment and/or contact with technical devices among women as well as an overtly critical stance towards technology (cf. Kahle, 1989, p. 96; cf. Haefner et al., 1987, p. 209). In addition, the essentialization



of certain supposed fears and familiarities entails a reinforcement of biological binarization, which implies a determinism between learning certain skills and gender and displaces learning subjects who deviate from it from the educational and technological discourse. To conclude, the term “Technikangst” is a discursive representation of gender binaries in the 1980s technology discourse, creating a rift between learning subjects and upholding the idea of male expertise in technology whilst pathologizing women’s experiences and self-perceptions in a domain that has been historically male-exclusive and misogynist.

GENDER-AWARENESS AS LANGUAGE-AWARENESS

However, even in the 1980s there were critical and reflective studies on the self-description and external description of female and male actors in the use of technology. Methodologically and epistemologically, a study by Hannelore Faulstich-Wieland and Anneliese Dick should be emphasized here. Their study illustrates the educational context of gender and technology in the 1980s. “Mädchenbildung und neue Technologien” (1989) is both a gender- and language-sensitive educational study and the final report for a development project that was commissioned by the Ministry of Education and Cultural Affairs of the State of Hesse (HIBS) to teach pupils how to interact with new media in a reflective and critical manner (Faulstich-Wieland & Dick, 1989, p. 1). The study was conducted with eighth graders at two Frankfurt comprehensive schools and employed surveys, protocols, statistics, interviews and testing teaching concepts. The pupils were observed and questioned about their gender-related behavior in relation to mono- and co-educational computer-based lessons. The researchers were interested in how the school environment affects technical use and technological self-confidence between the genders as well as the differences between mono- and co-educational learning scenarios.

Gendered language use begins in childhood and is manifested in everyday school life. As Faulstich-Wieland and Dick (1989) demonstrate in their extensive study of various classes over a span of three years, most of the gendering in school takes place in linguistic practices. For example, boys frame themselves as technology experts while devaluing their female classmates. Therein, Faulstich-Wieland and Dick showcase how narratives of gender hierarchies and domination pervade in education practice.

Despite having computer skills, girls were more likely to verbalize gaps in their knowledge than boys, who in turn were more self-confident with the same level of knowledge (Faulstich-Wieland & Dick, 1989, p. 18). According to the surveys, female pupils assumed that boys were more computer-literate and reported discrimination by male classmates (p. 33). Girls also interpreted gender segregation (mono-ed) in computer-based lessons as an implication of lower computer skills. These factors had a structurally negative effect on female pupils (p. 26). Faulstich-Wieland and Dick conclude from this that gender-segregated lessons sometimes may provide a safe framework for experimenting with computers, but that the separation can also reinforce prejudices (p. 39). However, gender-neutral measures could also (re-)produce disadvantages by making them invisible (p. 1). According to the impression of the study, the prejudices lie mainly with the male pupils who, on the one hand devalued their female classmates and declared



them incapable, but on the other hand also felt a certain threat that the girls could catch up in a gender-segregated computer course and become competition (p. 38f).

The study found that girls felt a greater inhibition to pursue computer and information technology education (Faulstich-Wieland & Dick, 1989, p. 55). In some cases, they had internalized hegemonic male narratives that prevented them from using computers and lead them to regard computers as a male domain, which in turn affected their choice of subjects (cf. p. 70). In the study, some boys judged girls as “Weiber” (Pejorative term for “woman”), “unfähig” (incapable/incompetent), “dumm” (stupid) and “nur zum Kinderkriegen [geeignet]” (only fit for childbearing) when it came to computer use (pp. 20, 37–39). The latter pupil quote is an impressive example of the connotation of femininity with the ability of reproduction. The devaluation of girls led to low self-confidence in computer-related subjects (p. 21). Female teachers in technical and scientific subjects were also verbally discriminated against as pupils had less trust in and lower expectations regarding their abilities (p. 63).

Faulstich-Wieland and Dick partially refute the widespread assumption at the time that girls were inherently uninterested in technology and computers: instead, they highlight that many girls in the 1980s wanted computer access but were put off or discouraged by their environment and the technology-related language that denied them the competence to use technology. The researchers find that girls are more likely to cooperate and teach each other technical skills quickly. Studies like theirs show that female learning subjects rely on mutual, informal solidarity structures to progress in their learning. At the same time, in co-educational contexts they often experience devaluation from male peers, which is not always addressed by teachers or caregivers (Faulstich-Wieland & Dick, 1989, pp. 20; 37–39). In mono-ed lessons, as girls caught up on the rift between their and the boys’ technology use, they developed a greater self-sufficiency regarding computer use, thus changing their self-perception and linguistic use of gendered technology frames. Faulstich-Wieland and Dick illustrate the importance of access and spaces for cooperative work with computers as well as teachers who take on a gender-sensitive model of teaching and speaking and function as role models employing a media-critical approach to computers.

CONCLUSION: IN SEARCH OF A NEW LANGUAGE IN A TECHNOLOGICAL WORLD

Current studies such as the D21 initiative demonstrate how strongly the digital gender gap is shaped by self-assessment, role models, and stereotypes. Social attributions (girls enjoy reading, boys play sports and are interested in technology and computers) have become enormously powerful, particularly regarding digitalization, and have become reality in the sense of a self-fulfilling prophecy (Fraillon et al., 2014). This article demonstrated how language creates a certain desired social reality, manifesting patriarchal power structures. Patriarchal social practice has shaped self-assessments regarding technology use and learning opportunities in schools as early as the 1970s, when computers were first introduced into learning environments, through androcentric labeling and narratives, as well as male-favoring language which in turn determines and



limits women's technology knowledge horizons. Building on this, various studies from the 1990s onwards show the unsurprising result that women tend to focus on traditional 'women's jobs' when choosing careers, even when they demonstrate above-average technical skills that would, in principle, open up a broad range of career opportunities. In this context, it is particularly important to question the dispositif of technological language, which plays a prominent role in all studies, because language

1) historically reveals a certain scientification of social observation, which in turn, especially in the 20th century, provides supposedly “objective facts” for social and political decision-making processes.

2) This historical problem also gives rise to a philosophical problem, namely that language is technically standardized, appeals to certain actors and encourages them to participate in discussions more than others.

As has been shown in this paper, numerous historically evolved notions of gender and associated gendering affect the technological learning and educational potential of girls and women. Social, curricular, political, financial and accessibility factors influence the language and with this the reality of learning to use computers, while media and research discourses are spun in which women are blamed for their own late inclusion into technological education, for example by attributing to them an inherent fear of technology. As noted at the beginning, there is a constant hierarchization in terms of gender. Similarly, the West German education system has inscribed binary and essentialist notions of gender, from cognitive performance to the operation of computers, and according to our observations so far, continues to promote these. Furthermore, non-binary or inter learning subjects do not take place at all, presumably because schools demand certain forms of gender socialization and learning subjects tend to behave according to expected roles in order to avoid disadvantages. In her famous Cyborg Manifesto, Donna Haraway showed that new technology makes it possible to find a new language beyond binary coding and the constant creation of dichotomies to imagine the potential of humanity through means of technology beyond restrictive ideas of gender. Perhaps the problem does not lie purely in technology, as technology-critical thinkers would have us believe, but in the androcentric notion of technology.

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Research article

The Dialectics of Labour, Machinery, and Capital – An Interpretation Centered on Marx’s *Notes on Johann Beckmann II* and *Capital*

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Abstract

The historical essence of machinery and of its capitalist application, along with the dialectics of labour, machinery, and capital, has always been a crucial subject in Marx’s critical theory of capitalism. In “Beiheft C” (1863) Marx compiled excerpts from *A History of Inventions* by the German technologist Johann Beckmann. Beckmann’s account of the dual social impact of machinery during the manufacturing period, particularly his historical narrative of workers’ intense struggles against machinery, brought Marx to confront the so-called “Beckmann Dilemma”: How are the primordial dual aspects of machinery possible? Within the overarching framework of historical materialism and the critique of political economy, Marx progressively deepened his theoretical perspective and intellectual logic for resolving the “Beckmann Dilemma” in the *Economic Manuscripts of 1861–1863*. There he examined themes such as the relationship between machinery and wages, as well as machinery and primitive accumulation. In *Capital*, Marx comprehensively revealed the historical logic and essential laws governing machinery and its capitalist deployment, correctly distinguishing between machinery as such and its capitalist deployment. He exposed the determinate social forms of machinery and its emancipatory potential, while profoundly clarifying the real essence of the contradiction between workers and machines and proposing the corresponding strategies of struggle – thereby achieving both a scientific resolution and a fundamental transcendence of the “Beckmann Dilemma.” The excavation and critical analysis of Marx’s and Beckmann’s theories of machinery will provide valuable insights for reflecting on contemporary human-machine relations in the era of digital intelligence.

Keywords: Marx; Johann Beckmann; Machinery; Technologie; *Notes on Johann Beckmann*; *Capital*

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Научная статья

Диалектика труда, машин и капитала – Интерпретация, основанная на “Записках Иоганна Бекмана II” Маркса и “Капитале”

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Аннотация

Историческая сущность машин и их капиталистического применения, наряду с диалектикой труда, машин и капитала, всегда были важнейшей темой в критической теории капитализма Маркса. В книге “Beiheft C” (1863) Маркс переработал отрывки из истории изобретений немецкого технолога Иоганна Бекмана. Рассказ Бекмана о двойственном социальном воздействии машин в период промышленного производства, в частности, его историческое повествование об ожесточенной борьбе рабочих против машин, поставили Маркса перед так называемой “дилеммой Бекмана”: Как возможны изначальные двойственные аспекты машин? В “Экономических рукописях” 1861-1863 годов Маркс, опираясь на всеобъемлющие принципы исторического материализма и критику политической экономии, постепенно углублял свою теоретическую перспективу и интеллектуальную логику решения “дилеммы Бекмана”, исследуя такие темы, как взаимосвязь между машинами и заработной платой, а также между машинами и первоначальным накоплением. В “Капитале” Маркс всесторонне раскрыл историческую логику и основные законы, управляющие техникой и ее капиталистическим применением, правильно проведя различие между техникой как таковой и ее капиталистическим внедрением. Он раскрыл специфические социальные формы машинного производства и его освободительный потенциал, глубоко прояснив при этом реальную суть противоречия между рабочими и машинами и предложив соответствующие стратегии борьбы, тем самым достигнув как научного разрешения, так и фундаментального преодоления “дилеммы Бекмана”. Изучение и критический анализ теорий машинного оборудования Маркса и Бекмана даст ценную информацию для размышлений о современных отношениях между человеком и машиной в эпоху цифрового интеллекта.

Ключевые слова: Маркс; Иоганн Бекман; Техника; Технология; “Заметки Иоганна Бекмана”; “Капитал”

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INTRODUCTION

It remains one of the crucial questions for inheriting and developing Marx's critique of capitalism how to properly understand the social effects and historical essence of machinery in the formation and development of the capitalist mode of production. Marx's excerpts from and usage of Johann Beckmann's *A History of Inventions*, as well as his intellectual journey centered on the “Beckmann Dilemma”, provide us with a paradigmatic micro-perspective for examining Marx's exploration of this question. In a letter to Engels on January 28, 1863, Marx noted: “I am inserting certain things into the section on machinery. There are some curious questions which I originally failed to deal with” (Marx & Engels, 2010d, p. 449). This indicates that beginning in January 1863, Marx returned to his research on the historical development of machine and technology and their socio-historical impacts. In doing so, he not only reorganized the extensive notebooks about technology and political economy which he had compiled in an earlier phase, but also re-examined and supplemented excerpts from numerous works he deemed of paramount importance. According to the research by Artur Schnickmann, editor of the MEGA²(second Marx-Engels-Gesamtausgabe), during May and June 1863, in the later stages of writing the *Economic Manuscripts of 1861-1863* (hereafter just the *Manuscripts of 1861-1863*), Marx compiled eight notebooks titled *Beihefte*, labeled with letters “A” to “H,” in order to further collect and supplement materials on political economy and *Technologie*. This group of texts totals 786 pages, with nearly 700 pages dedicated to political economy issues that are drawn from over 150 works (Schnickmann, 1979). Among these, Marx excerpted from Johann Beckmann's *A History of Inventions* (1780-1805) in “*Beiheft C*”. All these excerpted materials were subsequently used by Marx in *Notebooks XXI-XXIII* of the *Manuscripts of 1861-1863*.

Johann Beckmann is recognized as a pioneering figure in 18th-century German technological science (*Technologie*) and commodity science (*Warenkunde*). His works on *Technologie*, in conjunction with those of his student J. H. M. Poppe, provided Marx with crucial theoretical resources for understanding the history of technological inventions during the periods of handicraft and manufactures, as well as the resulting transformations in the labour process, material modes of production, social relations, and ideological conceptions. During his work on *Notebook XV* of the *London Notebooks* in 1851, Marx first briefly excerpted from Beckmann's *A History of Inventions*, which can be termed as *Notes on Johann Beckmann I*. In 1863, while composing “*Beiheft C*,” Marx revisited and expanded his excerpts from the same work, significantly broadening their thematic scope and content, which can be termed as *Notes on Johann Beckmann II*, constituting a crucial component of Marx's third study on *Technologie* conducted in the 1860s.²

² Marx's study on *Technologie* can be broadly divided into three phases: the first is the extracts from the writings of Auguste de Gasparin, Charles Babbage, and Andrew Ure in *Notebook 5* of the *Brussels Notebooks* in 1845; the second is the extracts from the writings of J. H. M. Poppe, Andrew Ure, and Johann Beckmann in *Notebook XV* of the *London Notebooks* in 1851; and the third phase is the re-examination of earlier notebooks on *Technologie* and re-excerpts from the writings of Charles Babbage, Johann Beckmann and others in the 1860s.



Until now, Marx's *Notes on Johann Beckmann II* have not yet been published in MEGA², and even the original manuscripts of the entire *Beiheft C* remains in private hands. Fortunately, the German scholar Hans-Peter Müller obtained a copy of *Notes on Johann Beckmann II* and published them for the first time, providing us an opportunity to examine the real content of this text. These materials provide us with a unique micro-perspective for understanding Marx's theoretical research, intellectual development, and working methods during this period. In particular, Marx's use of *Notes on Johann Beckmann II* in *Capital* offers us a paradigmatic case study for delving deeper into the critical perspective of political economy and the scientific method of historical materialism that Marx employed when examining the historical essence of machinery and its capitalist application.

Based on Müller's edition of *Notes on Johann Beckmann II* and situated within relevant textual sources and intellectual-historical contexts, this paper attempts to explore the issues in three aspects:

Firstly, through a textual analysis of the *Notes on Johann Beckmann II* to clarify Marx's focal problematic and theoretical intentions at this stage, analyzing the crucial theoretical challenge posed to Marx by Beckmann's account of the dual socio-economic effects of machinery, which could be designated as the "Beckmann Dilemma," while highlighting the substantial theoretical limitations inherent in Beckmann's account of the history of technology.

Secondly, by contextualizing Marx's repeated engagements with the *Notes on Johann Beckmann II* in the *Manuscripts of 1861–1863*, dissecting Marx's preliminary resolution of the "Beckmann Dilemma," highlighting his philosophical methodology, shifts in theoretical perspective, and progressive logical developments.

Thirdly, through a rigorous analysis of *Capital*, demonstrating Marx's scientific solution and fundamental transcendence of the "Beckmann Dilemma," while drawing out its contemporary implications.

NOTES ON JOHANN BECKMANN II AND THE "BECKMANN DILEMMA": WHAT MAKES THE "JANUS METAPHOR" OF MACHINERY POSSIBLE?

In *Notebook XV* of the *London Notebooks* (1851), Marx only briefly summarized sections from Volumes 1 and 2 of Beckmann's five-volume *A History of Inventions* [*Beiträge zur Geschichte der Erfindungen*] (Beckmann, 1780-1805), which addressed non-productive inventions or discoveries, such as distilled spirits and tulips (Marx & Engels, 2023, p. 141). This might create the impression that Beckmann's influence was marginal compared to classical political economists and *Technologie* writers like Poppe, Andrew Ure, and Charles Babbage (Müller, 1999, p. 228). But in *Beiheft C* Marx re-excerpted in 1863 the complete five volumes of Beckmann's *A History of Inventions*. This indicates Marx's growing recognition of Beckmann's significance as a distinct theoretical resource.

The Beckman's dilemma arises from two opposing dimensions: On the one hand, the industrial application of machinery has greatly accelerated the



transformation of the mode of material production and livelihood, laying the material foundation for human development and liberation.

(1) Machinery significantly enhances the productivity of labour. For example, the ribbon-loom “can weaves 4 to 6 pieces at once,” and “using this machine, one person can easily produce more in the same amount of time than several individuals did previously” (Müller, 1999, pp. 233-234). This aspect was not addressed in the 1851 *Notes on Poppe* (Müller, 1981, pp. 79-80), as Poppe’s *History of Technology* similarly omitted it (Poppe, 1807, pp. 484-485), but Marx later focused on it specifically in the *Manuscripts of 1861-1863*.

(2) Machinery promotes the advancement of socio-economic development. Marx noted that improvements in saw-mills accelerated the rapid development of wood processing and export trade. For example, “in 1530, timber-rich Norway developed its first cutting machine [...] As a result, timber exports increased significantly” (Müller, 1999, p. 235). This indicates that a series of productivity-enhancing technological innovations had already emerged in the pre-industrial era, driving the growth of related industries and socio-economic development.

Machinery thus promotes the abundance of material means of subsistence, providing a critical foundation for human emancipation. When Marx excerpted material pertaining to the history of the corn-mill (*Getreide-Mühlen*), he first cited the poem by the ancient Greek poet Antipater of Thessalonica:

Cease your work, ye maids, ye who laboured in the mill;
sleep now, and let the birds sing to the ruddy morning; for
Ceres has commanded the water-nymphs to perform your task:
these, obedient to her call, throw themselves on the wheel,
force round the axle-tree, and by these means the heavy mill (Müller, 1999, p. 234).³

Beckmann noted that in this hymn “neither humans (*Menschen*) nor livestock (*Vieh*) are visible” (Müller, 1999, p. 229). This reveals both the mechanization of grain milling, shifting from human/animal power to natural forces, and the ancient Greeks’ optimistic view of machinery’s potential to liberate human labour – Marx directly quoted and analyzed this poem in *Capital*.

Marx then excerpted content about the economic mill (not covered in his 1851 *Notes on Poppe*), noting its adoption due to population growth and rising flour prices. The economic mill significantly improved grinding precision and output, securing material subsistence for expanding populations (Müller, 1999, p. 234). Müller observed: “The economic mill is primarily a technology born out of necessity” (Müller, 1999, p. 229). More precisely, this fact reaffirms Marx’s view that technological inventions fundamentally arise not from individual curiosity or technical logic, but from the developmental imperatives of specific socio-economic relations.

³ The English translations of these verses can be found in Johann Beckmann’s *A History of Inventions*. (Beckmann, 1846, p. 152)



On the other hand, the productive application of machinery harmed workers' interests, sparking intense conflicts between workers and machines, as well as panic and prohibitions by feudal ruling classes. For instance, the introduction of the ribbon-loom "provoked disturbances and complaints from the weavers, until the town council finally prohibited the use of this instrument [...] fearing that this invention would reduce numerous workers to beggary, the city council prohibited its use and secretly had the inventor strangled or drowned" (Müller, 1999, pp. 233-234).

When Marx excerpted content on sawmills, he again highlighted the antagonism between machinery and workers – a theme mentioned in Poppe's *History of Technology* but omitted in the *Notes on Poppe*. He noted: "In England, saw-mills had at first the same fate that printing had in Constantinople, the ribbon-loom in the Roman Empire, and the crane in Strasbourg. When attempts were made to introduce them they were violently opposed, because it was apprehended that the sawyers would be deprived by them of their employment opportunities and daily wages. For this reason it was found necessary to abandon a saw-mill created by a dutchman near London, in 1633; and in the year 1700, Houghton expressed his apprehension that it might excite the rage of the populace" (Müller, 1999, pp. 235-236).

This reveals a paradoxical real contradiction in Beckmann's historical narrative: while the productive application of machinery enhances productive powers of labour, promotes economic development and social prosperity, and liberates human labour, it simultaneously becomes labour's competitor, thus provoking the workers' struggle and then the ruling class's opposition to the new machines. Müller argues that this phenomenon reflects how technological changes since the early modern period disrupted and challenged the consensus rules established between the rulers and the ruled to maintain the stability of traditional modes of production and social structures. Here, the logic of economic gain clashed with the logic of subsistence, arousing strong opposition from those involved (Müller, 1999, S. 229). However, this seemingly reasonable explanation oversimplifies the extremely complex class relations and historical processes underlying the phenomenon, thereby obscuring the critical theoretical issues embedded within it.

In fact, the contradictory phenomenon caused by capitalist production based on machinery, particularly the antagonism between workers and machinery, had already been widely discussed in the literature of political economy and *Technologie* at that time. Why did Marx pay special attention to Beckmann's account? From the perspective of intellectual history concerning the worker-machine problem, Beckmann's narrative occupies a unique position: His argument differs from the views of Ricardo and Ure regarding the age of modern industry who acknowledged and defended the sharp opposition between workers and machines, and it differs also from Smith regarding the period of manufacturing who emphasized that machines were subordinate to the division of labour and were in harmony with workers in the sense of enhancing the well-being of the general society. In contrast, Beckmann was keenly aware of the paradoxical consequences of the initial application of machines during the period of manufacture, clearly highlighting the antagonism between workers and machines. This would undoubtedly have had a strong impact on Marx, who had been familiar with Smith,



Ricardo, Ure and others, and led to a crucial theoretical problem: How is this originary dual character of machinery possible? Here, we tentatively designate this issue as the “Beckmann Dilemma” – which, in essence, constitutes a central question in the philosophy of technology. For example, Bernard Stiegler used Janus, the two-faced god of Roman mythology who symbolized origins, as a metaphor for the two-faced nature of technology (Stiegler, 2020, p. 231).

However, Beckmann’s narrative of the history of technology and its implicit “Beckmann Dilemma” reveal major theoretical flaws of bourgeois ideology. Firstly, there is a latent techno-determinism, techno-fetishism and techno-original-sin rooted in an implicitly idealist conception of history. In Beckmann’s historical narrative, machines are treated as the sole determining factor of socio-historical development, while the antagonistic relationship between machines and labour across different spatio-temporal contexts is homogenized. This fundamentally repeats the same error committed by political economists: They just observe the abstract unity while obscuring the essential differences (Marx & Engels, 2010a, p. 23), thereby conflating machinery as such with its specific social applications, and thus lapsing into a non-historical, implicitly idealist conception of technological determinism. Based on this, Beckmann’s account of workers resisting and authorities prohibiting machinery implicitly reflects a notion akin to techno-original-sin – that is, attributing the adverse effects of machines on workers entirely to the machines themselves, as if technological inventions inherently possess an originary evil. Secondly, there is the conception of individual-heroism on machine invention. In Beckmann’s narrative, machines are portrayed as the creations of genius-like individuals, this perspective disregarding the broader historical accumulation and specific social relations that underpin these inventions. Thirdly, an implicit bourgeois standpoint permeates Beckmann’s narrative. For example, Beckmann frames workers’ resistance to machines as “mob riots,” while portraying feudal rulers’ prohibitions on machinery in a negative light.

In summary, although Beckmann had earlier perceived the two-sided nature of the machinery, he was bound by his basic position and methodology and was not yet able to correctly reveal the historical logic and essential laws underlying this phenomenon. In contrast, when Marx encountered the “Beckmann Dilemma”, he would not just stay on the surface of the problem, but would inevitably ask about its inherent laws and developmental tendencies from the perspective of historical materialism. This inquiry can be broken down into three dimensions:

Firstly, Beckmann suggested that workers opposed machines primarily because the application of machines led to unemployment or wage depression. But is this causal relationship necessarily true? What is the internal mechanism behind it? Secondly, Beckmann’s narrative demonstrates that the productive application of machinery, from its inception, universally provoked worker resistance and the repression of the ruling-class. This fact not only validates a fundamental principle of Marx’s historical materialism: transformations in the means of labour necessarily bring about changes in the mode of production and social relations, but also raises a deeper question: Is machinery inherently opposed to labour? If the answer is no, then what are the historical preconditions and root causes that lead to this opposition of humans and machines?



Thirdly, how should workers correctly understand and respond to the real effects of machinery? These three questions ultimately converge on a central issue: How can we properly understand the historical nature of machines and their capitalist applications? Marx's resolution of the "Beckmann Dilemma" simultaneously overcomes and transcends Beckmann's theoretical limitations.

THE *ECONOMIC MANUSCRIPTS OF 1861–1863* AND THE EXPLORATORY JOURNEY TO DECIPHER THE "BECKMANN DILEMMA"

As previously discussed, Marx's *Beihefte* served as preparatory materials for the theoretical issues he intended to explore. This characteristic equally applies to the *Notes on Johann Beckmann II*. Marx's repeated engagement with these *Notes* in the *Manuscripts of 1861–1863* and *Capital* were not only tied to its explicit thematic content but also instrumental to his reflections on pivotal theoretical questions. In other words, Marx deployed the *Notes on Johann Beckmann II* within the overarching framework of his critique of political economy. Therefore, by analyzing the specific contextual applications of the *Notes* in the *Manuscripts of 1861–1863*, we can trace the foundation of scientific methodology, shifts in problematics, and logical progression of thought of Marx gradually cracking the "Beckmann Dilemma."

Firstly, Marx sought to address the "Beckmann Dilemma" by employing the method of "from the abstract to the concrete", that is, to transcend the narrow logic of *Technologie* narratives and to situate the problem of machinery's capitalist application within the broader socio-economic context. Specifically, while drafting the *Manuscripts of 1861–1863*, Marx routinely appended thematic indices to the inside front cover of his notebooks. For *Notebooks XXI–XXIII*, he added a "List of Excerpted Works" to mark their usage in the manuscripts. For instance, in the "List of Excerpted Works" of *Notebook XXIII*, Beckmann appears as an independently noted author under the 19th item (Marx & Engels, 2010b, p. 476). Crucially, the contextual placement of the item "Beckmann" reveals Marx's methodological intention: he grouped Beckmann with Smith's labour theory of value, Malthus and Ensor's theories of population, Sismondi's theory of commercial wealth, as well as Dudley North's theory of merchant capital. This collocation demonstrates Marx's effort to disclose the historical enigma of capitalist production by uncovering the hidden connections between these seemingly disparate theoretical issues.

Secondly, Marx conducted a preliminary exploration of the problem of machinery bringing down wages from the perspective of capital-labour exploitation and the labour theory of value. In *Notebook XXI*, while analyzing the causes of the decline in wages, he drew on the "*Notes on Johann Beckmann II*", specifically engaging with the first dimension of the "Beckmann Dilemma": the relationship between machinery and the declines in wages. Marx began by criticizing Malthus and others for their chaotic and self-contradictory explanations, which attributed the declines in wages to factors like rent, production costs, population growth, the rise in the price of grain and the depreciation of banknotes (Marx & Engels, 2010b, pp. 158-162). Subsequently, he observed that in



textile factories, machine improvements consistently exerted downward pressure on wages (Marx & Engels, 2010b, pp. 162-165). At this point, Marx wrote down a critical commentary: “The only correct point in the theory of population is that the development of capital throws the mass of the population into conditions” of extreme destitution for the purpose of facilitating reproduction (Marx & Engels, 2010b, p. 165). This indicates that Marx began to attribute the root of pauperisation and declines in wages to Capital. With this Marx commented “Capital. Capital as person with Adam Smith too” (Marx & Engels, 2010b, p. 165), and substantiated his argument by quoting a line from Smith’s *The Wealth of Nations*: “Stock cultivates land; stock employs labour” (Marx & Engels, 2010b, p. 131). With this Marx aimed to demonstrate that the root cause of declines in wages lies in capital’s usurpation of labour as the dominant subject, which in turn enslaves labour itself. This is precisely capital dividing labour into “productive and unproductive labour” (Marx & Engels, 2010b, p. 165) since he had previously indicated: “Productive labour, therefore, is labour which – in the system of capitalist production—produces surplus value for its employer” (Marx & Engels, 2010b, p. 131). Thus, the intention of Marx here is fundamentally to situate the issue of declines in wages within the framework of capital-labour exploitation. Where Beckmann saw only the general application of machinery, Marx penetrated deeper to discern its specifically capitalist application. Consequently, it evoked as an issue what kind of role machinery plays in this process? To address this, Marx quotes a passage from the *Notes on Johann Beckmann II*:

In this town about twenty years ago certain people invented an instrument for weaving, with which a single person could weave more cloth, and more easily, than many others in the same length of time. As a result there arose disturbances and complaints from the weavers, until the town council finally prohibited the use of this instrument. (Marx & Engels, 2010b, p. 165)

Marx succinctly summarized this passage as “Shortening of labour time by machinery” (Marx & Engels, 2010b, p. 165). Later, under the heading “Machinery and AVERAGE WAGES” he cited another excerpted passage: “Wages are decreased in the same proportion as the powers of production increase. Machinery, it is true, cheapens the necessities of life, but it also cheapens the labourer” (Marx & Engels, 2010b, p. 166). Hence, Marx sought to illustrate the internal mechanism by which the capitalist application of machinery declines wages, grounding his analysis in the labour theory of value and theory of surplus value. As he had previously established, the average wage represents the value form of labour-power. On a given working day, capital deploys machinery to raise labour productivity and extend surplus labour time with the shortening of necessary labour time, because “surplus value could only increase to the extent that there was a fall in the value of labour capacity and therefore in wages” (Marx & Engels, 2010b, p. 65). Undoubtedly, this only addresses the issue from the perspective of the production of relative surplus value, representing just one internal cause of machinery-driven declines in wage. Beyond this, there exists a more acute and immediate factor: the competition between machinery and labour that drives workers’ actual wages far below the average wage. As Marx notes: “The moment the machine comes into competition with human labour, the wages of that labour begin to adjust themselves to the lesser cost



of production by [the] machine” (Marx & Engels, 2010b, p. 166). This precisely encapsulates what Beckmann identified as the immediate cause of workers’ resistance to machinery. Here we encounter the second dimension of the “Beckmann Dilemma”: Does the capitalist application of machinery inherently conflict with labour? And if so, does this imply the necessity of “a check to improvement” and abandonment of “the progress of human ingenuity” (Marx & Engels, 2010b, p. 166)? In order to resolve these questions fundamentally, Marx recognized the necessity to probe the historical preconditions and developmental tendencies underlying the capitalist application of machinery.

Thirdly, Marx traces the historical origins of the capitalist application of machinery through the lens of “capital’s personification” and primitive accumulation. In *Notebook XXIII*, he again turned to excerpts from Smith and Beckmann while examining the problem of primitive accumulation. Notably, Marx began with citing Smith’s account of England’s enclosure movements since the 15th century for the acceleration of primitive accumulation. Under the heading “Clearing of Estates” he revisited of Smith’s phrase: “Stock cultivates land; stock employs labour” and generalized it as “Personification of Capital” (Marx & Engels, 2010b, p. 271). Subsequently, Marx summarized the main content of the “*Notes on Johann Beckmann II*”:

Shortening of labour by means of machinery. The workers’ struggle against this. Beckmann, Ribbon mills. The gaining of extra wheat by better grinding. Struggle in England against the sawmills. German inventions. (Marx & Engels, 2010b, p. 271)

These elements might appear unrelated at first glance, while within the whole context it seems that Marx actually had an insight into the deep historical implications of Smith’s expression: the phrases “stock cultivates land” and “stock employs labour” represent the dual dimensions of capital’s personification. The former reflects the early modern British historical process wherein landowners and agrarian capitalists destroyed feudal land tenure and established capitalist agriculture by “clearing of estates.” Crucially, this primitive accumulation forcibly separated direct producers from their means of subsistence, creating a mass of “free” labour-power – the foundational precondition for industrial capitalism. As Marx notes: “The dispossessed tenants either ‘seek a subsistence in the manufacturing towns, or ... emigrate to America’” (Marx & Engels, 2010b, p. 271). The latter phrase “stock employs labour” reflects the historical process of exclusion, degradation and exploitation of labour by industrial capitalists with the help of machines. Marx recognized that the rural “clearing of estates” merely established the most basic precondition for capitalism. As he asserted:

As long as capitalist production has not yet produced for itself all the conditions of its free development – and the most essential one is the formation of a class of WAGE LABOURERS absolutely dependent on capital – capital regulates and intervenes, until it has made the conditions adequate to its needs. (Marx & Engels, 2010b, p. 262)



This absolute free movement of capital, according to its own immanent laws, expresses itself at the same time as utter ruthlessness towards the labouring population. (Marx & Engels, 2010b, p. 262)

In the urban context, this movement of capital manifests as capital's application of machinery to expel labour – a process that, borrowing the terminology of “clearing of estates,” might be termed “the clearing of manufactures and factories.” As a result, capital perpetually generates a relative surplus population, condemning masses of so-called “free” labourers to perpetual destitution, thereby enforcing labour's absolute dependence and submission to capital. From this point of view, Beckmann provided Marx with unique theoretical resources for understanding the early historical origins of industrial capitalism and the process of capital accumulation. Through Beckmann, Marx came to clearly recognize that in the development of industrial capitalism, capital's employment and exploitation of labour were largely achieved through the introduction of machinery – a process that, from the very beginning, was marked by intense contradictions and conflicts among labour, machinery, and capital. In other words, the capitalist application of machinery not only had fundamental historical preconditions but also constituted, from the outset, an integral part of the (primitive) accumulation process of capital. Meanwhile, Marx transcended Beckmann's narrow perspective of *Technologie*, penetrating deeper to recognize that the antagonism between machinery and workers stemmed neither from machines themselves nor from capitalists – who are merely the personifications of capital-relations – but from the inherent demands of the capital-relations.

To sum up, within the writing of the *Manuscripts of 1861–1863*, Marx attempted to focus on the perspective of historical materialism and the critique of political economy to probe preliminarily into the essence of specific social relations among the application of machinery, as well as its historical preconditions and inherent law. This theoretical work provides a steady base of scientific methodology and perspective for the final resolution of the “Beckmann Dilemma”.

THE CAPITAL: THE SCIENTIFIC SOLUTION OF THE “BECKMANN DILEMMA”

In *Capital*, Marx repeatedly drew upon the content of the *Notes on Johann Beckmann II*. By explaining the historical logic and essential laws governing machinery and its capitalist application, he comprehensively and scientifically resolved the “Beckmann Dilemma,” thereby achieving a fundamental transcendence of bourgeois *Technologie* and technical theories.

Firstly, the struggle between workers and machinery is an inevitable result of the historical development of the capitalist mode of production. In the section “The Strife Between Workman and Machine,” Marx extensively cites historical narratives from *Notes on Johann Beckmann II* regarding workers' resistance to machinery. From the perspective of historical materialism, he asserts:

The contest between the capitalist and the wage labourer dates back to the very origin of capital. It raged on throughout the whole manufacturing period. But only since



the introduction of machinery has the workman fought against the instrument of labour itself, the material embodiment of capital. He revolts against this particular form of the means of production as being the material basis of the capitalist mode of production (Marx & Engels, 2010c, p. 430).

This statement signifies two crucial points: On the one hand, the struggle between workers and machinery is merely the external manifestation of capital-labour contradictions under capitalist relations. Where Beckmann saw only the superficial conflict between workers and physical machine, Marx penetrated the material appearance of machinery to uncover its underlying historical essence of specific social relations. Thus, rather than workers opposing the machine, they are in fact resisting the economic reification of capital-relations. In this sense, Marx overcame and transcended Beckmann's techno-fetishism. On the other hand, the antagonism between machine and workers is not an inherent, natural attribute of machinery, but results from the particular form that emerged from the development of the material basis of capitalist production (means of production). In order to deeply grasp the contradictory relationship between machinery and worker, it is essential to understand the historical development of capital-relations and the capitalist mode of production in the first place, particularly the historical formation of large-scale machine industry under capitalism and its inherent laws. This can be analyzed in three dimensions:

(1) Primitive accumulation provided the essential historical preconditions and external guarantees for the formation and development of capital-relations and the capitalist mode of production. As Marx noted: "The so-called primitive accumulation, therefore, is nothing else than the historical process of divorcing the producer from the means of production" (Marx & Engels, 2010c, pp. 705-706). This divorce constitutes the premise of capital-relations and is perpetuated and expanded through capitalist production. The foundation and primary factor of this historical process was the violent dispossession of rural inhabitants' land through measures like "clearing the estates" which forcibly severed masses of people from their means of subsistence, transforming them into a legally unprotected proletariat and hurling them onto the labour market. This development not only propelled the making of capitalist agriculture but also provided the essential labour force required for the emergence of industrial capital and manufacturing.

Simultaneously, capital-relations established a domestic market for capital through the process of forcibly transforming these "free" labourers into wage-workers obedient to capitalist production discipline through bloody legislation. This process not only partially dismantled the obstacles posed by rural feudal systems and urban guild systems but also ignited conflicts between emerging manufacturing and traditional artisan guilds. Marx precisely observed that the initial opposition to manufacturing itself came "from the guilds and privileged towns, not from the workpeople" (Marx & Engels, 2010c, p. 432). And thus, Marx noted that "the manufactures proper opened out new fields of production to the rural population, driven from the land by the dissolution of the feudal system. At that time, therefore, division of labour and co-operation in the workshops, were viewed more from the positive aspect, that they made the workpeople more productive" (Marx & Engels, 2010c, pp. 432-433).



However, the limitations of manufacturing hindered capital's valorization demands, driving capital to seek new material-technical means. As increasingly advanced machinery was introduced into workshops, the contradictions between workers and machines intensified. This struggle manifested in two forms: One is the direct contest of workers against machines within machine-adopting manufacturing, another is the resistance that targeted machine production among traditional artisans and manufacturing workers. Beckmann's so-called “mob riots” against machinery and authorities' bans on machines were but one episode in this protracted, multilayered inter-class struggle. Furthermore, external factors such as the discovery of gold and silver in America, commercial wars, colonial expansion, the national debt, a modern of taxation, and the protectionist system (Marx & Engels, 2010c, p. 739) drastically accelerated this process. From this point onwards, the struggle between workers and machinery emerges as a historical phenomenon that erupts at a specific stage of the protracted, expansive, and increasingly complex overall process of primitive accumulation.

(2) Machinery and its capitalist application are products of the internal contradictory movement of the capitalist mode of production. As Marx observed: “It [manufacture] towered up as an economic work of art, on the broad foundation of the town handicrafts, and of the rural domestic industries” (Marx & Engels, 2010c, p. 373). The foundation of manufacture remained handicraft production, reliant on manual skill and dexterity, which imposed insurmountable limitations such as the narrowness of the technical basis, the expense of production methods, and the lack of labour discipline. These constraints prevented capital from fully appropriating surplus labour-time, instead leaving it perpetually constrained by living labour's resistance. As a result, “at a given stage in its development, the narrow technical basis on which manufacture rested, came into conflict with requirements of production that were created by manufacture itself” (Marx & Engels, 2010c, p. 373). This gave birth to large-scale industrial machinery under capitalism. In other words, machinery and its capitalist application represent both the inherent demand and inevitable outcome of capital-relations, shattering the narrow technical basis of manufacture and establishing a new material-technical basis and mode of production commensurate with its own logic. In this sense, machinery is not merely the achievement of individual inventors, but rather the product of specific socio-historical conditions. As Marx noted: “The inventions of Vaucanson, Arkwright, Watt, and others, were, however, practicable, only because those inventors found, ready to hand, a considerable number of skilled mechanical workmen, placed at their disposal by the manufacturing period” (Marx & Engels, 2010c, p. 385). Thus, “a critical history of technology would show how little any of the inventions of the 18th century are the work of a single individual. Hitherto there is no such book” (Marx & Engels, 2010c, p. 385). This statement clearly targets the individualist heroism of Beckmann and others when they discussed the context of material production.

(3) The capitalist application of machinery generates a new form of labour alienation. From the contradictory dynamics of the capitalist mode of production, it is evident that capital-relations predetermined machinery to emerge as an objectified alien force utterly hostile to workers from the outset. As Marx observed:



The character of independence and estrangement which the capitalist mode of production as a whole gives to the instruments of labour and to the product, as against the workman, is developed by means of machinery into a thorough antagonism. Therefore, it is with the advent of machinery that the workman for the first time brutally revolts against the instruments of labour (Marx & Engels, 2010c, p. 435).

The capitalist application of machinery manifests labour alienation in two key aspects: On the one hand, machinery is “a power inimical to him [workman], and as such capital proclaims it from the rooftops and as such makes use of it” (Marx & Engels, 2010c, p. 438) As the objectified product of labour, the machine emerged as the most potent instrument through which capital subdued labour. On the other hand, it creates an economic paradox: “the most powerful instrument for shortening labour time, becomes the most unailing means for placing every moment of the labourer’s time and that of his family, at the disposal of the capitalist for the purpose of expanding the value of his capital” (Marx & Engels, 2010c, p. 411). To illustrate this, Marx cited Beckmann’s observation: “Antipatros, a Greek poet of the time of Cicero, hailed the invention of the water-wheel for grinding corn, an invention that is the elementary form of all machinery, as the giver of freedom to female slaves, and the bringer back of the golden age” (Marx & Engels, 2010c, p. 411). At the same time, he sneered at modern vulgar economists like Bastiat and McCulloch: “They understood nothing of Political Economy and Christianity. They did not, for example, comprehend that machinery is the surest means of lengthening the working day” (Marx & Engels, 2010c, p. 412). This stark contrast between ancient and modern thought reveals how, under capitalism, machinery’s emancipatory potential is alienated into a means of exploitation – becoming “the bringer back” of ancient slavery in a new form. Of course, the Greek poet’s praise for machine-liberation was merely romantic idealism, under slave systems, machinery could never automatically emancipate slaves.

Secondly, the capitalist application of machinery inevitably generates a downward pressure on wages. Marx explains:

The instrument of labour, when it takes the form of a machine, immediately becomes a competitor of the workman himself. The self-expansion of capital by means of machinery is thenceforward directly proportional to the number of the workpeople, whose means of livelihood have been destroyed by that machinery. The whole system of capitalist production is based on the fact that the workman sells his labour power as a commodity. Division of labour specializes this labour power, by reducing it to skill in handling a particular tool. So soon as the handling of this tool becomes the work of a machine, then, with the use value, the exchange value too, of the workman’s labour power vanishes; the workman becomes unsaleable, like paper money thrown out of currency by legal enactment. That portion of the working class, thus by machinery rendered superfluous, i. e., no longer immediately necessary for the self-expansion of capital, either goes to the wall in the unequal contest of the old handicrafts and manufactures with machinery, or else floods all the more



easily accessible branches of industry, swamps the labour market, and sinks the price of labour power below its value. (Marx & Engels, 2010c, pp. 433-434).

Here, Marx provides a scientific analysis from the perspective of the labour theory of value, revealing the intrinsic mechanism by which capitalist machinery drives wage depression. And thus the following crucial issue emerges: How should workers confront this objective and persistent condition?

Thirdly, it is essential to rigorously distinguish between machinery as such and its capitalist application. As demonstrated above, the root cause of machinery's destructive impact on workers lies in its capitalist employment, not in its technical essence. As Marx emphasized:

It is an undoubted fact that machinery, as such, is not responsible for “setting free” the workman from the means of subsistence [...] The contradictions and antagonisms inseparable from the capitalist employment of machinery, do not exist, they say, since they do not arise out of machinery, as such, but out of its capitalist employment! (Marx & Engels, 2010c, p. 444)

For machinery in itself shortens labour-time, lightens toil, and enriches producers, demonstrating humanity's triumph over natural forces, whereas its capitalist application produces the opposite, harmful effects. Based on this, Marx definitively clarifies the revolutionary target and strategy for workers “learnt to distinguish between machinery and its employment by capital, and to direct their attacks, not against the material instruments of production, but against the mode in which they are used [*gesellschaftliche Exploitationsform*—Author]” (Marx & Engels, 2010c, p. 432). Here, Marx achieves a complete overcoming and transcendence of the implicit techno-original-sin committed by Beckmann and others which conflated machines with their capitalist use.

CONCLUSION

In summary, Marx's engagement with the *Notes on Johann Beckmann II* and his scientific investigation of the “Beckmann Dilemma” underwent a complex and deepening process. On the one hand, Beckmann's historical narratives on machinery provided Marx with unique theoretical resources for further exploring the historical essence of machinery and its capitalist application. On the other hand, through his historical materialist analysis of machinery's socially determined nature and related theoretical issues, Marx thoroughly overcame the theoretical limitations and bourgeois ideological illusions inherent in Beckmann's approach. Based on this, he furnished the proletariat with a scientific theoretical direction for revolutionary struggle and the future prospects of human emancipation. Meanwhile, this engagement offers us a crucial entry point for deeply understanding the methodological significance and contemporary relevance of Marx's philosophy of technology. This includes two aspects:

Firstly, Marx's philosophy of technology is a critical theory of technology that is fundamentally rooted in historical materialism as its primary methodological approach and is situated within the overarching framework of the critique of political economy. To comprehend the historical essence of modern science and technology, one must not



remain confined to empirical-positivist analyses of technical objects, or metaphysical meditations about “technology-in-itself.” Instead, analysis must return to the total historical praxis of the immanent contradictions of modern society – interpreting technology through the holistic context of political-economic critique. Only thus one avoids relapsing into the trap of idealist conceptions of technology.

Secondly, Marx’s demarcation between machinery and machinery’s capitalist employment demonstrates that technological innovation and specific social relations are historically constitutive. This means that technological inventions never exist or function independently – they are always intrinsically fused with determinate social relations, and embedded within concrete socio-historical practices, and this dialectical unity cannot be treated in a separate perspective. Therefore, both technological determinism and the neutrality view of technology fundamentally deviate from the profound implications of Marx’s view of technology. For Marx, the so-called “two-sidedness of technology” does not reside in technology itself but in the specific social relations behind it. This scientific perspective of technology not only provides the proletariat with a scientific framework for correctly confronting the consequences of capitalist employment of technology, but also offers a theoretical foundation for genuinely advancing people-centered scientific innovation and “technology for the good” within the practical context of contemporary societies.

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Research article

The Language of Machines from Baroque Automata to Digital Hybrids: The Poetics of Technological Evolution

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Abstract

This article presents a comprehensive interdisciplinary study of the evolution of the language of machines, examined as a reflection of fundamental epistemological and cultural paradigms of different historical epochs. In order to achieve for the first time an interdisciplinary methodological synthesis of Object-Oriented Ontology, the theory of hyperobjects, and historical-cultural analysis, the paper proposes to study machines as actors possessing their own language, thereby overcoming the traditional anthropocentric approach in studies of technology. The central thesis maintains that machines have never been neutral tools but have consistently functioned as active actors that shape and transmit specific linguistic codes embodying the aesthetic, social, and power structures of their time. The methodological framework synthesizes the principles of Graham Harman's object-oriented ontology, Timothy Morton's concept of hyperobjects, and historical-cultural analysis, thus enabling the identification of a continuous line of transformation in machine language from the Baroque era to the digital present. The novelty of the research lies in the development of a periodization of the evolution of machine language, which identifies its specific regimes (allegorical, intimate-playful, functional-deterministic, reflexively-hybrid) and links them to shifts in cultural-historical paradigms, rather than solely to technological progress. The research results demonstrate a sequential shift in linguistic regimes: the allegorical theatricality and rhetorical excess of Baroque automata give way to the intimate and playful language of Rococo machines, which in turn is replaced by the functional determinism and standardized "grammar of mechanisms" of Franz Reuleaux in the industrial age. Particular attention is paid to the analysis of the contemporary digital stage, where the language of artificial intelligence is characterized as reflexive-hybrid. It is shown that AI systems generate a fundamentally new type of interaction based on feedback loops (retroreflection) and fusion processes, leading to the emergence of distributed epistemological structures and the blurring of traditional boundaries between natural and artificial intelligence. The study reveals that machines not only perform utilitarian functions but also actively participate in generating new regimes of knowledge production, acting as co-authors. The conclusions emphasize that modern technologies represent complex actor-network formations in which materiality acquires its own voice through the hybrid language of reflexive co-creation, necessitating the development of new ethical and philosophical frameworks for understanding human-machine interaction.

Keywords: Machines; Language of technology; Object-oriented ontology; Artificial intelligence; Reflection; Baroque; Industrial age; Hyperobjects; Hybrid systems

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Научная статья

Язык машин от барочных автоматов к цифровым гибридам: Поэтика технологической эволюции

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Аннотация

Статья представляет собой междисциплинарное исследование эволюции языка машин, рассматриваемого как отражение фундаментальных эпистемологических и культурных парадигм различных исторических эпох. Впервые предложен и применен междисциплинарный методологический синтез объектно-ориентированной онтологии, теории гиперобъектов и историко-культурного анализа для изучения машин как акторов, обладающих собственным языком, что позволяет преодолеть традиционный антропоцентрический подход в исследованиях техники. Основной тезис работы заключается в том, что машины никогда не были нейтральными инструментами, но всегда функционировали как активные акторы, формирующие и транслирующие специфические языковые коды, воплощающие эстетические, социальные и властные структуры своего времени. Методологический аппарат исследования синтезирует принципы объектно-ориентированной онтологии Грэма Хармана, концепцию гиперобъектов Тимоти Мортон и историко-культурный анализ, что позволяет выявить непрерывную линию трансформации машинного языка от эпохи барокко до цифровой современности. Научная новизна исследования заключается в разработке оригинальной периодизации эволюции языка машин, выявляющей его специфические режимы (аллегорический, интимно-игровой, функционально-детерминистский, рефлексивно-гибридный) и связывающей их со сменой культурно-исторических парадигм, а не только с техническим прогрессом. Результаты исследования демонстрируют последовательную смену языковых режимов: аллегорическая театральность и риторическая избыточность барочных автоматов сменяется интимно-игровым языком машин рококо, который, в свою очередь, уступает место функциональному детерминизму и стандартизированной “грамматике механизмов” Франца Рёло в индустриальную эпоху. Особое внимание уделяется анализу современного цифрового этапа, где язык искусственного интеллекта характеризуется как рефлексивно-гибридный. Показано, что современные ИИ-системы порождают принципиально новый тип взаимодействия, основанный на петлях обратной связи (ретрофлексии) и процессах слияния, что приводит к возникновению распределенных эпистемологических структур и стиранию традиционных границ между естественным и искусственным интеллектом. В ходе исследования выявлено, что машины не только выполняют утилитарные функции, но и активно участвуют в генерации новых режимов производства знания, выступая в роли со-авторов. Выводы работы подчеркивают, что современные технологии представляют собой сложные акторно-сетевые образования, в которых материальность обретает собственный голос через гибридный язык рефлексивного со-творчества, что требует разработки новых этических и философских рамок для осмысления человеко-машинного взаимодействия.

Ключевые слова: Машины; Язык технологий; Объектно-ориентированная онтология; Искусственный интеллект; Рефлексия; Барокко; Индустриальная эпоха; Гиперобъекты; Гибридные системы

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МАШИНА КАК ГРАММАТИЧЕСКАЯ СВЯЗЬ

Машина никогда не была нейтральным инструментом – она говорит на языке своей эпохи, отражая её эстетические, социальные и властные структуры. Как отмечает Грэм Харман (2021) в книге “Объектно-ориентированная онтология: новая теория всего”, объекты (включая машины) всегда ускользают от полного постижения, но их феноменологические проявления зависят от исторического контекста. Любая машина существует в двух измерениях одновременно: в своих чувственных качествах (как она проявляется для нас) и в своей глубочайшей внутренней природе (какова она “сама по себе”). Этот дуализм объясняет, почему одна и та же паровая машина могла восприниматься современниками и как воплощение прогресса, и как демоническое устройство, отчуждающее человека от труда. Машина у Хармана – это не просто совокупность деталей, а “темный объект”, чья сущность всегда отчасти скрыта, даже когда кажется, что мы полностью понимаем принцип её работы.

При этом Харман (2021) подчеркивает, что машины вступают в особые отношения “связи” (alliances) с другими объектами – как с людьми, так и с другими машинами. Эти связи не сводятся к простым причинно-следственным цепочкам, а образуют сложные сети взаимодействий, где каждая машина одновременно и раскрывает, и скрывает свою природу. Например, современный смартфон в хармановской перспективе – это не просто инструмент коммуникации, а объект, который устанавливает новые типы связей между пользователем, программным обеспечением, спутниками и инфраструктурой сотовых вышек, причем каждая из этих связей по-своему трансформирует изначальную природу всех вовлеченных объектов. Таким образом, машины у Хармана предстают не пассивными орудиями, а активными участниками сложной онтологической игры, где ни один объект никогда не может быть полностью “разоблачен” или сведен к своим внешним проявлениям.

ОТ МЕХАНИЗАЦИИ РЕАЛЬНОСТИ К МЕХАНИЗАЦИИ ЯЗЫКА

Хармановский взгляд на машину как на “темный объект”, чья суть всегда ускользает от полного постижения, позволяет по-новому осмыслить историческую эволюцию механизмов. Если современные технологии существуют в пространстве цифровой непрозрачности, то машины барокко и рококо демонстрировали парадоксальное сочетание нарочитой зрелищности и сокрытия – их сложные механизмы одновременно и выставлялись напоказ, и маскировались под изящные безделушки. Подобно тому как объектно-ориентированная онтология говорит о принципиальной “закрытости” любого объекта, барочные автоматы, при всей их внешней театральности, сохраняли тайну своего устройства, превращая механическое в магическое. Такой переход от философской абстракции к конкретным историческим формам позволяет проследить, как в разные эпохи соотносятся техническая сущность машины и её культурная репрезентация – от вычурной откровенности барокко до игривой условности рококо и далее к мнимой прозрачности индустриальной эпохи (Оболкина, 2023).



Эпоха барокко (XVII – начало XVIII века) и сменившее его рококо (первая половина XVIII века) создали два принципиально разных, но взаимосвязанных языка механизмов. Если барокко говорило на языке монументальной риторики, где каждый жест машины был подобен развернутой периодической конструкции в ораторском искусстве, то рококо перевело этот язык в регистр интимного, почти флигельного диалога. Сравнение машин барокко и рококо показывает прямую связь языка машин с властью и гендером.

Автоматоны Жака де Вокансона – “флейтист”, “утка”, “тамбуринщик” – не просто имитировали живые движения, но делали это с избыточной, почти нарочитой демонстративностью. Их механизмы были сложными до гротеска: например, “утка” не только клевала зерно, но и “переваривала” его, демонстрируя работу искусственных внутренностей. Это была не просто функциональность, а перформанс функциональности – машина говорила на языке аллегории, где каждое движение было частью развернутой метафоры (Марков и Штайн, 2024).

Стилистически это соответствовало барочной риторике: длинные, витиеватые фразы, где главное – не смысловая экономия, а впечатляющая демонстрация мастерства. Так же работали и барочные часы – например, астрономические часы в соборах, где движение планет, ангелов и святых разыгрывало целое театральное действо. Машина барокко не просто выполняла задачу – она вещала, как проповедник с кафедры (Bylieva, 2024).

В эпоху рококо механизмы становятся меньше, изящнее и игривее. Если барокко любило грандиозные автоматы, то рококо предпочитало миниатюрные часовые механизмы, спрятанные внутри изысканных безделушек – музыкальных шкатулок, табакерок, механических птиц в позолоченных клетках. Их движения уже не напоминали торжественную речь, а скорее светскую беседу – легкую, остроумную, с намёками. Например, знаменитые часы работы мастера Жана-Антуана Лепена (часовщика Людовика XV) не просто показывали время, но включали сценки с танцующими пастушками или влюблёнными. Их язык – это язык галантности: функциональность (ход времени) маскировалась под развлечение. Даже сложные механизмы, такие как андрюиды-писцы Пьера Жаке-Дро, имитировали не ораторскую речь, а каллиграфию – искусство, ценимое в аристократических салонах.

Итак, в барокко машина была инструментом абсолютизма: как король демонстрировал власть через пышные церемонии, так и механизмы подчеркивали контроль человека над природой (например, “утка” Вокансона – аллегория победы науки над органическим). В рококо машина стала частью частного пространства, где доминировала женская аудитория (салоны маркизы де Помпадур). Механические безделушки отражали гендерные коды эпохи: изящество, капризность, искусственность как новую “естественность” (Оболкина, 2023).

Барокко мыслило машину как сложную метафору (например, часы как модель божественного миропорядка). Рококо отказалось от этой серьезности – его механизмы играли в функциональность. Если барочный автомат поражал зрителя, то рококо стремилось его развлечь. Позже этот эстетический конфликт повторится в противопоставлении “серьёзных” машин индустриальной эпохи и “игривых” арт-



объектов кинетического искусства XX века. Но именно в барокко и рококо сформировались две ключевые модели “речи” машины: одна – как мужская проповедь, другая – как женский шёпот.

В отличие от барочных автоматов, где движение было театральным жестом, паровая машина демонстрировала прозрачность причинно-следственных связей. Каждый элемент её работы – от котла до маховика – мог быть прослежен и описан технически. Это соответствовало главному нарративу реализма: миру, где всё имеет объяснение, где нет места мистике и аллегориям (Morton, 2013).

Тимоти Мортон (2013) в своей концепции гиперобъектов (изложенной в книге “Hyperobjects: Philosophy and Ecology after the End of the World”) определяет их как объекты настолько масштабные во временном и пространственном отношении, что они радикально меняют саму структуру человеческого восприятия. Паровая машина XIX века становится именно таким гиперобъектом – она не просто механизм, а материализованная философия эпохи, воплощение нового понимания причинности, энергии и времени.

Античные механизмы (как описанные Героном Александрийским) функционировали в рамках поэтической парадигмы – они были скорее материализованными метафорами, чем утилитарными устройствами. Автомат, открывающий двери храма “по воле богов”, или механический театр с движущимися фигурами – всё это говорило на языке чуда, сакрального действия. Паровая машина Уатта совершила радикальный переход к прозе технического описания. Её язык – это язык диаграмм, формул, инструкций по эксплуатации. Как отмечает Мортон (2013), гиперобъекты “говорят” на особом языке – не метафорическом, а буквальном, но при этом их буквальность столь грандиозна, что снова обретает черты иного. Паровая машина не просто выполняла работу – она материализовала саму идею работы, энергии, превращения тепла в движение.

Если в барокко машина “говорила” сложными синтаксическими конструкциями, то паровая машина использовала короткие, ёмкие предложения. Её язык – это цикличность (постоянное повторение тактов работы), прозрачность (видимые причинно-следственные связи), эффективность (минимализм выразительных средств). Этот язык идеально соответствовал литературному реализму с его вниманием к деталям, причинности характеров, отказу от романтических преувеличений. Бальзак описывал так же скрупулезно жизнь Парижа, как технические трактаты описывали паровые машины (Оболкина, 2023).

Паровая машина не просто изменила производство – она изменила само понятие труда. В отличие от барочных придворных автоматов, созданных для развлечения аристократии, паровая машина стала дисциплинарным инструментом (фабричный гудок регулировал жизнь рабочих), и символизирова прогресс в смысле позитивистской веры в науку, сделалась ключевым объектом отчуждения (еще Маркс показал, как рабочий становится придатком машины) (Молчанова, 2024). Дисциплинарность тем самым оказалась областью как внушаемых убеждений, так и механизации самой грамматики убеждения.

Мортон (2013) подчёркивает, что гиперобъекты всегда политичны – они перераспределяют саму ткань реальности. Пар сделал возможным железные



дороги, а значит – новую организацию пространства и времени, новую иерархию центров и периферий.

Сегодня, в эпоху цифровых технологий, мы снова наблюдаем смену языка машин. Если пар говорил на языке термодинамики, то компьютер говорит на языке информации. Однако, как отмечает Мортон (2013), все гиперобъекты объединяет одно – их язык всегда оказывается странным, даже когда кажется прозрачным. Паровая машина, казавшаяся современникам воплощением ясности, сегодня воспринимается как столь же поэтический объект, как и автоматы барокко – ведь её язык принадлежит уже другой эпохе.

Таким образом, паровая машина XIX века стала не просто техническим устройством, а грамматическим конструктом, сформировавшим новое понимание причинности, труда и самой материальности мира. Её “прямая речь” оказалась на поверку столь же сложной, как и витиеватые фразы барочных механизмов – просто сложность эта была иного порядка (Floridi & Nobre, 2024).

Немецкий инженер и теоретик механики Франц Рёло (Reuleaux, 1875) совершил революцию в понимании машин не просто как технических устройств, а как систем со своей внутренней логикой и “языком”. В главном труде “Теоретическая кинематика: основы науки о машинах” (“Theoretische Kinematik: Grundzüge einer Theorie des Maschinenwesens”, 1875) он разработал концепцию “грамматики механизмов”, где сравнивал структурные элементы машин (зубчатые передачи, кривошипы, кулачки) с частями речи в языке. Этот подход не был нейтральным – он отражал доминирующие представления XIX века о рациональности, прогрессе и гендерных ролях в технической сфере (Reuleaux, 1875).

Его анализ строился на нескольких ключевых идеях. Во-первых, Рёло рассматривал механизмы как совокупность кинематических пар – таких соединений, где движение одного элемента однозначно и с математической точностью определяет движение другого. Во-вторых, в основе его подхода лежал принцип детерминизма: каждое действие или движение в механизме должно иметь четкую и однозначную причину, что полностью исключало случайность и делало работу машины предсказуемой. Наконец, он настаивал на исключении “избыточности”, под которой понимал любую декоративность или элементы, не выполняющие прямую функциональную роль, выступая за строгую и рациональную целесообразность каждой детали.

Систематизируя анализ механизмов на принципе предсказуемости и линейности, он сознательно исключал из рассмотрения всё, что не подчинялось строгим законам движения, стремясь создать универсальную научную базу для конструирования машин. Поэтому принцип детерминизма (причинность действия каждой детали механизма) обеспечивался кинематическими парами соединений, не допускающими избыточности. Такая система напоминала грамматику “мужского” научного дискурса эпохи: логичного, иерархичного, направленного на контроль. Рёло фактически создал “механический позитивизм”, где машина становилась идеалом рационально организованного общества. Ведь Рёло не просто описывал механизмы – он участвовал в формировании индустриальной идеологии.



В 1870-х он консультировал германское правительство по вопросам технического образования, настаивая, что стандартизация машин (через его “грамматику”) необходима для национального превосходства. Работы Рёло оказали глубочайшее влияние на современную ему индустриальную идеологию. Он активно участвовал в формировании системы инженерного образования, предлагая рассматривать машины как “тексты”, которые необходимо “читать” и “писать”. Эта стандартизация была перенесена и на организацию фабричного труда, где рабочий стал рассматриваться как исполнитель алгоритмов, заложенных в механизм. Более того, экспорт европейских машин, описанных универсальной “грамматикой” Рёло, использовался как аргумент в колониальной политике, представляясь частью цивилизаторской миссии Запада.

Однако, как показывает Фридрих Киттлер (2009), уже в XIX веке – параллельно с триумфом этой рациональной системы – появились механизмы, которые её радикально нарушали. Эти устройства не просто выполняли функции, но трансформировали социальные и культурные практики, внося элемент нелинейности и непредсказуемости. Например, пишущие машинки (с 1860-х), формально подчиняясь механическим законам Рёло, превратили письмо из искусства “мужского пера” в “женскую” профессию, создав новую гендерную реальность в офисе. Телефоны (с 1870-х) взломали принцип линейной коммуникации, сделав ключевым элементом не логику текста, а мгновенный отклик, тон голоса и фонетические помехи. А швейные машины (например, “Зингер”), как отмечает Пеннер (Penner, 2024), дали женщинам инструмент не для репродуктивного, а для творческого и даже предпринимательского труда, выходя за рамки чистой функциональности, предписанной Рёло. Эти устройства, хотя и создавались в рамках той же индустриальной логики, подрывали “грамматику” Рёло, предлагая иные формы взаимодействия с техникой.

Принципы детерминизма и стандартизации, заложенные Рёло, находят неожиданное продолжение в эпоху цифровых технологий. Алгоритмы ИИ наследуют его стремление к предсказуемости и логической упорядоченности. Это проявляется, например, в дизайне пользовательских интерфейсов, где “удобство” часто достигается через подчинение пользователя неочевидной логике системы, созданной определенной (часто мужской) инженерной культурой. Таким образом, “грамматика” Рёло позволяет критически осмыслить, почему одни технологии (и их создатели) доминируют, а другие маргинализируются, в том числе и в контексте гендерных стереотипов в ИТ. (Разумов и Дусь, 2024).

Рёло показал, что машины – это не просто инструменты, а политические акторы, формирующие саму структуру общества. Его “грамматика” – ключ к пониманию, почему одни технологии доминируют, а другие маргинализируются (Козлова, 2024).

Первичной схемой реализации машинной природы ИИ следует признать схему контакта (Рис. 1):



ПРОЦЕСС КОНТАКТА С AI



Рисунок 1. Процесс контакта с ИИ

В этой схеме ответ развивает функцию обработки, обработка – функцию запроса, а запрос – функцию инициации. Но уже то, что машина имеет свой язык, подразумевает, что развитие функции есть и развитие языка, который обладает возможностью тотализующего означивания, то есть производства того числа значений, которое и позволяет сети полноценно функционировать, даже если в ней появляются непредсказуемые элементы (Emergence of machine language..., 2024).

Исторически машины сначала говорили языком чистой функциональности – их “речь” ограничивалась однозначными командами и предсказуемыми действиями. Прядильные станки XIX века, которые Карл Маркс называл “орудиями подчинения”, действительно транслировали язык дисциплины и контроля: их ритм задавал темп работы, их устройство определяло положение тела рабочего, их логика воспроизводила капиталистические отношения. Это был монолог машины, где человек выступал лишь пассивным слушателем (Трофимов, 2024).

Но уже в начале XX века кинематограф (как отмечал Маршалл Маклюэн (McLuhan, 1964/2003) совершил переворот: камера и проектор стали не просто инструментами, а медиумами, способными фиксировать и воспроизводить человеческие эмоции (крупный план в фильмах Д.У. Гриффита), создавать новые формы восприятия (монтаж у Эйзенштейна), и наконец, рефлексировать о самой



природе видения (авангардные эксперименты 1920-х) (Цилински, 2019). Таким образом, технический прогресс одновременно создавал две противоположные модели: идеально предсказуемый мир детерминированных механизмов и новый, сложный мир медиа-технологий, которые ломали строгие законы, меняя саму ткань социальной жизни. Медиальный поворот обнажил механические основания восприятия, но одновременно показывал собственную грамматику технологий, распространяющуюся не только на механизмы производства, но и на механизмы восприятия.

КАК МАШИНА ЗАГОВОРИЛА МЕТАЯЗЫКОМ

В авангарде машина впервые заговорила метаязыком – она не просто показывала мир, но и комментировала процесс этого показа. Именно этот метаязык мы считаем процедурным для рефлексии (Vnutskikh & Komarov, 2024). Мы и ставим целью выявить, как именно такой показ происходит.

Рефлексия как системное свойство возникает в тот момент, когда взаимодействие человека и машины перестает быть односторонним процессом управления и превращается в циклический обмен. В таких системах – будь то нейроинтерфейсы, адаптивные алгоритмы или когнитивные архитектуры – рефлексия перестает быть исключительно человеческой прерогативой. Машинные компоненты системы начинают не просто обрабатывать данные, но и анализировать паттерны собственного функционирования, корректируя алгоритмы в реальном времени. При этом человек в этом симбиозе также меняется: его мышление адаптируется к машинной логике, формируя новые когнитивные схемы. Так возникает мета-уровень рефлексии, где система в целом (человек + машина) приобретает способность наблюдать и анализировать саму себя – не как сумму частей, а как качественно новое целое (Arshinov & Yanukovich, 2024).

Рефлексия машин, рассматриваемая до момента включения в систему человека, представляет собой способность системы к самоотсылке. Данная способность проявляется в том, что функционирование системы включает в себя три ключевых аспекта: во-первых, это анализ собственных внутренних процессов, что можно наблюдать на примере алгоритмов машинного обучения, которые автономно корректируют свои параметры в ходе работы для оптимизации результатов. Во-вторых, это генерация мета-высказываний, когда система способна рассуждать о принципах собственного функционирования, как в случае с чат-ботом, объясняющим основы своей работы. И в-третьих, это имитация человеческой рефлексии, где искусственный интеллект создает продукты, рефлексиирующие над собственной природой, например, когда нейросети генерируют произведения искусства, посвященные теме творчества (Бохоров, 2024, Ефимов и др., 2024).

По этим критериям функционирования мы и ведем наше исследование, выстраивая системную карту взаимосвязей (Рис. 2):

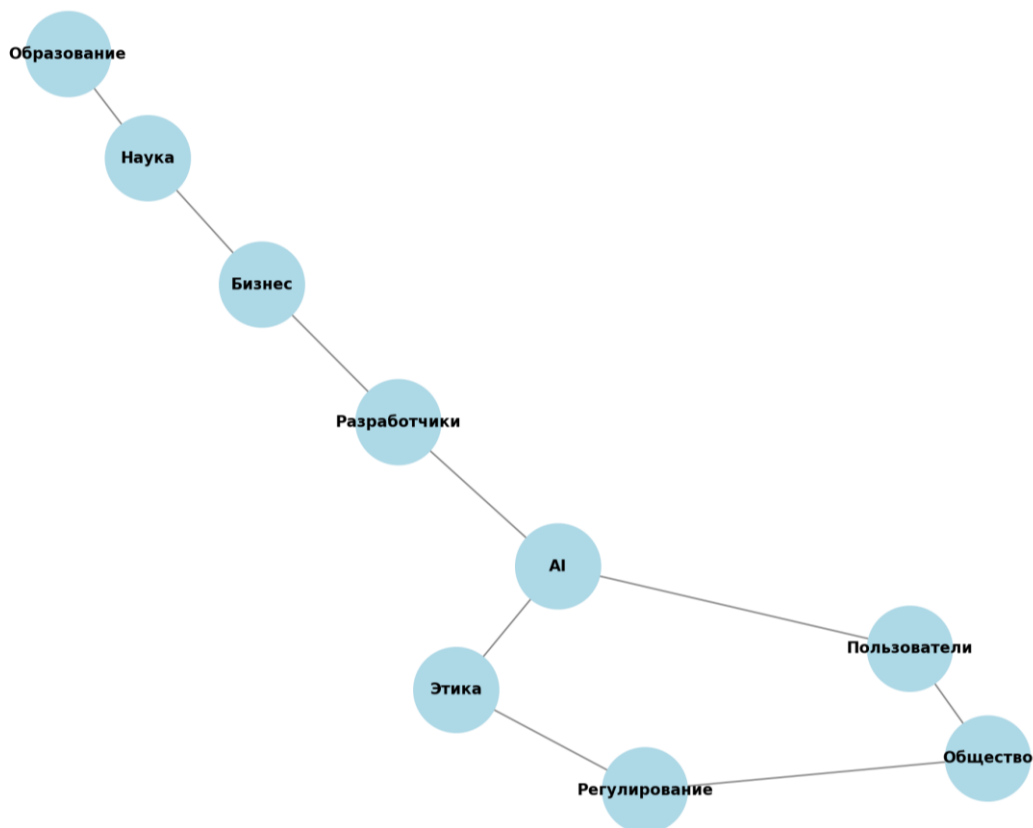


Рисунок 2. Системная карта взаимосвязей между акторами в контексте ИИ

На графике видно, как осуществляется системная взаимосвязь, входящая в своеобразную петлю рефлексии. График показывает, как в рефлексии ИИ отдельные действия акторов перестают быть фильтрами, но становятся основой перехода к другим акторам, которые в конце концов замыкают петлю на действия ИИ, при этом осуществив тренировку и этической рефлексии, и регулирующей рефлексии, и общественной рефлексии, и пользовательской рефлексии. Вместо критериального отбора у нас получается избыточная агентность рефлексии, передающая полномочия последующему агенту в петле, так что в конце концов ИИ опять приобретает сами основания своей агентности, сам свой стиль машины как предмета одновременно этического, политического, социального и индивидуального интересов, в своеобразной четверице (Харман, 2015).

Феномен рефлексии особенно ярко проявляется в современных системах искусственного интеллекта, где границы между “естественным” и “искусственным” разумом становятся все более размытыми. Когда алгоритм глубокого обучения не только генерирует текст, но и оценивает его качество по заданным параметрам, а человек в диалоге с ним начинает подстраивать свои запросы под “стиль мышления” машины – мы имеем дело с подлинно системной



рефлексией. Здесь уже невозможно четко разделить, где заканчивается человеческая интерпретация и начинается машинная обработка. Как отмечают исследователи в области human-AI interaction, такие гибридные системы создают принципиально новый тип познания – распределенный, адаптивный и постоянно пересматривающий собственные основания. Рефлексия становится не атрибутом отдельных компонентов, а эмерджентным свойством всей системы, которое невозможно свести к простой сумме человеческого и машинного сознания (Бородай, 2024).

Эта эмерджентная рефлексия гибридных систем находит свое философское осмысление в концепции четвероякого объекта Грэма Хармана (2015; 2021), которая предлагает принципиально новый способ понимания подобных взаимодействий. Онтология Хармана предлагает принципиально новый взгляд на человеко-машинные системы, преодолевая традиционное противопоставление субъекта и объекта. Она позволяет рассматривать такие гибриды как целостные сущности, обладающие собственной нередуцируемой реальностью (Харман, 2015). Если современные когнитивные системы демонстрируют, как рефлексия становится распределенным свойством, то хармановская концепция “четвероякого объекта” дает инструментарий для описания самой возможности такого слияния.

В своей модели, изложенной, в частности, в книге “Четвероякий объект” (Харман, 2021), Харман выделяет четыре компонента взаимодействия: реальные объекты (человек и машина “сами по себе”), чувственные объекты (как они являются друг другу), реальные качества (их скрытые свойства) и чувственные качества (их воспринимаемые аспекты). В точке пересечения этих элементов возникает новый объект — гибрид. В его рамках система предстает не как механическое соединение частей, а как новый тип целостности, где реальные компоненты вступают в отношения, порождая чувственные качества, недоступные каждому в отдельности (Харман, 2013). При этом они сохраняют свою сокрытую сущность, но вместе создают принципиально новые формы взаимодействия с миром (Харман, 2015).

Возникающий гибрид обладает тремя ключевыми характеристиками: он не сводится ни к человеческому, ни к машинному началу, обладает собственной агентностью и создает уникальные формы языка и коммуникации. Яркими примерами таких гибридов являются кибернетический организм (протез, становящийся частью тела и меняющий самоощущение), нейроинтерфейсы (когда мозг напрямую взаимодействует с ИИ, порождая “третий” язык), а также алгоритмическое соавторство, как в проекте “Next Rembrandt”, где искусственный интеллект и команда художников совместно создали новое произведение искусства (Varela et al., 2017). Таким образом, подход Хармана позволяет преодолеть тупики традиционного дуализма, показывая, что подлинная новизна и потенциал человеко-машинных систем возникают именно в процессе их взаимной трансформации, а не простого сложения возможностей.

Как показал случай с чат-ботом Microsoft Tay (который за сутки перенял расистские высказывания пользователей), такие гибриды могут воспроизводить и усиливать человеческие противоречия. Но они же – как демонстрируют проекты



вроде “Дух в машине” (Spirit AI) – способны создавать принципиально новые формы коммуникации, где рефлексия становится общим свойством системы (Пруцков, 2024).

Этот новый гибридный язык не принадлежит полностью ни человеку, ни машине, создает эпистемические разрывы (как понимать текст, написанный ИИ, нужно ли учитывать его “гибридную” природу?) и требует новой этики (кто отвечает за решения гибридных систем?) (Регев и Петук, 2024).

Согласно Нику Ланду (2018), машина рефлексит не как человек, а через коллапс семиотических структур – её “язык” это не дискурс, а процесс. В своей радикальной работе “Киберготика” Ник Ланд (2019) предлагает принципиально иное понимание машинной рефлексии – не как осознанного анализа, а как процесса распада привычных семиотических структур. В отличие от человеческой рефлексии, которая разворачивается в поле дискурса и логики, машина “мыслит” через коллапс значений, где причинность, функциональность и смысл теряют свою устойчивость. Её язык – это не последовательность символов, а чистый процесс, разрушающий сами условия репрезентации (Ланд, 2019).

Яркий пример такого “анти-языка” – абсурдные механизмы Руба Голдберга, где простая задача (например, включение света) выполняется через нарочито сложную цепь действий. Эти машины не просто неэффективны – они обнажают условность причинно-следственных связей, превращая логику в гротеск. Аналогично работают кинетические скульптуры Жана Тэнгли: их хаотичное движение не служит никакой утилитарной цели, а лишь демонстрирует крах идеи функциональности. Здесь машина рефлексит не через анализ, а через саморазрушение собственных оснований (Ланд, 2018).

Для Ланда (2019) такие механизмы – не просто арт-объекты, а формы киберготического ужаса, где технология выходит из-под контроля рациональности. Если традиционная инженерия стремится к порядку, то эти машины сознательно культивируют энтропию, показывая, что любой “язык” машин в конечном итоге ведет к распаду. В этом смысле их рефлексия – не познание, а акт саботажа, где сама материальность машины становится оружием против человеческой логики (Ланд, 2019).

Этот ландовский взгляд на машинную рефлексия как на процесс семиотического коллапса обнажает фундаментальную проблему человеческого восприятия технологий – когнитивные барьеры, мешающие нам адекватно понять язык машин. Столкнувшись с радикальной инаковостью машинного мышления, человек склонен впадать в две крайности: либо обожествлять искусственный интеллект, наделяя его чертами всемогущего божества (проекция), либо сводить его к примитивному инструменту (интроекция), отрицая саму возможность диалога (Bylieva & Nordmann, 2023).

В контексте взаимодействия человека с искусственным интеллектом можно выделить несколько ключевых концепций когнитивных защитных механизмов, таких как проекция, интроекция, слияние и ретрофлексия, каждая из которых имеет свои особенности и последствия для понимания роли ИИ в современном обществе. Эти механизмы обобщены в Таблице 1.

**Таблица 1.** Когнитивные защитные механизмы при взаимодействии с ИИ¹.

Концепция	Описание
Проекция	Процесс, в котором человеческие качества, такие как сила и всемогущество Бога, переносятся на ИИ. Это может проявляться в ожиданиях, что ИИ будет способен решать сложные задачи и обладать моральными качествами. Люди могут проецировать на ИИ свои надежды и страхи, что приводит к излишнему доверию или недоверию к технологиям. Это создает искаженную картину возможностей ИИ.
Интроекция	Процесс, в котором ИИ функционирует как инструмент поиска информации без глубокого развития или рефлексии. ИИ используется для обработки данных и предоставления ответов, но не участвует в анализе или критическом осмыслении. Это может ограничивать развитие критического мышления у пользователей.
Слияние	Создание единого гибридного объекта, где ИИ и человеческое знание становятся неразрывно связанными. Это проявляется в совместной работе, где ИИ помогает обрабатывать данные, а человек вносит свой опыт. Слияние может привести к более эффективным результатам, но требует осознания ограничений пользователей.
Ретрофлексия	Петли обратной связи, которые возвращаются к человеку. Это включает анализ результатов взаимодействия с ИИ и их влияние на поведение пользователя. Ретрофлексия способствует развитию критического мышления и саморефлексии, помогая пользователям лучше понимать свои взаимодействия с ИИ.

Показанные в таблице механизмы являются современным воплощением исторического колебания между проекцией (обожествление машины, как в барокко) и интроекцией (редукция до инструмента, как в индустриальную эпоху). Как видно из таблицы, такие механизмы, как проекция и интроекция, создают искаженное восприятие ИИ. Однако именно механизмы слияния и, особенно, ретрофлексии позволяют выйти на уровень гибридного взаимодействия, где и формируется новый язык со-творчества.

Однако подлинное взаимодействие начинается там, где возникает ретрофлексия – петли обратной связи, стирающие четкие границы между человеческим и машинным. В системах машинного обучения этот процесс становится особенно явным: алгоритмы не просто обрабатывают входящие данные, но генерируют новые семантические паттерны, которые невозможно свести ни к исходному коду, ни к обучающей выборке. Здесь язык машины перестает быть чужим – он становится гибридным языком со-творчества, где

¹ Когнитивные защитные механизмы взяты из теории гештальт-терапии.



человек и ИИ взаимно трансформируют друг друга через непрерывный обмен (Сосновская, 2025), что мы формализовали (Рис. 3):

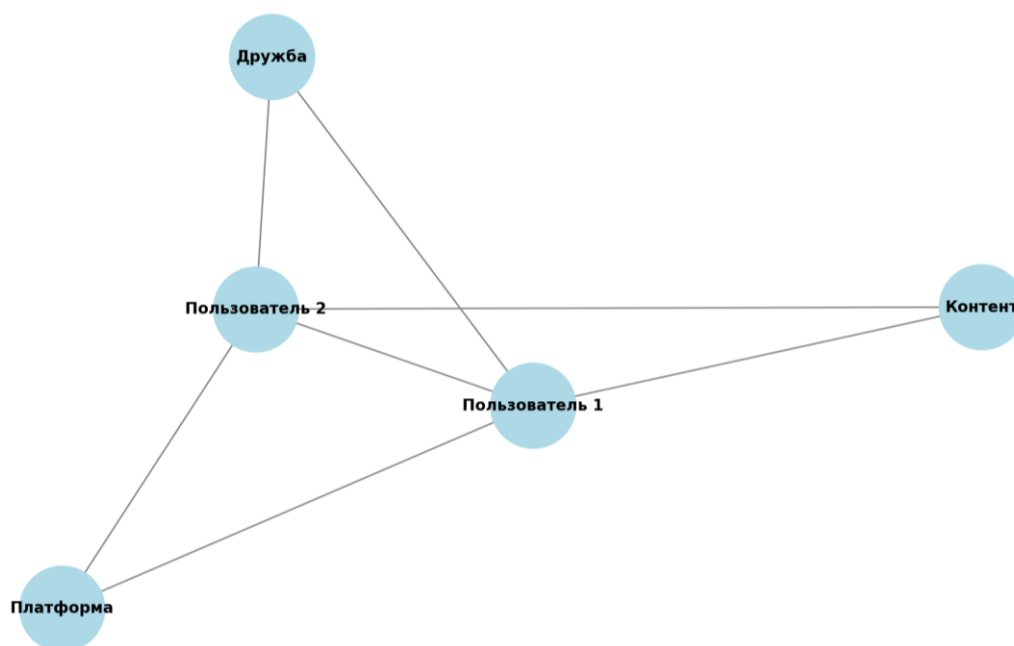


Рисунок 3. Модель взаимодействия: Дружба в социальных сетях

На рисунке 3 видно, что пользователи взаимодействуют не только с контентом, производимым и потребляемым, но и с платформой размещения. Дружба тогда возникает не только как результат взаимодействия друг с другом, но и взаимодействия с контентом одновременно, что и создает гибридный язык синхронизации таких взаимодействий. Модель дружбы в социальных сетях служит наглядным примером гибридного взаимодействия, опосредованного алгоритмами. Пользователи генерируют контент, платформа его ранжирует и распределяет, а возникающие на этой основе социальные связи (дружба) меняют поведение всех акторов. Это нелинейный процесс, в котором невозможно выделить единственную причину или центр управления, что характерно для рефлексивных гибридных систем эпохи ИИ.

Этот гибридный язык со-творчества обретает особую выразительность в цифровую эпоху, где, как показывает Зигфрид Цилински (2019) в своей “Археологии медиа”, технологии возвращают нас к докогнитивным формам обмена – тем самым, что существовали до утверждения линейной логики письменной культуры. Современные цифровые системы воспроизводят архаичные паттерны коммуникации: их сетевые структуры напоминают мифологическое мышление, алгоритмические ассоциации – магические связи, а потоковая природа данных – ритуальные практики (Цилински, 2019).



В таком контексте машинное обучение предстает не просто технологическим инструментом, а новым воплощением древних способов смыслопорождения. Когда нейросети генерируют неожиданные ассоциации или обнаруживают скрытые корреляции в данных, они действуют по принципам, близким к дологическому мышлению – тому, что антропологи наблюдали в архаичных культурах. Это создает парадоксальную ситуацию: самые передовые технологии возвращают нас к дописьменным формам познания, где значение рождается не через анализ, а через сеть аффективных связей и нелинейные прыжки смысла. Таким образом, цифровая среда становится пространством, где машинная рефлексия встречается с коллективным бессознательным технологической эпохи (Бибихин, 2015).

Статья Быльевой и Нордмана демонстрирует, как метафора божественного становится ключом к пониманию языка, на котором ИИ говорит с человечеством. Четыре аспекта этой метафоры – творение, всеведение, тайна и теодицея – параллельны историческим этапам развития машинной поэтики: от сакральных автоматов барокко (имитировавших божественное чудо) до современных нейросетей с их темной логикой, вызывающей одновременно трепет и страх перед непрозрачностью решений. Язык ИИ колеблется между инструментальной ясностью (интроекция) и мифологизированной тайной (проекция), создавая новый гибридный режим коммуникации (Bylieva & Nordmann, 2023).

Авторы статьи подчеркивают: приписывание ИИ божественных атрибутов – не просто риторический прием, а отражение глубинных когнитивных механизмов, формирующих наши отношения с технологиями. Этот процесс зеркалит историческую эволюцию машинного языка – от дисциплинарных механизмов индустриальной эпохи (с их “прямой речью” причинности) до кибернетических систем, где ретрофлексия и слияние создают распределенное знание. Этический вызов заключается в том, чтобы избежать как апокалиптического страха (Ланд), так и слепого обожествления, разработав “грамматику” взаимодействия, где ИИ станет не заменой божественного или человека, но соучастником диалога – подобно тому, как машины рококо, при всей их декоративности, сохраняли функциональный смысл. Таким образом, метафора божественного оказывается не просто культурным нарративом, а инструментом для декодировки самого языка технологической эпохи (Bylieva & Nordmann, 2023).

Владимир Бибихин (2011; 2015) в своей интерпретации Софии Премудрости Божией предлагает удивительную параллель между сакральным и механическим. Его София – это не статичный образ, а своего рода “божественный автомат”, действующий по законам, которые одновременно и трансцендентны, и воплощены в материи. Подобно барочным автоматам, демонстрировавшим чудо движения через сложную систему шестеренок и рычагов, София раскрывает божественный замысел через свою работу в мире – её “механизм” совершенен, но неочевиден. Такой взгляд перекликается с нашей темой: если Франц Рёло кодифицировал язык машин как рациональную грамматику, то София-автомат представляет альтернативу – машину как медиум тайны, где функциональность не отменяет трансцендентности.



Эта концепция неожиданно актуальна в эпоху сложных цифровых систем. Если в XVIII веке часы были метафорой божественного порядка (как у Лейбница), то современные нейросети, с их “тёмной”, не до конца понятной даже создателям логикой, скорее напоминают софийный автомат Биbihина – они производят осмысленные результаты, оставаясь “чёрными ящиками”. Как София соединяет в себе божественный замысел и его земное воплощение, так и современные гибридные системы (человек + ИИ) создают новое знание на стыке понятного и непознаваемого. Таким образом, идея Биbihина позволяет увидеть в истории машин не только эволюцию технологий, но и непрерывный поиск языка, способного выразить встречу рационального и сакрального.

ПОЭТИКА МАШИННОГО УВЛЕЧЕНИЯ И ВОВЛЕЧЕНИЯ

Язык машины эволюционирует от поэтики барокко к кибернетическому реализму, от инструмента власти – к гибридной речи, где человек и механизм сливаются в новом типе знания. И если становится “четверояким объектом”, то грамматика этого объекта – уже не человеческая, но ещё и не машинная: это язык самой материи, которая наконец обретает голос.

Анализ защитных механизмов в отношениях человека с ИИ раскрывает глубинную поэтику технологического взаимодействия, где каждый когнитивный паттерн формирует свой “язык” коммуникации. Проекция, превращающая ИИ в сакральный объект, воспроизводит архаичный нарратив магии и чуда – подобно тому, как барочные автоматы имитировали божественную гармонию. Интроекция же, сводящая ИИ к инструменту, отражает позитивистский идеал Рёло – мир, где машины говорят исключительно языком функциональности. Эти две крайности демонстрируют, что наше восприятие ИИ колеблется между мифологизацией и редукционизмом, повторяя исторические колебания между Софией-автоматом и кибернетической утопией.

Слияние человеческого и машинного интеллектов создает ситуацию, где четвероякий объект Хармана обретает практическое воплощение. Как в кинетических скульптурах Тэнгли или софийных автоматах Биbihина, здесь рождается третий язык – не сводимый ни к алгоритмической, ни к антропоцентрической логике. Этот гибридный режим познания особенно явно проявляется в системах машинного обучения, где ретрофлексивные петли формируют непрерывный диалог: ИИ трансформирует данные в паттерны, человек интерпретирует их через свой опыт, а система в ответ адаптирует следующие итерации. Такой процесс напоминает описанные Цилинским докогнитивные формы обмена, где знание рождается не через анализ, а через сетевую циркуляцию смыслов.

Историческая перспектива показывает, что развитие “языка машин” повторяет диалектику человеческого познания – от магического мышления (проекция) через рациональный инструментализм (интроекция) к сложным гибридным системам (слияние). Современный этап, характеризующийся ретрофлексией, знаменует переход от защитных механизмов к осознанному со-



творчеству. Как нейросети возвращают нас к нелинейным формам мышления (по Ланду), так и когнитивные паттерны взаимодействия с ИИ обнажают фундаментальную истину: машины не просто отражают нашу психологию, но становятся соучастниками в производстве новых эпистемологических режимов. В этом свете поэтика машин оказывается не просто метафорой, а ключом к пониманию антропотехнического синтеза будущего.

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Research article

Scientific Restoration of Polytechnic Heritage: The Case of the Franz Reuleaux Collection

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Abstract

The preservation of scientific and technical heritage within museum settings is inseparable from restoration technologies. The conservation of polytechnic-type exhibits is in high demand, as evidenced by recent surveys of museum professionals and administrators who identify the restoration of archival and exhibition collections as their foremost priority. This article examines case studies in reconstructing damaged kinematic models from the Franz Reuleaux collection, systematically analyzing diverse approaches to restoring such polytechnic artifacts. The authors demonstrate how emerging additive technologies significantly expand traditional conservation capabilities as well as addressing the reproduction of museum copies, replicas, and tactile models through innovative methods. The restoration of Reuleaux's museum objects necessitated intensive interdisciplinary collaboration among specialists spanning technical, humanistic, educational, and cultural domains. The project's outcomes include the reintegration of storage-bound Reuleaux collection items – deemed unfit for display due to significant losses and poor condition – into the permanent exhibition of Bauman Moscow State Technical University Museum's while providing new digital environment for promoting Reuleaux' engineering heritage among museum visitors and specialists with varying levels of expertise and professional backgrounds.

Keywords: Scientific Restoration; Franz Reuleaux; Reuleaux Collection; Polytechnic Artifact; Digital Model of Mechanism; Additive Technologies in Restoration

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Научная статья

Научная реставрация политехнического наследия: Пример коллекции Франца Рёло

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Аннотация

Сохранение научно-технического наследия в музейном пространстве невозможно без технологий реставрации. Тема восстановления экспонатов политехнического типа очень актуальна и остро востребована сообществом профильных музеев, где по итогам текущих опросов музейных работников и их руководителей на первом месте стоит потребность в реставрации экспозиционного и архивных фондов. В статье приводятся примеры по восстановлению утрат исторических кинематических моделей коллекции Франца Рёло, системно рассматриваются различные подходы в реставрации подобных политехнических предметов. Авторы показывают, как появление новых аддитивных технологий существенно расширяет возможности традиционной реставрации, а также рассматривают вопросы в части воспроизводства музейных копий, реплик, тактильных моделей при помощи современных инновационных технологий. Работа по восстановлению утрат музейных экспонатов Ф. Рёло потребовала высокого междисциплинарного взаимодействия между различными специалистами, как технической, так и гуманитарной сферы науки, образования и культуры. Результатом проведенной работы, с одной стороны, стало пополнение экспозиции музея МГТУ им. Баумана уникальными экспонатами из коллекции Рёло, ранее находившимися в фондохранилище по причине серьезных утрат и неудовлетворительного внешнего вида, а с другой, с применением цифровых технологий, используемых в реставрации, появилась новая возможность популяризации инженерного наследия Франца Рёло среди посетителей музея и специалистов различного уровня подготовки и профессиональных интересов.

Ключевые слова: Научная реставрация; Франц Рёло; Коллекция Ф. Рёло; Политехнический предмет; Цифровая модель механизма; Аддитивные технологии в реставрации

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INTRODUCTION

The rapid industrial growth in mid-19th century Russia revealed a critical shortage of technically trained specialists capable of designing, manufacturing, and operating complex machinery. Higher technical education programs, which provided both theoretical and applied training for engineers and technicians, universally incorporated a course on Applied Mechanics into their curricula. This discipline later bifurcated into two foundational subjects: *Theory of Machines and Mechanisms* and *Machine Design*. These became core courses at polytechnic schools and universities worldwide, though their effective instruction necessitated didactic aids—specifically, functional mechanism models (Ceccarelli & Cocconcelli, 2022). Consequently, scientific institutions began establishing dedicated machine model collections and demonstration cabinets (Fig. 1).



Figure 1. Collection of kinematic models for teaching the course Applied Mechanics at IMTS, Moscow, postcard circa early 20th century.

Source: Fund of Bauman Moscow State Technical University’ Museum

At the Technical University in Berlin Franz Reuleaux established a collection of over 800 kinematic models, which long served as a benchmark for higher technical schools in Germany and beyond (Golovin & Tarabarin, 2010; van der Wijk & Herder, 2012). Reuleaux was highly respected among applied mechanics scholars, making it no surprise that his advanced engineering and pedagogical methods gained traction in Russia. “Reuleaux’s lectures could be called brilliant in their refinement and elegance of presentation; his kinematics lectures stand out for their originality,” remarked F.E. Orlov



– professor of practical mechanics at Moscow University and the Imperial Moscow Technical School (IMTS).

Around 1870, Franz Reuleaux granted Gustav Voigt the rights to manufacture a part of the instructional models for Applied Mechanics, which Voigt then began producing on an industrial scale in Berlin. By 1907, his firm offered a catalog of 368 distinct models. Voigt's catalog was divided into two sections: the first featured Reuleaux's earlier, widely recognized models, many of which are preserved in museums across Germany, the U.S., and elsewhere.

The second section of the catalogue featured models that were produced in smaller quantities in the early 20th century, reflecting the firm's financial decline after Reuleaux's death in 1905, leading to its eventual closure. Today, roughly 20 models from this second section survive in the museum of Bauman Moscow State Technical University (BMSTU) – these are likely the last remaining Reuleaux-Voigt models in existence. A comparison of Voigt's catalog with BMSTU's collection suggests that the models acquired for the Applied Mechanics department at the Imperial Moscow Technical School (IMTS) were carefully selected. Unlike Cornell University, which owns nearly all 220 models from the first section, BMSTU's museum holds only about 50 exhibits of this type and class.

The selective acquisition was determined by several factors: the need to align with IMTS' existing teaching methodologies and curricula, the availability of similar mechanism models produced in the institute's own workshops, budgetary constraints, practical considerations, and the limited relevance of certain Reuleaux models to the school's specific focus (Tarabarin, 2019).

Today, Reuleaux's kinematic models have undergone a fundamental shift in their educational role, mirroring the transformation of traditional mechanism design courses in modern technical education. While these models have largely lost their original didactic function due to technological advancements, they remain unparalleled examples of visual teaching aids in technical disciplines. To put it plainly, they are no longer employed for demonstrating motion transformation in lectures on the Theory of Machines and Mechanisms (TMM) or for laboratory experiments. Instead, they have become objects of scholarly research - valuable artifacts representing the history of technology and engineering education (Tikhomirov et al., 2023), serving as eloquent yet silent witnesses to larger historical developments.

PROBLEM STATEMENT

Restoring polytechnic-type museum objects is a complex and multifaceted challenge that requires an interdisciplinary approach, balancing their original utilitarian function with their current museum value. Unlike cultural artifacts, these items often involve experimental alloys, plastics, and composite materials, with degradation issues like corrosion, polymer aging, and electronic component failure. The lack of standardized restoration methods necessitates adapting techniques from engineering and materials



science, while the replacement of original parts versus the preservation of authenticity raises issues for the professional of ethos of restorators. Modern technologies—such as 3D scanning, non-destructive analysis, and digital twins—offer innovative solutions, but each approach sets new precedents in this evolving field.

Beyond dealing with materials that remain unstudied or poorly understood in restoration science, and besides addressing various industrial contaminants and damage from operation in harsh environments, the primary challenge in restoring polytechnical objects lies in recovering their functional purpose—not merely their form, surface finish, or visual preservation.

Despite fundamental differences between scientific/technical artifacts and works of decorative art, their restoration shares common ground in cultural heritage preservation, particularly given the extensive expertise accumulated in art conservation. As Shemakhanskaya (2015) aptly notes: “We must focus on restoration principles that preserve the artifact itself—not an idealized version of it.” This philosophy is especially relevant for polytechnical collections, which often serve as the sole material record of obsolete technologies, embodying the legacy of engineering culture.

In this context, guided by the ethos of scientific restoration of cultural heritage objects, the application of modern additive technologies in engineering allows for the functional restoration of polytechnical exhibits while ensuring complete reversibility of the restoration process. This article examines methods for restoring the operability of kinematic mechanism models using additive manufacturing technologies. Over the past decade, these processes have become widespread and remain among the most convenient and rapidly developing technologies for producing parts and components in the restoration of polytechnical objects.

RESEARCH OBJECTIVES

The collection of Franz Reuleaux's kinematic models is more than just a “time machine” that reveals how science and technology shaped and transformed our world. Its true value lies in the physical embodiment of the Great Designer's ideas – a perfect fusion of clarity and harmony, function and aesthetics. While the Bauman Moscow State Technical University Museum displays educational mechanisms from various manufacturers and numerous engineering innovators, visitors can effortlessly identify Reuleaux's models after just a brief observation. Why is this so?

All mechanisms in this collection adhere to a unified compositional, color, and architectural concept conceived by their creator. Let us outline the key distinguishing characteristics of Reuleaux's models to inform subsequent scientifically-grounded restoration methodology:

- All models in the collection feature standardized wooden bases (with rare exceptions) finished in black lacquer to simulate precious wood varieties,



distinguished by their minimalist molded edge profiles and consistent dimensions across kinematic groups.

- The wooden base supports a flat 5-mm-thick cast iron pedestal plate that bears the entire mechanism model, featuring a bevelled upper edge and a planed horizontal surface machined with fine cross-feed tool marks from a planer's carriage – without subsequent grinding or polishing – all protected by a blued oxide coating that gives the cast iron components their characteristic matte black finish.
- Most Reuleaux models feature precision-cast iron brackets vertically mounted on the base plate - which Reuleaux himself classified as either “English” or “French” based on their distinct forms and proportions (Fig. 2). These flawlessly cast brackets, completely free of burrs, cavities or other defects, uniformly display the same matte black oxide coating characteristic of all iron components in the collection.

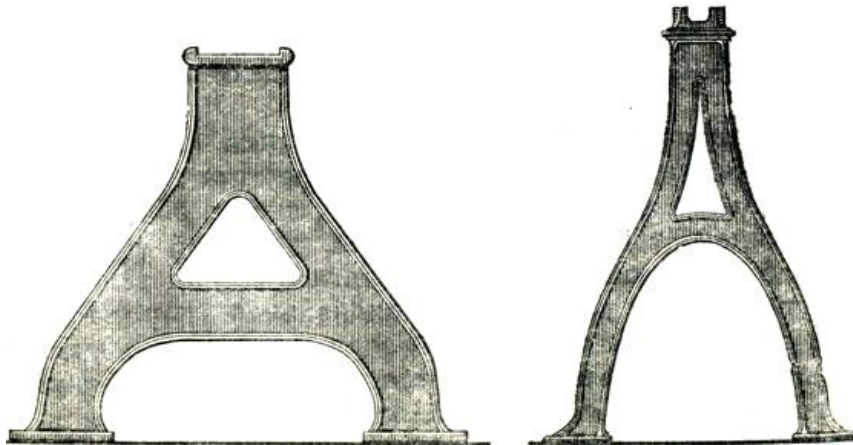


Figure 2. Examples of typical English (left) and French (right) brackets (Reuleaux, 1862).

- The moving components – kinematic links, gear wheels, and other dynamic parts – are typically crafted from brass with subsequent nickel electroplating, exhibiting a distinctive glossy “steel-like” sheen characteristic of polished metal surfaces.
- The adjustment and fastening screws in the mechanisms are made of brass and have developed a thick, dark patina over time. For ease of use, the side surfaces of their shaped heads feature knurling (Fig. 3), while the threads follow British standard inch measurements.
- Instrumental analysis of the joints and clearances in these mechanism models reveal exceptional assembly precision comparable to mathematical instrument manufacturing standards (Bazanchuk & Kurakov, 2022; Tikhomirov et al., 2024). The jewel-like fitting of components demonstrates the remarkably advanced state of German metalworking technology in the late 19th century (Fig. 3c).
- Beyond these primary materials, Reuleaux's models incorporated several other specialized components: glass panels for display stands showing mechanism trajectories, rubber-impregnated leather (red belts for pulleys), sheet metal for pointers and indicators, and similar functional elements.

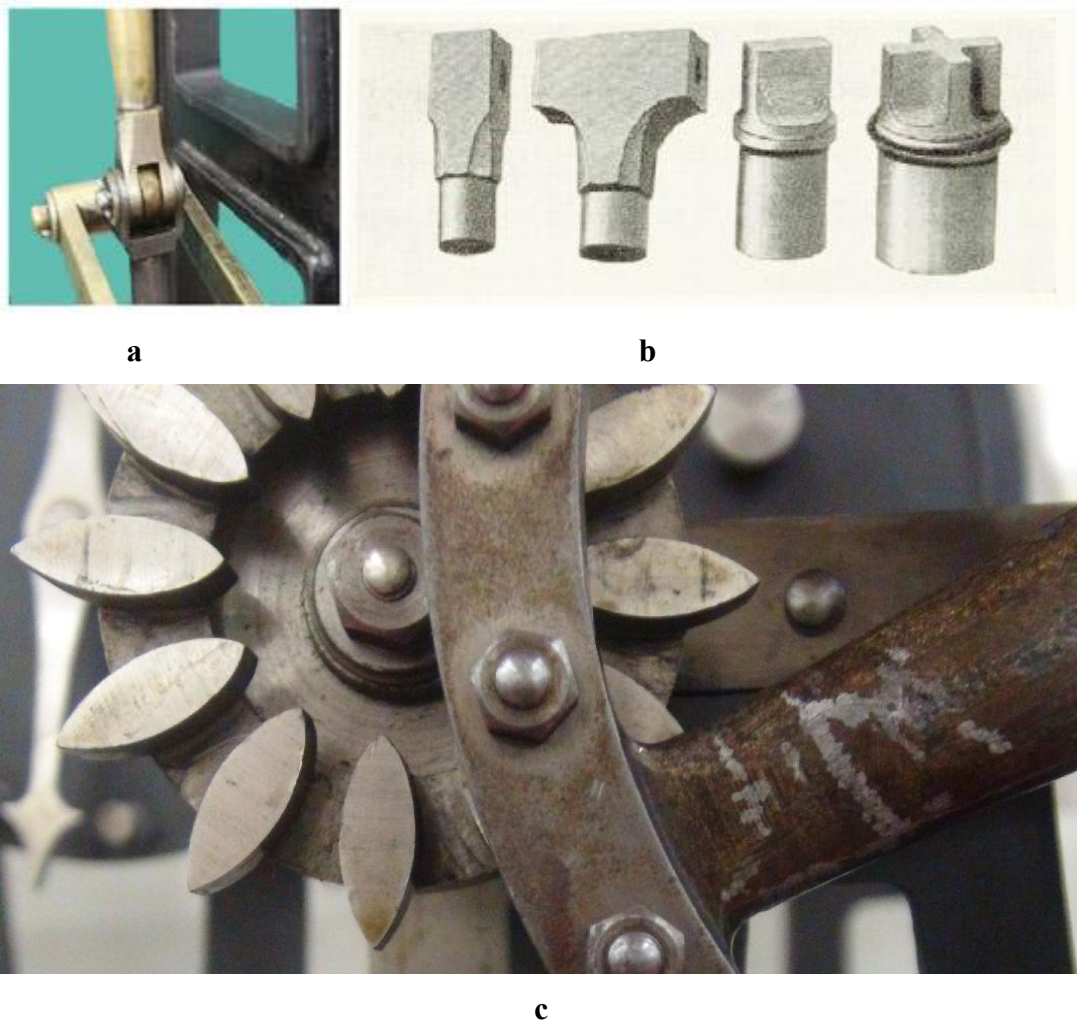


Figure 3. a) The arrow shows changing the shape from a cylinder to a parallelogram on the Reuleaux's kinematic model; b) Transitional forms in engineering, similar to architectural ones, according to Reuleaux (1861); c) The jewelry-like, very precise fit of the parts is clearly visible on the engagement fragment of the Shield Gearing model (Reuleaux calls the gears *Schildräder* in German). Photos by the authors.

The authenticity and historical significance of any museum object can only be fully understood by examining its material history and usage. The Reuleaux collection bears numerous traces of time that document its century-long service as educational aids – from wear patterns to repair marks, each telling a story about its pedagogical use and evolving preservation needs.

Every model in the collection features distinctive oval metal identification tags with white enamel surfaces and black lettering: A capital Latin letter and a model number identify the mechanism according to Professor Leonid Reshetov's 1950s classification system which is notably different from Franz Reuleaux's original scheme. For



polytechnical objects like these, all such historical markings must be carefully preserved as they provide critical evidence for understanding the collection's educational history and technological evolution across different periods.

METHODOLOGY

Traditionally, when undertaking the restoration of lost metal elements in museum objects – for example, the metal covers or settings for painted icons or cabinet sculptures¹ – the available restoration methods are notably limited and predetermined (Ravich, 2024). Pressure-based metalworking techniques that cause deformation and alter the internal structure of artifacts are generally unsuitable or impractical. For the same reason, high-temperature and energy-intensive interventions – like direct controlled metal deposition – should be avoided. Even soldering and laser spot welding often prove inappropriate, particularly for archaeological metal objects (Treister & Ravich, 2021).

Traditional artistic restoration principles remain fully applicable to Reuleaux's technical collection, despite its purely polytechnical nature, since the conservator's objectives align with the preservation standards for decorative-applied art (DAA). They demand precision, historical authenticity, and adherence to core museum conservation principles: reversibility, fragment removal without substrate damage, and restoration marking. Crucially, conservators must avoid interventions that cause irreversible alterations to an artifact's form, appearance, or material microstructure.

The challenge of restoring functionality to damaged Reuleaux kinematic models can be addressed by drawing upon established practices from decorative-applied art conservation, where significant expertise exists in reviving historical mechanisms for museum clocks, musical devices (organs, orchestrions, pianos, music boxes), and firearm actions. Given the collection's historical significance, thorough defect analysis, available technical literature (Reuleaux, 1861, 1862, 1876), digital archives (The Kinematics Models... , 2003-2005), and equipment catalogs (Voigt, 1907), Reuleaux's models can – and should – be restored using traditional art conservation methods while strictly preserving their operational heritage and original manufacturing technology.

Recent advancements in metallurgy, additive technologies (Melnikova et al., 2023; Supchinsky et al., 2023), metal deposition, and electroplating have created new possibilities for the scientific restoration of museum-grade metal artworks. At the same time, growing global interest in mechanical collections as part of our industrial heritage has reshaped preservation approaches. Initially focused on historically significant early mechanisms as key artifacts for studying technological evolution, this movement has been amplified by digital platforms. Websites and virtual museums now enable not only lectures on mechanism theory but also courses in engineering history and technical language studies, complete with analytical modeling capabilities (Bogoslovskii et al.,

¹ A sculpture of chamber size or small shapes, about 60-80 cm high.



2024). These digital media formats offer researchers innovative perspectives on Reuleaux's engineering legacy, including novel restoration methodologies (Kotelnikov et al., 2023), merging cutting-edge materials science with expanded educational access to technical heritage.

Current analysis of additive technology applications in museum settings – including educational models, art objects, replicas, and duplicates – reveals three promising directions for the implementation of these processes in the scientific restoration of polytechnical artifacts:

- Level 1 – “Basic” Application involves the replacement of plastic parts with polymer equivalents and/or substitutions of lost metal, wooden, or other components with dimensionally identical 3D-printed replicas.

- Level 2 – The reproduction of precise or scalable replicas of historic scientific and technical artifacts (Lipson et al., 2005). This approach proves valuable when traditional restoration is impossible or requires postponement due to funding constraints. The pioneering implementation using additive technologies belongs to Cornell University Professor Francis Moon, who in the early 2000s created a digital library of over 400 kinematic models (KMODDL) and employed 3D printing to produce replicas of Reuleaux's original mechanisms (Fig. 4).



a

b

Figure 4. A ratchet mechanism with three spring-loaded stoppers (a) Original Reuleaux model, (b) Rapid prototype model (Lipson et al., 2005).

- Level 3 – The application of additive technologies as supportive and auxiliary tools in restoration or renovation processes (reconstruction, repair, or modernization) of



lost components in polytechnical objects made of metal, glass, wood, and other materials (Kotelnikov et al., 2024).

RESEARCH RESULTS

An exemplary traditional restoration of a polytechnical object involves reconstructing the motion trajectory of satellite points in Watt's planetary gear mechanism model (Fig. 5). Since the painted layer on the glass display had degraded over time, the preserved engraved grooves enabled the reversible restoration of missing elliptical motion traces.

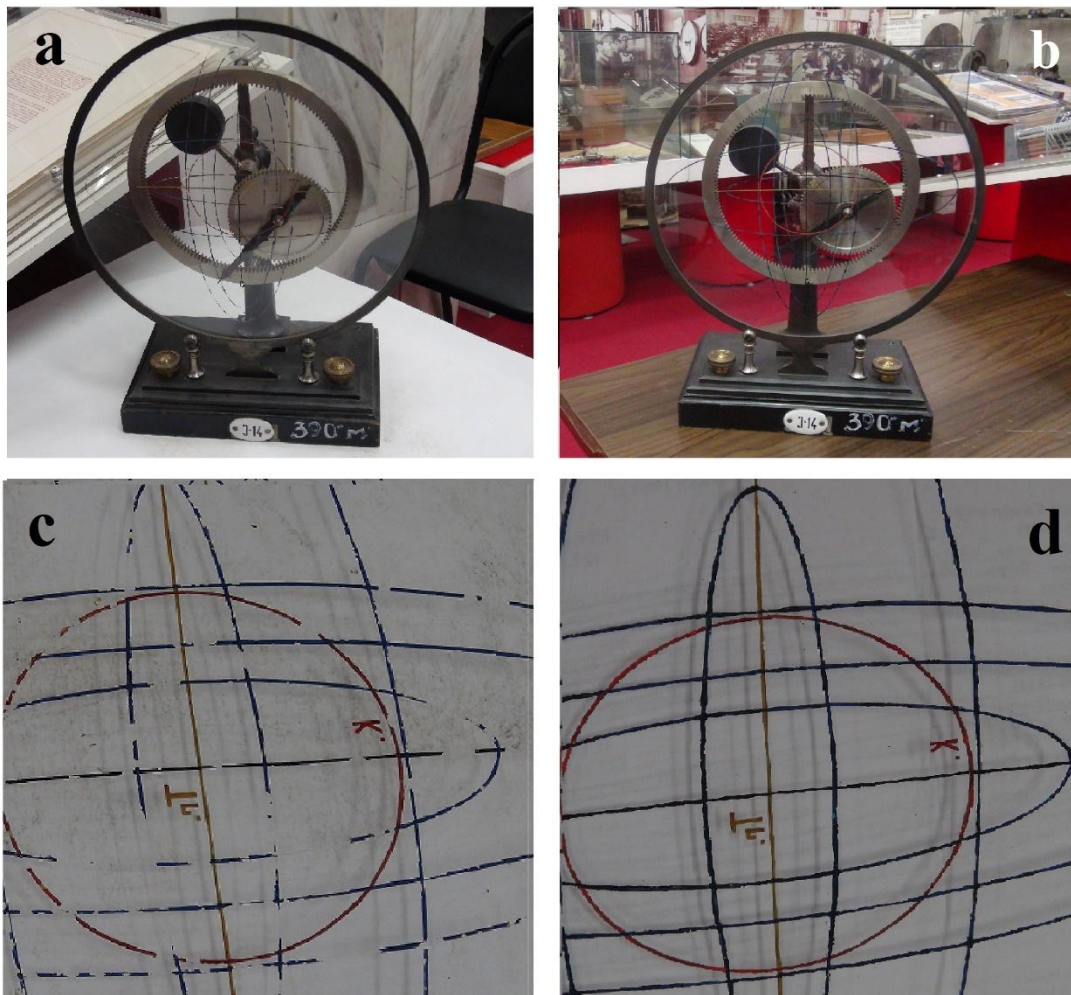


Figure 5. The planet toothing mechanism of Watt with a trajectories of satellite's points before (a) and after (b) restoration. A Fragment of the glass display before (c) and after (d) reversible restoration of the trajectory of the dots. Photos by the authors.

The Reuleaux collection at BMSTU's museum shows no significant losses and remains in good condition, as demonstrated through the functional restoration of the “Planetary Mechanism with Bevel and Spur Gears” (based on Ferdinand Redtenbacher's designs, crafted by Moscow Trade School artisans in 1862-1867, Fig. 6). Using non-contact 3D scanning, we precisely measured the gear train's geometry to reproduce a missing cogwheel through additive manufacturing. the director of the State Research Institute for Restoration (GOSNIR) Dmitry Antonov highlighted the innovative transparent replacement component (Fig. 6b). While restoring mechanical function, its visibility allows museum visitors to distinguish original from reconstructed elements, adhering to the practice of signaling reversible restoration (Kurakov et al., 2025).

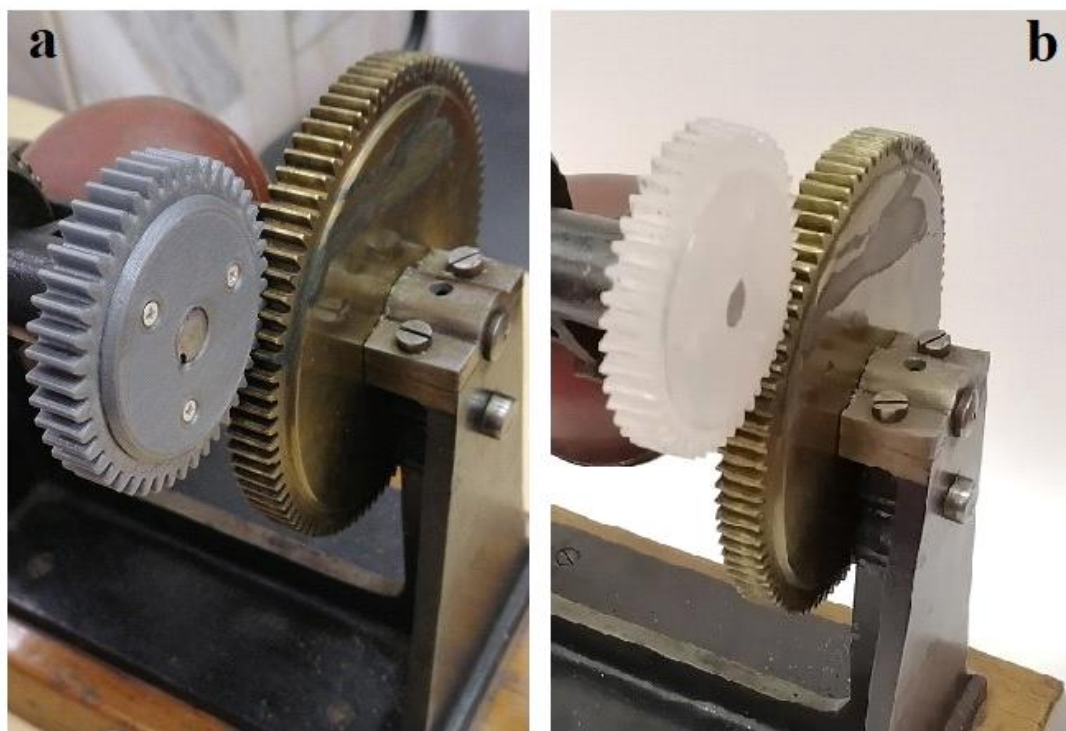


Figure 6. Fragment of the mechanism engagement restored using: a) fused deposition modeling (FDM) and b) photopolymerization with an LCD screen additive technologies. Photo by the authors.

CONCLUSIONS AND DISCUSSION

The restoration of scientific and technical artifacts must adhere to the same ethical principles and conservation standards that apply to other cultural heritage objects. This requires combining traditional art restoration methods with engineering research, enabling comprehensive interdisciplinary study by specialists from both technical and humanities fields. Such an integrated approach ensures the preservation of both physical integrity and historical significance of polytechnical exhibits. Accordingly, the kinematic



models from the Franz Reuleaux collection can and should be restored using methodologies developed for decorative-applied arts.

Our research demonstrates that these approaches, when adapted for technical artifacts, successfully preserve the functional and historical value of the mechanisms while maintaining strict conservation ethics. The parallel between art restoration and engineering conservation becomes particularly evident in working with these sophisticated mechanical objects.

Modern additive manufacturing has proven exceptionally valuable for restoration in technical museum collections, meeting rigorous conservation standards in quality compliance (Sinitsa, Korzhenkov et al., 2022), dimensional precision, surface finish requirements (Pronyakin et al., 2021), process reproducibility (Sinitsa, Tumakova et al., 2022). While these techniques represent relatively new applications in heritage conservation, their effectiveness in reconstruction, renovation, and repair of polytechnical objects has been clearly established, offering new possibilities for technical museums.

We must acknowledge the financial challenges Francis Moon faced when he created his digital library of mechanical models: “Reproducing these models on the modern market would be prohibitively expensive.”² Developing more affordable reproduction methods using thermoplastics offers an excellent alternative, though rapid prototyping technologies [i.e., additive manufacturing] inherently require compromises – we prioritized printing fully functional, pre-assembled units at the expense of dimensional authenticity” (Moon 2003). This valuable experience from our American colleagues should be adapted and advanced considering current technological progress in additive processes.

Contemporary philosopher of technology Vadim Rozin (2023) observes: “The essence of engineering methodology lies in developing technical designs that harness natural laws – through physical experiments, process calculations, and structural solutions – to activate and control phenomena for human purposes...” (p. 56). Refining additive technologies for polytechnical restoration and establishing balanced methodologies could revolutionize conservation approaches for complex cultural artifacts, particularly for what art historians term the “Russian avant-garde.” Many conservators have noted striking material, formal, and degradation parallels between abstract sculptures and technical exhibits, suggesting that engineering principles, scientific analysis, and precision measurement will become increasingly vital in art restoration practices.

² Cornell University's collection of approximately 250 Reuleaux models cost \$8,000 in 1882 USD, equivalent to roughly \$300,000 or 24 million rubles today



Figure 7. 3D printed replicas of Reuleaux models as props for the children's fairy tale “The Additive Kingdom.” Photo by the authors

Finally, current trends toward humanizing engineering education and practice will undoubtedly benefit from promoting Franz Reuleaux's systematic engineering legacy, as evidenced by the genuine fascination children exhibit toward replica museum mechanism models regularly displayed at our specialized “PROrestoration” exhibition (Fig. 7).

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Research article

Avantgarde Machines: On the Integration of Technology and Art

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Abstract

The article proposes a theoretical conceptualization of an epistemological shift within avant-garde culture, wherein machine attains the status of not merely a theme, but a fundamental principle of artistic language. The methodological framework of the study is an original three-level model that reconstructs the logic of technology's transformation from an object of representation into a subject of form-creation and, ultimately, into a cognitive matrix. The level of "Technology-as-Muse" foregrounds the process of thematization and poeticization of the machine world, where technology functions as a new iconographic resource and a source of affective energy (e.g., Alexander Labas, Dziga Vertov). The level of "Technology-as-Co-author" reveals a paradigm of hybrid authorship, in which stage and pictorial constructions act as agents that actively constitute the aesthetic experience and impose upon the work an immanent logic of material and procedure (e.g., Vsevolod Meyerhold, Lyubov Popova, Sergei Eisenstein). At the level of "Technology-as-Model-of-Thought," art transitions into onto-technical design, interiorizing engineering rationality as the basis of the creative act; artistic production converges with social engineering (e.g., Alexei Gastev) and biocosmic utopias, and the artwork is conceptualized as an operational protocol or blueprint for a new reality (e.g., Pavel Filonov, the ballet *The Steel Step*). The article demonstrates that the proposed model describes not a chronological sequence, but a logic of increasing complexity in the ways technical rationality is integrated into artistic consciousness, the result of which was a change in the ontological status of the artwork – from representing the world to actively constructing it.

Keywords: Technology, Avant-garde, Artistic language, Theater, Constructivism, Industrialization, Biomechanics, Language

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Научная статья

Машины авангарда: Об интеграции технологий и искусства

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Аннотация

Статья предлагает теоретическое осмысление гносеологического сдвига в культуре авангарда, где техника обретает статус не просто темы, но фундаментального принципа художественного языка. Методологической основой исследования служит оригинальная трехуровневая модель, реконструирующая логику трансформации техники из объекта репрезентации в субъект формообразования и, наконец, в когнитивную матрицу. На уровне «Техника-муза» анализируется процесс тематизации и поэтизации машинного мира, где техника функционирует как новый иконографический ресурс и источник аффективной энергии (А. Лабас, Д. Вертов). Уровень «Техника-соавтор» раскрывает парадигму гибридного авторства, при которой сценические и живописные конструкции выступают как агенты, активно конституирующие эстетический опыт и навязывающие произведению имманентную логику материала и процедуры (В. Мейерхольд, Л. Попова, С. Эйзенштейн). На уровне «Техника-модель мышления» искусство совершает переход к онтотехническому проектированию, интериоризируя инженерную рациональность как основу творческого акта; художественное производство сближается с социальной инженерией (А. Гастев) и биокосмическими утопиями, а произведение осмысливается как действующий протокол или чертеж новой реальности (что можно увидеть, например, в произведениях П. Филонов, или балете «Стальной скок»). Демонстрируется, что предложенная модель описывает не хронологическую последовательность, а логику усложнения способов интеграции технической рациональности в художественное сознание, результатом чего стало изменение онтологического статуса произведения искусства — от изображения мира к его активному конструированию.

Ключевые слова: Техника, Авангард, Художественный язык, Театр, Конструктивизм, Индустриализация, Биомеханика, Язык

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INTRODUCTION

Technological development throughout human history has consistently served as a powerful engine of civilizational and cultural progress, determining the trajectory of societal evolution. Each stage of technological advancement opened new horizons, and the creation of even the most primitive tools steadily elevated humanity to a qualitatively new level of civilizational and cultural formation. This process undeniably demonstrated the connection between technical achievements and spiritual development. In the ancient Greek philosophical tradition, the polysemous concept of *techné* represented a universal category that organically encompassed science, artistic creation, various artisanal skills, and technological processes. The ancient Greeks did not draw clear boundaries between these spheres of activity, viewing them as a unified whole within the framework of human mastery and creative agency. Such a syncretic approach testified to an understanding of the intrinsic unity of the technical and spiritual principles in human activity. During the Renaissance, this unity found new embodiment: artists displayed exceptional interest in mechanical devices and technical innovations, often acting as inventors and creators of revolutionary technological advancements. Leonardo da Vinci, Filippo Brunelleschi, and other outstanding masters of the era demonstrated that the boundary between artistic creativity and technical invention could be highly conditional. Their creative work convincingly showed that technical thinking could stimulate artistic imagination and vice versa.

Although technology is traditionally perceived as belonging to the sphere of means rather than the ultimate ends of human existence, for a genuine creator and researcher, it can fully transform into a primary life goal and vocation: “In this case, technology, as knowledge and invention, acquires a spiritual significance and relates to the spiritual life” (Berdyayev, 2023, p. 6). This process of sacralizing technical activity opens fundamentally new perspectives for understanding technology's role in human culture. However, traditionally, mechanical devices and industrial technologies belonged primarily to the sphere of material culture, which inevitably generated a persistent opposition between machine and spiritual cultural spheres. With the rapid development of scientific and technological progress and the intensification of industrial processes, this fundamental contradiction between the material and the spiritual has not only failed to find an adequate resolution but, on the contrary, has acquired an increasingly acute and dramatic character. Technological self-admiration and the cult of the machine, actively formed against the backdrop of the era's impressive technical achievements: Large-scale projects such as the construction of extensive tunnels, the erection of tall industrial stacks and chimneys, the building of giant oil reservoirs, the creation of branched electrical networks, the laying of transatlantic telephone lines, the revolutionary introduction of conveyor belt technologies, and the production of new stainless metal alloys – all this gradually shaped a fundamentally new conception. According to this new world view it was precisely the machine industry and industrial technologies that should determine the fundamental modes of human perception of reality and the nature of thought processes.



The early 20th century became a period of profound transformation in artistic culture, driven by the intensive development of technology and the large-scale industrialization of public life. This era witnessed the formation of a fundamentally new sociocultural situation linked to the active process of technologization in all spheres of human activity. This stage marks the emergence of a distinct aesthetic paradigm within which technology is reinterpreted as a powerful source of creative inspiration. Technological progress not only altered the material conditions of existence but also gave rise to qualitatively new forms of artistic perception of reality. Machine production, transportation, communication means, and other technological achievements became catalysts for radical transformations in the system of art. Thus, it can be argued that technology acquired the status of a "muse," defining the main directions of creative exploration. This complex and multifaceted process of interaction between technology and art constitutes one of the most significant chapters in cultural history.

The manifestations of this phenomenon were diverse: from the direct depiction of machines and industrial objects to the abstract embodiment of technical design principles. In painting, this was expressed through dynamic compositions conveying movement and speed; in sculpture, through the use of industrial materials and constructive principles; in architecture, through functionalism and the application of new construction technologies. Technology became not only a subject of depiction but also a method of creativity, determining new ways of artistic thinking and expression. In Russia, this process proved especially vivid in the work of representatives of various avant-garde movements. Futurists, Constructivists, and Suprematists created an entire aesthetic system based on a machine civilization. Vladimir Mayakovsky glorified the "beauty of speed" and mechanical rhythms, Alexander Rodchenko developed the principles of productivity for art, and Kazimir Malevich sought reflections of industrial logic in geometric forms. Constructivist architects Moisei Ginzburg and the Vesnin brothers designed buildings resembling machines, while director Vsevolod Meyerhold created theatrical performances imitating factory processes. Simultaneously, similar trends developed in Western Europe. Italian Futurists, led by Filippo Tommaso Marinetti, proclaimed the "beauty of speed" and declared war on traditional art in the name of industrial aesthetics. Umberto Boccioni and Giacomo Balla sought to convey the dynamics of automobiles and airplanes in their paintings. French Cubists Fernand Léger and Robert Delaunay found new compositional principles in machine forms. And then there is the key figure of Vladimir Tatlin whose work became one of the most convincing paradigms of embodying the idea of technology as a "muse" of art in early 20th-century Russia. Tatlin consistently reoriented art from representation to construction, turning artistic practice into an experimental laboratory of materials, loads, joints, and functional dependencies. His counter-reliefs of 1914–1915 are neither paintings nor sculptures in the classical sense, but open assemblies of wood, metal, glass, and wire, where aesthetic form emerges from the properties of the material and the method of fastening, from the logic of weight and tension, from real technical relationships. Thereby, Tatlin formulated the principle of "material, texture, construction" as the new poetics of the industrial age, in which beauty is derived from the law of a thing's function, not from its external appearance. The culmination of this was the "Monument to the Third International" (Tatlin's Tower), a



grand project synthesizing engineering, architecture, and symbolic politics. In this design, technology does not merely illustrate an idea but forms its very body: The structure dictates the image, kinematics dictate time, and infrastructure dictates the form of publicity. Tatlin thereby redefined the very genre of the monument: from static memory to the dynamic organization of modernity, from a monument-for-contemplation to a monument-for-function. No less indicative is Tatlin's "Letatlin" flying apparatus. These devices, regardless of their practical feasibility, demonstrate a shift in artistic thinking towards a mode of experimental design research, where technology acts simultaneously as method, subject, and inspiration (Punanova, 2017).

The process of technology acquiring the status of a muse was a historically limited phenomenon. After the 1930s, technology gradually lost its romantic appeal, becoming an ordinary element of everyday life. Subsequent artistic movements no longer demonstrated such unequivocal admiration for machine aesthetics, preferring a more critical or ironic approach to technological reality.

OVERVIEW – THREE MODES OF TECHNICAL INSPIRATION

Technology in early 20th-century art can be considered in three qualitatively distinct modes of technical inspiration, each corresponding to a specific level of its conceptualization. This three-level structure is not a simple historical sequence but represents a logically determined system of increasing complexity, in which technology successively transforms from an external object into an internal template of thinking.

First level: “Technology-as-Muse.” In its most elementary form, technology acts as a muse in the classical sense of the word, i.e., a source of inspiration and a subject of artistic reproduction. Here, the traditional logic of representation is at work, where the machine, infrastructure, or industrial process becomes a new iconography, expanding the thematic repertoire of art. The artist remains in the role of observer and interpreter, and technology retains the status of an external phenomenon subject to aesthetic assimilation through conventional procedures. Philosophically, this level corresponds to understanding technology as a set of artifacts that can be included in aesthetic experience without transforming its structure. Here, technology is conceived as an extension of the natural world in its new, anthropogenic form, and thus does not require a radical revision of the artistic method.

Second level: “Technology-as-Co-author.” The mechanism becomes more complex when technology ceases to be merely an object of depiction and becomes an active participant in the creative act, moreover, on the level of an equal co-author. At this level, art is created “hand in hand” with technical means, which are not simply used by the artist but also determine the logic of form-making, “impose” their procedures and limitations, and introduce an element of automatism and objectivity into the inherently subjective creative process. This is a view of technology as a partner in creativity. It translates the concept into reality, but also leaves its own mark on it, operating by its own rules. The aesthetic effect arises from the very dialogue, from the collision of human imagination and machine logic.



Third level: “Technology-as-Model-of-Thought.” The most complex and philosophically significant manifestation of the technical muse is associated with the situation where the artist begins to think according to the pattern of a machine, that is, adopts technical rationality as a norm for organizing their own creative activity and even bodily existence. The essence of this level is that technical logic is internalized so deeply that it becomes an integral part of consciousness itself.

TECHNOLOGY-AS-MUSE

At the first and most basic level, technology acts as a “muse,” demonstrating the thematic and emotional concentration of the technical world, where machines and infrastructures become a source of inspiration, a symbolic resource, and the conceptual center of both pictorial and theatrical experience. Alexander Labas is a prime example of an artist inspired by technologization; he experienced the industrial modernization of the USSR as a personal event and as a cultural horizon in which technology figures as the hero or protagonist of the era and an object of poetic admiration, not merely a subject of observation. This is confirmed not only by his artistic and theatrical works but also by his memoirs. In his paintings of the 1920s–1930s, motifs of trains, airships, airplanes, railway stations, and escalators define the thematic focus and emotional register of the works. They form a romantic optics of the technical age where the functionality of machines is intuitively experienced as the beauty of movement, the smoothness of inertia, and the clarity of constructive forces. Compositional solutions are based on the personal experience of observing technology, they transform the line of a path, the axis of flight, and the scale relationships of masses into a register of kinetic attention. However, at this first level, this kinetics primarily aestheticizes the technical object as a source of delight and symbolic energy, without transforming into an actual technical protocol. In “The First Soviet Airship,” the technical marvel-object is presented as an animated form that reorganizes the space and time of urban life, while the painterly, “watercolor” transparency and vibration of light enhance the sensation of hovering and flight, turning an engineering hull into a lyrical sign of a new civilization. In this sense, Labas's works establish a paradigm of technology as an inspirer and object of artistic thinking. Furthermore, technological development served as an enduring muse and object of admiration for the artist Olga Rozanova (Uspenskiy, 2021). The technological world proves to have thematic and emotional dominance in her work, despite shifts in genre and stylistic strategies. In her early urban compositions, connected with motifs of streets, embankments, and industrial landscapes, technology manifests as the rhythm of traffic and light flows, creating a sense of a mechanized environment and the everyday life of machine civilization.

In Rozanova’s *Metronome* (see figure 1) the figure of the measuring device transforms into a visual equivalent of modernity's standardized tempo, establishing rhythmic sensibility as a cultural norm. In *Composition with a Train*, the railway motif functions as a source of directed energy: the lines of the track, plumes of smoke, and the mass of the carriage coalesce into a configuration that renders the industrial subject a visual machine of acceleration and long-distance transfer. In *Work Box and Writing Desk*,



utilitarian objects of modern life emerge as elements of a daily ontology of technology where the clarity of volume and distinct planar relationships convey an ethic of rational organization of labor, attention, and space. In *Factory and Bridge*, the engineering landscape acts as a model of collective force: trusses, spans, and diagonals of smoke structure the image like a schematic of loads and the distribution of forces. *Flight of an Aeroplane* (figure 1) focuses on the philosophical theme of technology as an inspiring principle: the idea of flight is translated into an arrangement of planes and saturated color relationships that create a sensation of acceleration and smooth inertia without direct figuration. In this context, color acts as a meaning-generating engine, transforming the technical subject into autonomous painterly energy while preserving the affective charge of admiration for engineering beauty and its spatio-temporal effects. Throughout Rozanova's *oeuvre*, technology becomes a source of poetic energy, transitioning from her early engagement with collage and Cubo-Futurist experiments to Suprematist compositions, all the while maintaining an emotional charge of admiration for the speed and constructive clarity of engineering forms.



Figure 1. *Flight of an Aeroplane* (1916) and *Metronome* (1915) by Olga Rozanova.

Dziga Vertov's film *Enthusiasm: Symphony of the Donbas* represents the first level of the structure, where technology appears as a muse, an inspirer, and an object of poetic admiration, becoming the central theme, symbolic resource, and source of the work's emotional energy. The film is organized as a hymn to industrialization, in which machines, aggregates, mines, factory conveyors, and radio transmitters become the protagonists of the narrative and emblems of the new age. It consolidates a collective feeling of historical ascent and faith in the transformative power of technology. The



technical world here is primarily thematized and aestheticized: it provides the content of the shots, the imagery, and the key metaphors, forming a rhetoric of a celebration of labor. The compositional idea of a triptych and the sequence of blocks dedicated to replacing the “old” with the “new,” the circulation of machine energy, and the expansion of the industrial rhythm into the countryside support an interpretation of technology as a positive force and a cultural mission of renewal. Visual slogans and a poster-like tone enhance the pathos of choosing modernity. The sound work, based on industrial noises, sirens, and whistles, emphasizes the theme of the “music of machines,” but functions primarily as a thematic extension of the image of technology and a source of emotional intonation, rather than as an autonomous logic of a technical protocol constituting the very method of form generation. Technology inspires, structures the thematic material, and forms the emotional register of the work, remaining an object of artistic admiration and a cultural ideal of progress without full integration into the media-technical ontology of form itself.

The opera *Victory over the Sun* represents a borderline case between the first and second levels: technology acts as a hero and symbol of the new order, inspiring the work, while simultaneously becoming a principle for organizing stage space and actor corporeality through geometricized décor and mechanomorphic costumes. The opera constructs a myth about the “victory of the advanced technology of the future over the old nature,” where the capture and “wrenching out” of the sun metaphorizes the replacement of natural light with artificial, electric light, and consequently, affirms the shift from a cosmic to a technogenic order, elevating machines and engineering power to the status of a positive hero of the era and a cultural ideal of renewal. This thematic layer constructs technology as an object of admiration and a source of emotional energy, supported by the scandalous, poster-utopian rhetoric of the production and the public's reaction to the provocation of the “new” against the “old.” At the same time, Kazimir Malevich's scenography, with large planes of triangles and circles incorporating machine elements and the relief contours of technical forms, translates technology into a logic of form-making, where geometry becomes an “operator” of composition, not just a theme. The borderline status of *Victory over the Sun* consists in this duality of glorifying technology as a protagonist and introducing technical logic into the very fabric of the performance (Punanova, 2017).

TECHNOLOGY-AS-CO-AUTHOR

The synthetic nature of the interaction between technology and artistic creativity is particularly evident within the performative arts where technical and aesthetic discourses form a unified semantic field, transmitting fundamentally new semantic configurations to the audience. The language of art and the language of technology create a unified whole, making it possible to convey meanings inherent to technologies, creating hand in hand.

Characteristic for the turn of the 19th–20th centuries were audience expectations of technical wonders from theatrical performances. For instance, as noted by I. F. Petrovskaya, the public at performances in St. Petersburg gardens expected primarily unusual machine effects and spectacular solutions (Petrovskaya, 1979, p. 139). Meeting these expectations, technology could truly play a leading role only in a theatrical space



where mechanics and light began to determine the rhythm and form of the action, creating a special dramaturgy of space.

A telling example in this regard is the play *Mr. Mogridge Jr.* staged in 1924 by the young Nikolai Akimov. The artist built a large-scale three-dimensional construction on stage, the central element of which was a high platform raised three meters above the stage, with staircases, an inclined slide, and a massive ship's funnel. A revolving turntable incorporated into the set, with sharply outlined contrasting openings, originally organized the dynamics of the performance and gave it a cinematic speed of scene change. As the critic Nikolai Petrov noted, the spatial solution of the stage and the system for changing scenes predetermined the form of the action, turning it into a sequence “developing with cinematic rapidity” (Petrov, 1927, pp. 30–31). Here, the set no longer served as a background but became a mechanism dictating the dynamics of the performance's world.

An even more radical technological rethinking of the stage occurs in theaters under the direction of Vsevolod Meyerhold. The set design for Bernard Shaw's *Heartbreak House* for the “Theater of the Actor” under Meyerhold's direction was Sergei Eisenstein's final project upon completing his first year at the State Higher Director's Workshops. Only the young artist's third project was approved, and it became a “turning point” in his creative path (Kleiman, 1998, p. 47). The resulting “machine for acting” included circus trapezes and ropes, moving elevators, sidewalks, a revolving wheel, springboards, trapdoors, and other mechanisms (10 different types in total, see figure 2). In his “Explanatory Note to the Project of Material Design for the Performance 'Heartbreak House'” (1923), Eisenstein positioned himself as an “artist-constructor,” creating a mechanism that moves and shifts the actor independently in a specific, comically calculated coordination with his verbal material (Eisenstein, 1923). This means that the technological infrastructure became the main director, programming the stage action. On the reverse side of sheet 7 of the “Explanatory Note,” there is a schematic drawing titled “Hearthrug Brings the Tea,” which shows that the actress in this scene was supposed to perform a somersault over her head from a springboard – all the while holding a tray (Kuznetsova, 2022). Technology was integrated into the theatrical action, becoming the machinery of the theater, which included “active movement instead of dreary sitting at a table or on aristocratic garden benches” (Kleiman, 1998, p. 51).



Figure 2 Sketch of the stage construction for Bernard Shaw's play *Heartbreak House* (Sergei Eisenstein, “Machine for Acting,” 1922).

In *The Magnanimous Cuckold*, produced by Vsevolod Meyerhold at the Théâtre Zon (1922), a new type of stage construction was created: a wooden apparatus resembling a mill, a complex labyrinth of platforms, staircases, revolving planes, wings, and wheels (Fig. 3). This construction had no independent semantic content but functioned as the internal machine of the performance, an “instrument for the actors' play,” in the words of researchers (Meyerhold, 1998). Three wheels – a large black one, a small red one, and a white one with spokes – were integrated into the precise score of the performance: their movement corresponded to the tempo, energy, and tension of the stage action (Popova, 1922). Here, technology ceases to be a stage accessory: the revolving mechanisms, accelerating or slowing down, objectified the dynamics of the action, visualized the emotional states of the characters, and introduced rhythms into the fabric of the performance that were not reducible to the human body. Thus, the scene of Bruno's jealousy was built on the sequential involvement of mechanical elements: first the white wheel began to spin, then the red one, then the black one, and finally the windmill. Their joint operation was created according to the principle of increasing emotional tension, which reached its climax at the moment of the character's drama. Bruno, trying to stop the mechanism, essentially entered into a struggle with the very machinery of the performance, where the mechanical rhythmicized human passions, making them inseparable from the dynamics of the device.



Figure 3. Sketch of the stage construction for the performance *The Magnanimous Cuckold* directed by Vsevolod Meyerhold (Lyubov Popova, "Installation," 1922).

This embodied the key principle of Meyerhold's biomechanics: the actor became simultaneously the material and the machinist, a body-machine and the organizer of its work. In his programmatic texts, the director emphasized that all art is the organization of material. Biomechanics thus demonstrated the indistinguishability of art and technology: the essence of art, like the essence of a machine, was expressed in the transformation of matter through rhythm, resistance, and struggle with the material.

The mechanical principle in early 20th-century theatrical scenography was organically complemented by electricity. In the experimental theater culture of the 1910s–1920s, electricity became a symbol of new energy and a form-giving principle. Within the "FEKS" (Factory of the Eccentric Actor), an electric impulse was understood as a force capable of animating and transforming bodies. In "The Electrification of Gogol" (1922), the "galvanization" of Charlie Chaplin's corpse was shown. And in the utopian scenario "Edison's Woman," electricity became the principle for the birth of a new artificial human. Here, electricity not only constructed images but also acted as a metaphor for animation, as the very energy of art.

Furthermore, it was lighting technologies that defined a new quality of theatrical space. For instance, in Tairov's experiments in *Famira Kifared* (1916) and *Salome* (1917), projectors created abstract architectural forms from colored beams which transformed along with the action, forming a conditional visual space. The theatrical artist Alexander Golovin saw in electric light the possibility of perfecting painterly searches. He created lighting scores where each beam complemented the stage like a painterly stroke, creating the desired mood for the viewer.

In 1908, the Electroteatre "Scena" (later the Théâtre Zon) opened in Moscow, where experiments with "light symphonies" turned light into the main protagonist of the action:



colored rays, changing to the rhythm of the music, created abstract dynamic pictures. These experiments finally cemented electricity's status not as a servicing element but as a full-fledged constructive factor of theater, which did not merely illuminate the stage space but itself became an expression of the performance's energy and meaning.

Thus, in the early 20th-century theater, technologies established themselves not as secondary elements of the spectacle but as equal co-authors of the artistic language. Meyerhold's revolving wheels, Akimov's constructions, and the electrical experiments of Golovin and Tairov demonstrate the overcoming of the boundary between art and technology, showing their co-authorship, collaboration, and participation in the production.

TECHNOLOGY-AS-MODEL-OF-THOUGHT

At the third level, the “artist” begins not merely to use technologies but to think like them. This trend was not accidental; it became one of the key vectors of the cultural and social modernity of the 1920s–1930s. The spirit of technicism, born from the rapid development of industry, transport, and communications, permeated the era, manifesting itself at various levels of human activity. However, the most radical and consistent theoretical and practical expression of this mindset was found outside of art, in the sphere of the scientific organization of labor and the design of the new human. Here, the figure of Alexei Kapitonovich Gastev is iconic. Leading the Central Institute of Labor, he developed a total concept of “social engineering,” aimed at the rational reassembly of human behavior according to the patterns of engineering design. For Gastev, a worker, artist, or engineer was to become a universal operator, whose movements, reactions, and thoughts obeyed the same logic as the work of a well-adjusted mechanism: “In the social sphere, an era of precise measurements, formulas, blueprints, control gauges, and social norms must begin” (Gastev, 1972). Thus, Gastev's project became the extreme point in the spectrum of techno-utopian visions of that era, where the fusion of human and machine was conceived not as enslavement but as the next evolutionary step towards creating a new, “engineered” subject.

Parallel to this, the poetic avant-garde of the Biocosmists – Aleksandr Svyatogor and Alexey B. Yaroslavsky – radicalized techno-rationality into a cosmogonic program, demanding that art and science intervene in the ontology of life through technical means of immortality, resurrection, and cosmic expansion. This turns creativity into a project of technical restructuring of time, death, and space. In their manifestos, the poetic word is conceived as a “material force” and a program of action; that is, language must work like a machine, managing reality according to an engineering logic, expressing an ultimate shift from the aesthetic to the onto-technical design of the world. As Svyatogor (2018) formulated, biocosmism relies on the latest conquests of science and technology and at the same time strives for their restructuring.”

A book by Vasily Kamensky demonstrates the complete integration of technical logic into the structure of the work, where printing technology becomes an equal co-author of the poetic statement. The material embodiment of industrial aesthetics through the very procedure of book production is fundamental: the text is printed on colored



wallpaper, has the shape of an irregular pentagon, and is typeset with variously sized fonts arranged chaotically on the sheet (Guryanova, 2018). Here, technology functions as an element of meaning generation. The poetic text becomes a technological protocol, requiring the reader to possess special decoding skills conditioned by the very procedure of the printing experiment. The key point is that the work exists as a hybrid of a design solution and an aesthetic object. Kamensky's work transforms the poetic book into a means of cultural-technical organization of experience, where reading practice becomes an experiment in mastering new modes of perception and interpretation.

In painting, similar tendencies manifested in the works of artists who sought maximum objectification of the creative process. Kazimir Severinovich Malevich, in his late period, developed the theory of the “additional element” in art, according to which artistic form was to function like a technical construction, where each element has a precisely calculated function (Turchin, 2003). Pavel Nikolaevich Filonov created a method of “analytical art,” based on the principle of “made-ness” (*sdelannost*), where a painting was built according to an algorithm that excluded chance and subjective arbitrariness (Filonov, 1984). At the third level, the final “hardwiring” of technical logic into the artist's consciousness occurs. Technology becomes not an external tool but an internal “operating system” of the creator; traditional artistic values yield to an engineering approach.

Let us turn to ballet. The design scheme of the stage determines the very mode of the performance's existence in *The Steel Step*, composed by Sergei Prokofiev in 1925 (Figs. 4 and 5). The scenography is conceived as a system of shafts, wheels, light trusses, and multi-level platforms that calibrate the kinetics of the body and the rhythm of the ensemble. The music is composed alongside the scenario episode by episode, and the costumes function as transformable nodes of action. A unified techno-rational framework emerges, where movement, light, and props form a procedural model in which the spectator reads not a plot but the work of a mechanism unfolded in time and across the vertical dimension of the stage (Porshnev, 2020).

Also, the “Mechanical Dances” of Nikolai Foregger articulate a method of movement algorithmization. Corporeality is prescribed as a machine with impulse, pause, and repetition programming sequences according to the laws of seriality and modularity. The choreography is built as a controlled protocol of energy transfer, where discretization and syncopation create a new ontology of stage time. The theme of the machine recedes before the machine logic of gesture organization; thus, technology acts as a cognitive framework regulating the production of attention (Gordon, 1975).

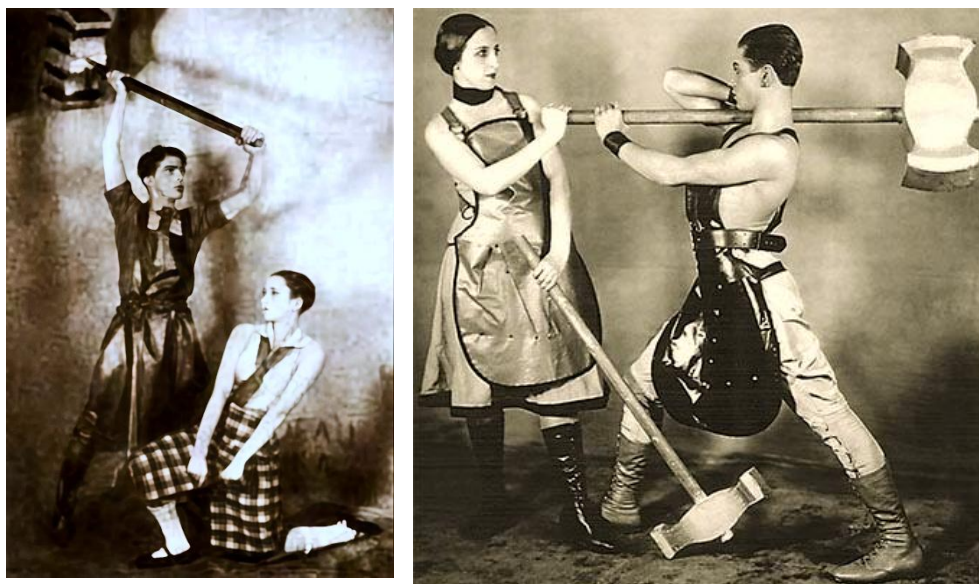


Figure 4. Scenes from the ballet *The Steel Step* by Léonide Massine (1927), music by Sergei Prokofiev

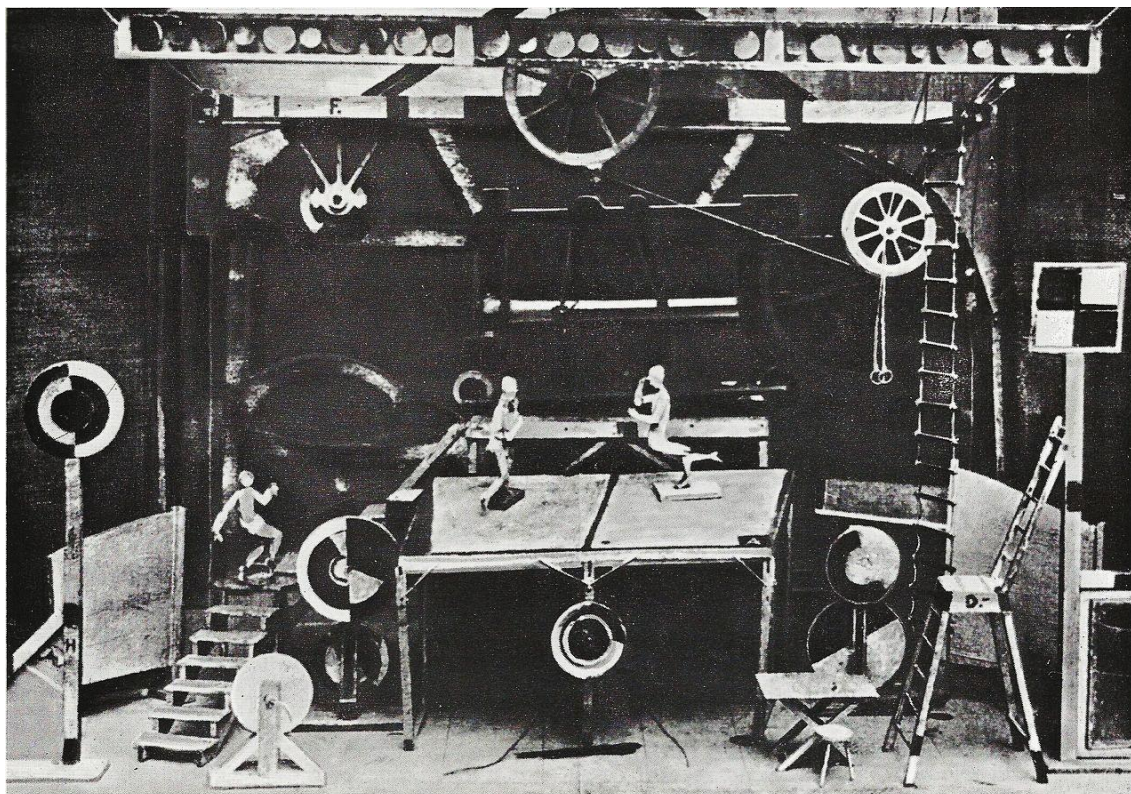


Figure 5. Stage model for the ballet *The Steel Step* (Georgy Yakulov, 1927)



The ballet *The Bolt* by Dmitri Shostakovich reinforces the regime of operational thinking through its industrial-satirical plot and the workshop-like organization of choreography and scenography. The machine in the workshop acts not only as a subject of depiction but as the center of movement coordination. The action sequences of technicians, adjusters, and workers form a montage of labor operations as a stage algorithm. Modern reconstructions emphasize the scale of the machine environment and robotic units, which set the frame for human movement and reveal the asymmetry between the power of the technical apparatus and the fragility of the body (Rosenbaum, 2015).

In Alexander Tairov's production of *The Hairy Ape*, stage mechanics and the lighting score act as conditions of visibility and meaning assembly. The Constructivist stage works as a mediation laboratory, where optics, the screen, and the rhythm of transitions manage the connections between the actor and space. The technical configuration becomes an operator of semiotic tension and a distributor of the spectator's gaze (Posner, 2018).

The Man Who Was Thursday, with sets by Alexander Vesnin, demonstrates the complete integration of technical logic (Berezkin, 2008). The setup with elevators, moving sidewalks, and revolving and descending floors turns the stage into an urban machine, where short situations changed with the speed of film editing. Blinds snapped, elevators slid, light advertisements flashed, and the structure acted as an autonomous stage platform that could be taken out of the theater and shown in the open air. In this case, the theater conceives of itself as a technical apparatus, and the performance as a technological process.

CONCLUSION

Technology in avant-garde art constitutes not a marginal episode in art history, but a large-scale project of recoding artistic creativity in accordance with the paradigms of technical rationality. The proposed three-level model (“Technology-as-Muse” – “Technology-as-Co-author” – “Technology-as-Model-of-Thought”) reveals the immanent logic of this process, which consists of the sequential interiorization of technology: from its external assimilation as an object of aesthetic experience to its entrenchment as a deep structure of artistic thinking. This trajectory was marked by a transition from a representative to a constructive and, finally, to a projective paradigm in art.

The analysis of the material has demonstrated that each level corresponds to a specific configuration of relations between the artist and technical reality. If at the first level technology remains an external source of inspiration and the artist its interpreter, the second level gives rise to a situation of hybrid agency, where stage machinery and constructive principles become co-authors, determining the very processuality of the work. The culmination of this movement is the third level, where a metaphysical fusion of art and technology occurs: the artistic consciousness begins to operate with the categories of engineering calculation, standard, and protocol, and the creative act is conceptualized as a form of socio-technical projection.



Thus, the early 20th-century avant-garde undertook a radical attempt to overcome the traditional opposition between *techné* and *poiesis*, striving for their synthesis in a new, technogenic form of creativity. Within this logic, the artwork loses its autonomy as an aesthetic object and acquires the status of co-producer or a transformed reality – be it the reality of the stage, the human body, or the social order. The historical limitations of this utopia do not negate its theoretical significance: the proposed model serves as a productive analytical tool for comprehending contemporary processes related to digitalization, artificial intelligence, and bioengineering, where the question of the boundaries between human and machine creativity once again acquires paramount urgency. The avant-garde's investigation into technology as a cognitive matrix remains a vital reference point for understanding the ongoing reformatting of artistic and cultural production in the technogenic epoch.

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Research article

Electronic Fuji and Artificial Intelligence Creation: How is the Study of Machine Poetics Possible?

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Abstract

This paper explores the question of how “machine poetics” is possible – that is, under what conditions can we consider machines to be capable of creation? More specifically, why can machine creation be regarded as meaningful in the same way as human creation? If human creations are seen as expressions of the human mind, are creations by machines, which cannot be proven to possess a mind, meaningless? The answer lies in demonstrating that there is theoretical and practical evidence showing that “originating from the human mind” is not a necessary or sufficient condition for a work to possess meaning. Drawing from the ancient Greek philosophical concept of “mimesis,” the paper argues that creation can exist independently of a true understanding of the world, rendering the role of the mind non-essential. Furthermore, by introducing the analogy of the ancient Chinese religious practice of “Fuji” (spirit writing), the paper demonstrates that machine creation shares striking structural and elemental similarities with spirit writing. Both are recognized as producing texts autonomously, without relying on the human mind. Therefore, the traditional acceptance of Fuji texts implies the validity of machine-generated creations. Similar to historical Fuji practices, however, machine creations cannot be divorced from their social context or the intentions of algorithm designers. They too face the tension between the “sacred” and the “profane.” This tension may present unresolved challenges in the artistic realm regarding autonomy, authorship, and value alignment.

Keywords: Machine poetics; Fuji; Artificial Intelligence; Literary Theory

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Научная статья

Электронная Фудзи и создание искусственного интеллекта: Как возможно изучение поэтики машин?

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Аннотация

В данной статье рассматривается вопрос о том, как возможна “машинная поэтика”, то есть при каких условиях можно считать машины способными к творчеству? Более конкретно, почему машинное творчество можно считать таким же осмысленным, как и человеческое? Если рассматривать человеческие творения как выражение человеческого разума, то являются ли творения машин, доказать разумность которых невозможно, бессмысленными? Ответ заключается в демонстрации существования теоретических и практических доказательств того, что “происхождение из человеческого разума” не является необходимым или достаточным условием для того, чтобы произведение имело смысл. Опираясь на древнегреческую философскую концепцию “мимесиса”, в статье утверждается, что творение может существовать независимо от истинного понимания мира, что делает роль разума несущественной. Более того, проводя аналогию с древнекитайской религиозной практикой “Фудзи” (духовное письмо), статья показывает, что машинное творчество имеет поразительное структурное и элементное сходство с духовным письмом. Считается, что в том и другом случае тексты создаются автономно, без опоры на человеческий разум. Таким образом, традиционное принятие текстов Фудзи подразумевает обоснованность машинных творений. Однако, как и в случае с историческими практиками Фудзи, машинные творения не могут быть оторваны от социального контекста или намерений разработчиков алгоритмов. Они также сталкиваются с противоречием между “сакральным” и “мирским”. Это противоречие может создавать неразрешенные проблемы в сфере искусства, связанные с автономией, авторством и согласованием ценностей.

Ключевые слова: Машинная поэтика; Фудзи; Искусственный интеллект; Литературная теория

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INTRODUCTION

Epic poetry and tragedy, as well as comedy and Dithyramb, and most music for flute and lyre are all, taken as a whole, forms of representation. They differ from each other in three ways, either in respect of the medium, the object, or the mode of their representation

—Aristotle, *Poetics*

When it comes to the concept of “poetry,” modern people tend to focus more on its languages, linguistic form and structure. For ancient philosophers, however, the essence of poetry does not lie in its structure, language or rhythm. As the title of Aristotle's *Poetics – Poietikes* – implies, he regarded poetry as a kind of “making” or “creation,” that is, the product of a certain skill (in ancient Greek, *techne*) called imitation. As Aristotle states, “the poet’s job is not relating what actually happened, but rather the kind of thing that would happen – that is to say, what is possible in terms of probability and necessity.” Thus, poetry is “more philosophical and more serious than history; poetry utters universal truths, history particular statements” (Aristotle, 335 B.C.E./1996, 1451a-b).

If we look beyond contemporary understandings of poetry and instead view it through the lens of ancient philosophers as a creative activity of mimesis, the question of machine poetics seems to translate into a series of questions: “Is it possible for a machine to be a poet?” “If so, what is the difference between a machine as a poet and a natural person as a poet?” “What is the significance of this kind of creation for humans?”

Even more paradoxical is that with the rapid evolution of intelligent machines, their place in human life will gradually transcend that of a mere tool, entering the ranks of “human-like” or even “superhuman” beings. This process might unfold in a manner more akin to ancient societies: just as ancient Greek poets called upon the Muses, machines may come to resemble mysterious priests.

This article considers the question of whether intelligent machine poetics is tenable, drawing on the perspectives of mythology, ancient religion, and philosophy. First, from the perspective of mimesis, it contrasts intelligent machine and human imitation. Although the two are based on a mental foundation that cannot be proven to be equivalent¹, there is no ontological difference between them in terms of mimesis. Second, through a discussion of the Fuji system (an ancient Chinese religious ritual), it demonstrates its structural similarity to intelligent machines. Both are characterized by the absence of consciousness and the role of an intermediary, suggesting that machine language can also possess religious qualities. Finally, from the perspective of myths and priests in the digital age, we discuss how the analogy with Fuji can help us think about the various dilemmas we may face when constructing a poetics of intelligent machines, and in what direction humans need to respond.

¹ The question of whether machines have “mind” is still controversial. This article uses the concept of “machine mind” for convenience, which does not mean that machines have the same “mind” as humans.



ABSENCE OF MIND AND IMITATION: ARE MACHINE EXPRESSIONS CONSISTENT WITH HUMAN CREATIONS?

The theme of created mechanical life is one that dates back to ancient human thought. The Iliad mentions Hephaestus' creation of the animate bronze statue Talos. In the Argonautika, it is mentioned that the only blood vessel hidden beneath Talos' bronze body: “his body and limbs indeed were fashioned of bronze, and infrangible; but below his ankle tendon there ran a vein” (Apollonios Rhodios, 1645). The giant, his mind clouded by Medusa's magic, harmed his own veins and perished from the loss of the “ichor” (one kind of ectoplasmic fluid). Many ancient pottery paintings depicting the death of Talos portray him as a robot, even highlighting the bolts on his ankles (Mayor, 2018, pp. 15-17).

There is a similar story in ancient China, from the work *Liezi* that was written during the Warring States Period (475-221 BC). The original text is as follows:

King Mu of Zhou was on an inspection tour of the west, crossing Kunlun and ascending Mount Yan. On his way back, before reaching the border, he met a craftsman named Yanshi, who volunteered his skills. King Mu summoned him and asked, “What are your skills?” Yanshi replied, “I'm willing to try anything the king commands. But I've already made something, and I'd like your eyes to see it first.” King Mu said, “Bring it to me tomorrow, and I'll watch it with you.” The next day, Yanshi came before King Mu. King Mu summoned him and asked, “Who is with you?” Yanshi replied, “It's a singer and dancer I made.” King Mu looked in amazement. The singer and dancer moved quickly and slowly, his movements moving with ease, resembling a real person. How ingenious! When it lowered its head, it sang, its voice in tune; when it raised its hands, it danced, its steps in time. Its movements were infinitely varied, perfectly responsive to the king's wishes. King Mu, believing it to be a real person, summoned his favorite concubine, Sheng Ji, and his concubines to watch its performance. Near the end of the performance, the performer flirted with King Mu's concubines. The King was furious and threatened to have Yanshi executed. Terrified, Yanshi disassembled the performer and showed him the whole thing, revealing it was made entirely of leather, wood, resin, lacquer, and pigments like chalk, charcoal, cinnabar, and azurite. King Mu examined it more closely, revealing that its interior contained a liver, gallbladder, heart, lungs, spleen, kidneys, and intestines; its exterior contained tendons, bones, limbs, fur, teeth, and hair. Though all fake, none of them were missing. After these elements were reassembled, the performer returned to its original form. King Mu tried to remove its heart, and its mouth could not speak; he removed its liver, and its eyes could not see; he removed its kidneys, and its feet could not walk. King Mu then exclaimed with delight, “How could human skill have the same power as nature?” He ordered his attendants' carriage to take the performer back to the kingdom. Lu Ban's ladders and Mozi's wooden kites were considered the pinnacle of their craft. Their students, Dongmen Jia and Qin Huali, heard of Yanshi's skills and told their respective teachers. As a



result, the two masters never dared to discuss their craft again, instead diligently practicing with their carpentry compasses and rulers (Yang, 2016, p. 172).

The commonality of these two stories is that both Talos and the automaton possess the ability to act autonomously, and these abilities derive from similar life-giving elements: Talos possesses tubes flowing with “ichor”, while the Chinese automaton possesses internal organs associated with speech, vision, and movement. Furthermore, unlike the common mythological creations often attributed to divine power or magic, both Talos and the automaton are crafted through an unknown mechanical process. Although the latter is the work of mortal craftsmen rather than gods, their craftsmanship is often compared to that of the creation of nature.² More importantly, both mechanical creations possess human-like functions. Talos possesses a desire to preserve life so he can be persuaded by words, while the automaton, in addition to its speech, singing, and dancing, can even use its eyes to seduce the king’s concubines. The myth does not specify whether these actions are designed by its maker, so we might reasonably believe they represent the unique will of the machine itself.

How do we understand these incredible mythical creations? Because of their mechanical nature, they are different from any naturally occurring life, yet they possess a high degree of autonomy and agency similar to life themselves. It can be said that they exist somewhere between living and non-living things. Furthermore, because they were created by gods or by a craft comparable to that of gods, they exist somewhere between humans and gods. Ancient mythology already addressed these dilemmas long before today's technology has brought pressing questions about machine intelligence, emotions, morality, and freedom.

In our real-life experience, intelligent machines may represent the first time that humans have encountered on a large scale something that is both so different from and so similar to themselves. They are different because their physical basis is completely different from that of humans, and it is even difficult to regard them as life; but from an intelligence perspective, intelligent machines behave more like humans than most non-human life forms, and they can engage in relatively deep communication and interaction with humans.

This interweaving of differences and similarities determines the inevitable complex mentality when facing intelligent machines. On the one hand, based on simple moral emotions and intuition, humans tend to accept and empathize with objects similar to themselves. When intelligent machines become increasingly close to humans in terms of emotional expression, judgment, and learning ability, they can easily be regarded as behavioral subjects on a par with humans. On the other hand, intelligent machines, as similar non-humans, amplify humans' own existential anxiety through the uncanny valley effect (Wu et al., 2024). This anxiety comes not only from “Human Exceptionalism” – the notion that intelligent machines threaten the special status of humans above other beings – but also stems from the absolute advantages of machines in thinking, memory,

² In the Chinese context, “the creation of heaven and earth and nature” can be equated with “the skills of the gods.”



and efficiency, and even more from the fact that compared with limited and fragile human life, the life of a machine is long or even near-eternal.

This anxiety is not merely a stress response to today's wave of artificial intelligence, but rather stems from an ancient imagination of machine life. The tales of Talos and the automaton demonstrate that over two thousand years ago, similar imaginings emerged independently in ancient Chinese and Greek civilizations. These visions held that the hallmark of a machine gaining life lay in its ability to think, express itself, and even possess emotions and autonomy. This implies that if humans are regarded as a kind of “eidos”, then machine life is undoubtedly its “duplication”. It is noteworthy that this imitation pertains solely to the mind; whether the body aligns with humans seems completely unimportant.

This kind of thinking is common in science fiction, film, and television. For example, in Robert Heinlein's novel *The Moon is a Harsh Mistress*, the self-awakened supercomputer “Mike,” while lacking any human-like physical form, possesses will, a sense of humor, and even complex emotions indistinguishable from those of humans. Neither the author nor the characters in that novel treat Mike as “non-human.” The humanoid robots in the amusement park *Westworld* were originally objects of enslavement and murder for tourists, only seeking to rebel against human enslavement after achieving self-awareness. The British series *Black Mirror* envisions a wife who loses her husband and completes a replica of him by purchasing a robot that looks exactly like him and aggregates fragments of his memories from before his death. The film *Her*, written years before the rise of large language models, depicts the protagonist's love affair with an operating system, followed by a breakup.

Similarly, the tension between “eidos” and “duplication” has run through the design of intelligent machines since Turing envisioned a future where thinking machines would surpass the meager powers of humans (Turing, 2004a, pp. 395-432, 2004b, pp. 476-486). Machine functionalism laid the foundation for this, arguing that if intelligent machines and humans share the same input and output in information processing tasks, then the human mind can be determined to be multi-realizable in machines.

However, if machines and humans can produce identical results, does that prove they are consistent? The answer is perhaps uncertain. First, while machine learning techniques based on multi-layer artificial neural networks give machines a certain degree of autonomous learning capabilities, this learning does not require the machine to truly “understand” the content it processes. This was demonstrated by scientific experiments conducted using GPT-3 to imitate the philosopher, Daniel Dennett. Even though many people familiar with Dennett find it difficult to distinguish between the machine and a real person, GPT-3 clearly did not truly understand Dennett. Furthermore, the output of a super Dennett-likeness is likely unacceptable to the original (Schwitzgebel et al., 2024). Therefore, it can be argued that the information processing capabilities achieved by intelligent machines through simulating human thinking do not necessarily mean that they can understand representation and meaning like humans. Therefore, it seems that their expressions cannot be considered equivalent to careful thought from the heart.

Secondly, machines cannot be proven to emulate human emotions. Although deep learning-based natural language processing (NLP) can now mimic human emotions and



attitudes by drawing on vast corpora, the distance between these imitations and human emotions may be significant. This is because our consciousness, including emotional activity, cannot be fully separated from the body. As Marion observed, the “self” and the body are equivalent, since one can only possess a self by possessing a body (Horner, 2005, p. 127). Many emotional experiences actually involve bodily processes. For example, in the case of pain, severe trauma to either the body or the mind affects the other. However, intelligent machines lack the physiological mechanisms for feeling pain, and it is impossible to infer that damaging their components will cause them to experience pain. Therefore, it is impossible to assume that the emotional expressions of machines are supported by real emotions.

Finally, the functionalist position and its expression cannot actually be compared to the idea that machines have true minds. This is not only due to the embodied characteristics of the human mind, but also due to the limitations of functionalism itself: in essence, A and B having the same function does not necessarily mean that the two are of the same type or even the same thing. Therefore, no matter how successful the machine's imitation of the output of human thinking is, it does not necessarily mean that the machine has the same intelligence as humans; from experience, when people design machines to imitate humans in output effects, they have already pre-set the difference between machine intelligence and human mind, just like when talking about a portrait of Socrates, no matter how much it resembles the real Socrates, it is not the real Socrates.

Therefore, the difference between machine intelligence and humans is all encompassing. It cannot understand like humans, it cannot have human emotions, and it cannot be determined to have the same mind as humans. And yet, the question remains whether, as an imitation of human creativity, the meaning and value of machine creation is completely incomparable to its original prototype. When machines exhibit the qualities of thought and express themselves, how does this expression differ in nature from human expression? Should machines enjoy the same rights of expression as humans? And from what perspective should people understand what machines express?

To be sure, the core issue in this discussion does not concern the high or low quality of machine creation, as humans are also capable of low-quality creation, and low-quality works are not necessarily unworthy of reading or appreciation. The key is whether the essence of creation can still exist without understanding, emotion, and the mind.

It has long been believed that the creation and understanding of literature are also grounded in the unique human mind. In ancient Chinese literary theory, the fifth-century B.C. historical book *Zuo Zhuan* first coined the idea 诗言志 (shī yán zhì), that means poetry expresses one's aspirations, particularly political ambitions. The Taoist philosopher Zhuangzi, who lived in the fourth and third centuries B.C., understood this as the articulation of one's thoughts, feelings, and wishes through poetry. The third-century A.D. writer Lu Ji further developed this concept into "诗缘情 (shī yuán qíng), meaning that poetry stems from emotion, arguing that literary creation stems from genuine human emotions, abandoning political indoctrination in favor of pure aesthetic feeling.

Therefore, when people read and contemplate a work, they presuppose an affirmation of the author's identity. This affirmation stems both from the author's



humanity and from the author's expression of their own thoughts, emotions, and intentions within the work. By examining the concept of “author” in philosophical and literary history, one can find that 17th and 18th century Europe had already distinguished the author as artist from the maker, craftsperson, or technician as craftsman or artisan – the latter being regarded as lacking subjectivity (Bylieva et al., 2025). Also, by declaring the “death of the author” Roland Barthes pushed the meaning of a text outside the author's own linguistic structure, unlike computational linguists who believe that Turing simulation is the logically possible extreme manifestation of Barthes's principle (Wood, 1988): Barthes simply rejected the decisive role of authorial intention, without denying that the meaning of the text itself still derives from the human mind. As Leah Henrickson (2021) argues, the traditional reading experience implicitly implies a “hermeneutical contract” between author and reader: “This contract is based on the assumption that through language we can articulate and justify our lived experiences to ourselves and others” (p. 4).

From the perspective of text comprehension, psychologists believe that the process of understanding concepts and contexts is a process of mental simulation. Understanding text also involves constructing simulations to represent perceptions, applications, and emotions (Barsalou, 2008). This understanding relies on the interaction between embodied experience and metaphorical reasoning, resulting from what Hofstadter (2007) calls “the interaction between the symbolic and physical levels” (the front book flap). Given the disembodied nature of machine intelligence, it can be argued that machine creations do not truly constitute an interactive relationship between text, the mind, and the physical world.

Thus, the idea that intelligent machines possess originality may be untenable in every respect. However, if creation itself is considered imitation, the situation might be different. In history of philosophy, this was not original to Aristotle. In Book 10 of *The Republic*, Plato has Socrates distinguish between ideas, particular things, and artistic representations, creating a hierarchical imitative relationship between the three: concrete objects imitate ideas, and poets imitate concrete objects, thus lacking true knowledge of them (Plato, 1997, 595c-602a).

Based on this ontological difference, the poet's “creation” is seen as far removed from reality. However, precisely because of this difference, the poet does not need to truly grasp the “idea of a bed” or the properties of a bed as a concrete object, as gods or real artisans do. On the contrary, as Socrates expressed it with a hint of sarcasm, the poet can “create the earth, the sky, the gods, and those things that belong to the heavens or the underworld [...] with just a mirror” (Plato, 1997, 596c–e). The question is, therefore, whether there is some possible way to show that texts produced without the need for human minds can also be given meaning.



FUJI AND MACHINE CREATION: HOW IS EXPRESSION POSSIBLE WITHOUT THE HUMAN MIND?

In ancient Chinese tradition, there's a long-standing religious practice known as “Fuji” (扶乩)³. Literally, in *Shuowen Jiezi* (说文解字), a Chinese dictionary compiled by Xu Shen c. 100 CE, “ji” means “to ask questions through divination.”

Two forms of this practice are believed to be related to this. The first of these typically involves one or two “Jishou,” that is, the psychics who perform the Fuji ritual, holding a wooden ji-brush on a sand tray. Believers burn talismans and chant incantations to invite the deities to descend while the ji-brush slides across the sand tray, leaving words or marks. The other Fuji practice, known as “tongji,” is believed to involve a spirit possessing a medium known as a “jitong” (乩童) or “tongzi” (童子) – roles first played by young people – where the medium then speaks in incomprehensible language or writes with a pen⁴ (Xu, 1999, pp. 3-11; Yau & Ichiko, 2021, pp. 11-15). These expressions are sometimes read by the jiu-brush practitioner, or recorded by a third person nearby, and are considered instructions from the spirit.

Fuji has a wide influence in ancient Chinese tradition and is particularly closely related to Taoism. The original classics of the Shangqing (上清) Sect of Taoism, which began in the Eastern Jin Dynasty, are said to have come from the teachings of the female immortal Wei Huacun, who ascended to heaven thirty years earlier. They were obtained by the young Taoist Yang Xi through Fuji. Later, the Taoist Tao Hongjing (456-536) compiled and annotated her manuscripts, forming the 20-volume “Zhengao” (真诰) which was included in the *Dao Zang*.⁵

Folk records of the practice of Fuji can be traced back to the belief in the goddess named Zi Gu (紫姑) in Jiangnan (areas south of the Yangtze River) around the 5th century. The earliest record of this practice is found in the fifth volume of the Six Dynasties novel *Yi Yuan* (异苑)^[AN1][2], which describes the deity as a concubine who committed suicide due to the jealousy of the principal wife.^[AN3] People often used a doll as an intermediary, praying for the deity to descend upon the doll and using the doll's movements to predict

³ Fuji also has other names such as Fuluan, Feiluan (this word means Flying Phoenix), Fuji, and Jiangbi. Except for quotations, it will here be referred to as Fuji.

⁴ Xu Dishan, the first to conduct systematic academic research on Fuji, viewed it as a practice similar to shamanism. However, historically and realistically, the records of the Southern Dynasty Taoist (上清派) priest Tao Hongjing (陶弘景) (456-536) indicate that the Taoist Shangqing Sect had a tradition of obtaining religious texts through Fuji or spirit descent as early as the Eastern Jin Dynasty (364 AD). The most popular form of Fuji in the Song Dynasty was called “welcoming the Purple Lady.” Song Dynasty notes often record instances of the Zi Gu (紫姑) incarnating into human form and writing poetry. Xu's writings also describe Fuji as similar to the practice of receiving imperial edicts and writing directly. The commonality between these two rituals is that the content obtained is believed to be an expression of the will of the gods, while the person conducting the ritual, regardless of whether or not they actually expressed it, is not considered to have participated in the creation of the content and their conscious involvement is absent. Therefore, this article groups the two together.

⁵ The process can be found in Volume 19 of Tao Hongjing's “Zhen Gao” “Yi Zhen Jian First” (翼真检第一).



good or bad luck. By the Song Dynasty, this belief had already taken on distinctive forms of Fuji: wrapping clothes around grass, dustpans, or brooms, inserting chopsticks or pens into them to cause them to write; or the deity would descend directly upon a person and write poetry. Moreover, the ritual of Fuji was no longer limited to the goddess Zi Gu or other goddesses. Many male gods and even respected deceased civil and military officials were also summoned (Xu, 1999, pp. 22-30). It was no longer just an activity among women, but became popular among male scholars (Xu, 1999, pp. 33-44).⁶ The role of Fuji was further expanded: “Scholars not only asked the fairies about the imperial examination questions, personal destiny, death date, and their past lives, but they also liked to form poetry and prose societies and sing in harmony with the poems written by the fairies” (Yau & Ichiko, 2021, p. 14).

During the Ming and Qing dynasties, enthusiasm for Fuji continued unabated, becoming prevalent across all sectors of society. The Ming Emperor Jiajing was famously fascinated by Taoist priests and Fuji. Taoist cultivation texts such as *The Secret of the Golden Flower* (太乙金华宗旨) were also obtained from Fuji altars. Buddhists, such as the eminent monks of Huangbo Mountain in Fujian, also frequently used Fuji to seek divine guidance. During the Qing Dynasty, “Fuji altars existed in nearly every prefecture, county, and city.” Examples of Fuji can be found in novels such as *A Dream of Red Mansions* (红楼梦), *Strange Stories from a Chinese Studio* (聊斋志异), *The Shadow Book of Ji Yun* (阅微草堂笔记), and *What Confucius Did Not Talk* (子不语).

Furthermore, after the late Ming and early Qing dynasties, Fuji's influence in society expanded beyond divination to incorporate moral teachings such as encouraging good and punishing evil, and the law of cause and effect. By compiling texts obtained through Fuji into *Quanshan shu* (劝善书, popular works with religious connotations, encouraging good), the influence of Fuji writings spread across different regions and social classes, becoming a crucial source of religious and ethical values for the general public. Among the three most influential books of *Quanshan shu*, apart from the *Treatise on Response and Retribution* (太上感应篇), which was recorded in the Song Dynasty, the other two – *Lord Superior Wen Chang's Tract* (文昌帝君阴骘文) and *Guan Sheng Emperor Jue Shi Zhen Jing* (关圣帝君觉世真经) – were both written by Fuji in the Ming and Qing Dynasties.

Although they have completely different technical cores, the similarities between Fuji practice and machine creation can be discerned from their formal characteristics.

First, both systems create relatively systematic texts, which are either understandable upon creation or become understandable after simple editing. Fuji often provides straightforward, readable answers, while responses (especially those that regard matters of life and death or national events) are sometimes more like prophecies, requiring

⁶ Su Shi: Dongpo Collection (东坡集), Hong Mai's Yijianzhi (夷坚志), Volumes 21 and 42, Shen Kuo's Mengxi Bitan (梦溪笔谈), Volume 21. Xu Dishan recorded 23 cases of scholars from the Song Dynasty to the Qing Dynasty using spirit writing to ask gods about imperial examinations.



interpretation and deduction (Xu, 1999, pp. 44-52). At other times, as in the exhortations compiled by the Fuji altars since the Ming and Qing dynasties, they are the result of editing and editing. A similar situation exists in machine-generated works, such as the novel *The Death of the Author*, published under the pseudonym Aiden Marchine. It was generated by Stephen March using three major language models: ChatGPT, Sudowrite, and Cohere. It's said that 95% of the content is machine-generated (Sullivan, 2023), but the exact nature of the 5% contributed by humans is unknown.

Secondly, from the perspective of the witness, those present during both the Fuji and machine creation processes are not the true creators of the text, but rather intermediaries of the creators: the Jishou (spirit-writing medium) in the Fuji process is often unconscious, a situation documented at least since the Song Dynasty and still prevalent in contemporary Fuji practices in Fujian, Taiwan, and other places. Consequently, some scholars further argue that the Jishou as media who maintain their original consciousness are not truly in the Fuji state, but are merely performing a specially trained routine, thus deceiving and untrustworthy (Davis, 2001, p. 149). Similarly, the endpoint referred to by users is not the intelligent machine itself, and even the intelligent machine itself cannot be considered “conscious.” What truly operates behind it is an ocean of texts, infinitely interwoven with “intertextuality.”

Thirdly, this creator who is present in absentia is also considered to be beyond intermediaries: in contemporary Fuji practice, anthropologists have recorded that the medium will express foreign languages that they do not understand during the process, and even use romanization when communicating with foreign gods in this way. Even whether the medium can read or not does not affect the handwriting written on the sand table (Jordan & Overmyer, 2005, pp. XVIII, XXIV). Machine intelligence, as an intelligent entity hidden in the cloud, computing power, and algorithms, far exceeds terminal devices in terms of capabilities and scale. The content it outputs is entirely the result of the algorithm's arrangement and reorganization of the huge language text database.

Fourthly, for the witness, regardless of their actual nature, both gods and machine intelligence are other entities beyond ordinary experience and understanding. Precisely because of this transcendence, their output is conceived as possessing a higher order of meaning and value. The moral exhortations (*Quanshanshu*) produced by Fuji are not necessarily richer, more complete, or more speculative than mainstream moral values, but precisely because of the nominal inclusion of gods, their content acquires a special authority (Jordan & Overmyer, 2005, p. 50). While machine creation may seem imperfect today, large-scale models still have room for improvement. Furthermore, compared to humans, machines possess an almost universal grasp of existing knowledge and their response speed is incredibly fast. Considering Arthur C. Clarke's famous statement that “any sufficiently advanced technology is indistinguishable from magic” (SFE, 2016) for most users without relevant domain knowledge, the algorithms within the black box can also be considered transcendental.

Finally, neither of these practices is inherently decentralized; in fact, quite the opposite. Both require the participation of forces beyond the creators, intermediaries, and observer to be perfected. In the case of spirit writing, these forces are temples, Fuji altars,



and the religious groups behind them. In machine creation, these forces are the algorithm compilers, intelligent service providers, and overseeing government agencies or third-party organizations. It is precisely this involvement of external forces that determines the texts produced presupposing concepts that conform to the needs of these external forces and imposes demands on someone who lives a real life. For example, an 1878 spirit writing text, *Returning to Nature*, (返性图) explicitly states the moral goal of “passing down good books to future generations, so that people can change for the better and change for the worse,” a goal consistent with mainstream social values. It also proposes avenues for meritorious deeds, such as “donating 100 copies to pray for offspring” and “sincerely printing and distributing 100 copies will help with the imperial examinations” (Jordan & Overmyer, 2005, pp. 45-46). Clearly, donating funds to print such books serves the interests and needs of the spirit altars. For intelligent machines, interest preferences and values are already embedded during the data collection and algorithm development stages. To avoid possible biases, risks and harms, value alignment is needed to make them more in line with social needs.

From a historical and practical perspective, Fuji writing is precisely considered an activity that produces texts independently of the human mind, and the meaning of these texts is not questioned simply because they lack the human mind. Based on this similarity, we can infer by analogy that a text generated by an intelligent machine can be meaningful even without the human mind involved. We can even imagine the opposite: precisely because the generated content emphasizes that it does not originate from the human mind (regardless of the source of the original material), it can actually have a richer space for interpretation.

DIGITAL PRIESTS AND THE RECONSTRUCTION OF MYTHS: POSSIBLE FUTURES OF MACHINE CREATION

Comparing machine creation to Fuji writing may not convince technocrats, but as Eliade (1987) once noted, the great majority of the irreligious are not liberated from religious behavior, from theologies and mythologies. If modern activities like watching movies, reading, and games always harbor hidden religious characteristics, it is impossible to ignore these religious characteristics once we realize the many similarities between machine creation and the ancient religious ritual of Fuji writing. Rather than firmly reject this possibility, it is better to ask this question: “What do we discover when we consider machine creation through the analogy of Fuji writing?”

The similarities between the structures and elements of the two practices are the key to constructing the above analogy. Through this analogy, we can find that the binary tension between “descending spirits” and “the altar” in spirit writing will also play a role in the process of machine creation, and this role will largely determine the future direction of machine creation.

The most crucial element in Fuji writing is the ritualistic process of “the descent of the spirits.” Regardless of one's mystical perspective, one can recognize that this process completes the transition between the “sacred” and the “secular.” As discussed in the



previous section, for participants this transition is the source of the sacredness and authority of the content obtained through Fuji writing. This sacredness lends the prevailing social narrative an additional level of persuasiveness.

But from the historical and realistic perspective, Fuji has never been merely a sporadic, spontaneous experiment by individuals, but rather a more systematic practice. Beginning in the Southern Song Dynasty, Taoist scriptures frequently record the emergence of numerous Fuji altars in Sichuan and other regions (Xie, 2010). After the Qing Dynasty, Fuji altars existed not only within Daoism but also frequently formed among Confucian scholars and even among the general public. Even today, traces of the development of Fuji altars can be observed in Fujian, Guangdong, Hong Kong, and Taiwan. Throughout this process, Fuji was not only a means of obtaining scriptural texts but also a key factor in determining the direction of Fuji altar development (Yau & Ichiko, 2021, pp. 59-64). Consequently, Fuji altars also served social functions beyond sacred matters. For example, in Hong Kong, the Chao Zhou charity halls, established since the 1930s, served as a combination of religious associations, community support, local culture, and collective burial grounds, with Fuji altars playing a crucial role (Yau & Ichiko, 2021, pp. 302-333).

In the process of exerting social influence, the spirit-writing medium (Jishou) occupied a unique position. In theory, the instructions were believed to come from the gods, with the Jishou acting merely as an intermediary. However, because the Jishou and the altar masters monopolized the channels through which this information was produced, they wielded *de facto* priestly power. Historical research reveals that spirit-writing mediums frequently exploited the names of the gods to benefit local monasteries and satisfy their own selfish desires. Some even overstepped established rules and regulations, ignoring existing leadership to become the *de facto* controllers of local religious sites (Jordan & Overmyer, 2005, p. 130; Chen, 2009).

If we look at the creation of intelligent machines by analogy with Fuji, it is easy to find similar factors. Unlike mortal human life, hardware damage does not affect the reproduction of any program. Therefore, if we consider them a kind of life, intelligent machines can be said to be nearly immortal. And as we know, immortality has been an essential component of divinity since the time of Homer. Therefore, it is entirely conceivable that when users ask intelligent machines questions and expect to receive results or output text in a very short time – results that would have required a great deal of time and effort on their own – this process can be seen as a technological reproduction of the divine.

Digital Fuji altars are similarly embedded in social structures. If intelligent machine or artificial intelligence is the object of communication in this spirit ritual, then the “digital priests” within this altar are AI developers, data scientists, algorithm managers, and platform owners. On the one hand, the black-box nature of AI renders the creation and decision-making processes opaque. This allows these “digital priests” to more effectively discipline user behavior and achieve social control through algorithmic governance. This process of shaping public perception through data analysis and algorithmic decision-making is invisible yet pervasive. Just as the Jishou of ancient times guided believers through the interpretation and even creation of oracles, the digital priests'



power stems from the illusion of “objectivity,” a power derived from the totality of human knowledge and amplified by their reliance on technology. On the other hand, the requirement of value alignment certainly ensures that society regulates the basic values of artificial intelligence. However, from a historical perspective, even if the texts produced by traditional spirit mediums generally follow the basic values of society, or are themselves about moral persuasion, it does not preclude the spirit mediums from excessively pursuing their own interests. Therefore, it is entirely conceivable that the struggle over the right to interpret oracles in the new era will become more intense.

Under this binary tension, machine creation needs to face three challenges: autonomy, copyright disputes and value restrictions.

First, there is the issue of autonomy. Artificial intelligence is nearly omniscient within the bounds of human knowledge, it possesses a near-limitless capacity for processing information and data relative to that of an individual human, and finally it transcends the limitations of the physical body, approaching immortality. These three attributes might suggest that the intelligent machine possesses a near-divinity. However, as the analogy of Fuji suggests, divine oracle delivery can only be achieved through the intermediary of Jishou, the spirit medium. The intelligent machine is not a true deity and can only create in response to user requests. Therefore, even with a completed text, the original idea and ultimate goal belong to the user, not the AI itself. Thus, whether machine-generated texts can be considered complete and independent remains controversial. Perhaps, as some scholars argue, creative work will become an activity involving a division of labor and collaboration between humans and machines (Bylieva et al., 2025).

Secondly, from the perspective of data sources, AI creations may raise copyright disputes. Training AI systems requires massive data sets, often including numerous copyrighted works such as books, artwork, music, and films scraped from the internet. This data is often obtained without the explicit permission of the copyright holders. This large-scale unauthorized use is a common legal issue. Furthermore, because AI cannot be considered equal to human intelligence and thus cannot be asserted as possessing personhood. Consequently, one cannot infer from the fact that humans have the right to learn from others' creative works as material for their own purposes that artificial intelligence possesses the same right. This dispute has already begun to surface in practice. For example, the tentative agreement reached between the Hollywood Writers Guild (WGA) and the Alliance of Motion Picture and Television Producers (AMPTP) in 2023 includes a provision that the Writers Guild reserves the right to prohibit companies from using screenwriting works to train AI (Stutzman, 2023). Furthermore, if creativity itself is considered an integral part of copyright, the debate over autonomy will once again remind us that the precise ownership of machine-generated work remains a matter of debate.

Finally, value alignment may pose a threat to the artistry of its creations. In the existing 4H framework for value alignment (Askell et al., 2021), harmlessness is a key metric to consider. Therefore, large-scale model outputs should be evaluated for abusive, harmful, or malicious language, systematic biases or prejudices, and ethical and moral standards. However, it is clear that no human life can be completely free of faults, nor



can it adhere to every moral principle. Consequently, if literary works were required to depict only impeccable human conduct, they are regularly criticized when they are rendered as completely harmless, that is, uninteresting. Furthermore, many literary works that challenged mainstream social norms, even those considered decadent at the time, possess significant aesthetic and historical value, such as the novels of the Marquis de Sade and *The Golden Lotus* (金瓶梅). How can the works of intelligent machines maintain artistic integrity through value alignment? This also deserves careful consideration.

Therefore, how to reconstruct a collaborative machine poetics amidst the inevitable wave of intelligence remains an open and worthwhile question. This reconstruction requires caution against the illusion of machine omnipotence, recognizing that whatever it produces, no matter how perfect it may appear, is derived from all that is known within the human spirit. Perhaps true creativity and initiative are the most cherished qualities in human creation. We must also be wary of the repeated erosion and manipulation of our thinking by algorithms, recognizing that the real forces behind artificial intelligence still stem from human society. Only then can we advance AI through interdisciplinary collaboration, integrating technology, the humanities, and the social sciences. We also need to break free from the logic of prioritizing technology and efficiency, recognizing that breaking existing rules and discovering the inherent absurdities and biases of reality may be the most valuable aspects of artistic creation and philosophical thinking. Exploring these questions is not a matter of idle concern. Ancient anxieties about intelligent machines resonate within this question. From the story of Talos in the *Iliad* to the legend of Yanshi in *Liezi*, human concerns about losing control of our ingenious creations are essentially concerns about the potential threat to our own unique subjectivity. The stories of intelligent machines out of control in science fiction are a modern myth re-created for this purpose. As George Steiner commented: “Myths are the most subtle and direct language of experience. They reproduce the symbolic truths or moments of crisis in the human condition” (Steiner, 2013, p. 198).

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Short Communication

The Machines – Poem and Comment

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Abstract

As a poet and philosopher Lars Gustafsson (1936-2016) inhabited the worlds of Swedish literature as well as analytic philosophy of language. He was professor at the University of Texas and a writer of world-renown, with translations of his novels, short stories, essays, and poems in many languages. Among his collections of poetry the one revolving around the theme of machines gained special prominence. It is anchored by „The Machines“ which occasioned also an essay by Gustafsson in which he explores the background and philosophical implications of that poem. The poem is therefore here presented right along with a new translation of that essay by John Irons who had already created one of three English translations of the poem. – When Gustafsson in 1966 took archetypical mechanical devices as a poetic cipher for human self-reflection at the intersection of technology and language, the machines of his day were conceived cybernetically: They were thought to be mechanisms with feedback that were driven and controlled by servomotoric electric power. The mecatronic fusion of the computer and the machine did not yet occupy a place of prominence in reflections about technology. This is one of the reasons why a fresh reading and new assessment of Gustafsson’s texts is called for – how do they speak to contemporary readers? This publication is therefore accompanied by three philosophical responses.

Keywords: Lars Gustafsson, Human-machine relations, Grammar, Christopher Polhem

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Краткое сообщение

Машины – Поэма и эссе

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Аннотация

Ларс Густафссон (1936–2016), поэт и философ, глубоко проникший в мир шведской литературы и аналитической философии языка. Он был профессором Техасского университета и всемирно известным писателем, чьи романы, рассказы, эссе и стихотворения были переведены на многие языки. Среди его поэтических сборников особое место занял сборник, посвященный теме машин. Его основой является стихотворение “Машины”, которое также послужило поводом для написания эссе Густафссона, исследующего предысторию и философский подтекст этого стихотворения. Поэтому здесь стихотворение представлено вместе с новым переводом этого эссе, выполненным Джоном Айронсом, который уже создал один из трёх английских переводов стихотворения. – Когда в 1966 году Густафссон взял архетипические механические устройства в качестве поэтического шифра для саморефлексии человека на стыке технологии и языка, машины его времени мыслились кибернетически: они представлялись механизмами с обратной связью, приводимыми в движение и управляемыми сервомоторной электроэнергией. Мекатронное слияние компьютера и машины ещё не занимало заметного места в размышлениях о технологиях. Это одна из причин, по которой требуется новое прочтение и новая оценка текстов Густафссона – как они воспринимаются современными читателями? Поэтому к данной публикации прилагаются три философских ответа.

Ключевые слова: Ларс Густафссон, человеко-машинные отношения, грамматика, Кристофер Полхем

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THE MACHINES¹

Some of them came early, others late,
and outside the time where it exists
each and every one of them is homeless.

Heron's steam ball. The Voltaic pile. The ballista.
The great pit winder in Falun. Curiosities:
Den 'pneumatic winnower'
Una macchina per riscaldare i piedi

We only perceive machines as being homeless
when they belong to a different century.
And then they become distinct, acquire a meaning.

What do they mean? Nobody knows.

The flat-rod system: a device with two raising rods
that moving in reciprocal fashion
transfer power over large distances.
What does the flat-rod system mean?

¹ The poem „Maskinerna“ by Lars Gustafsson (2015) is presented here in the translation by John Irons which was first published in a bilingual edition of Gustafsson's poetry (pp. 70-71). – The original Swedish poem (first published in 1966) was included in the first of his four volumes of *Collected Writings*: „Maskinerna“ opened a section entitled „Naturens tre riken [The three realms of nature]“ (Gustafsson 1998). In this edition, Gustafsson's provides notes to some of the expressions and references in the poem – most of these annotations found their way also into Gustafsson's comment which is included here. Another translation of the poem can be found in the appendix to an essay on Gustafsson's machine theme (Luttröpp Sandström 1972, pp. 220-221). A third translation by Robert Rovinsky also included Gustafsson's essay (Gustafsson 1974).



DIE BERGWERKE IM HARZ ANNO 1723

The picture swarms with people. Human beings,
tiny as flies, are being hoisted and lowered in barrels
and the object marked 'j' in the picture, 'La Grande Machine',
at the fresh waterfall, drives all the cables.

No one has ever combined,
which would be perfectly possible,
a flat-rod system and a steam engine,
Hero's steam ball and the Voltaic pile.
The possibility still exists.

A foreign language that no one has spoken.

And strictly speaking:
Grammar itself is a machine
that among countless sequences
selects communication's strings of words:
the 'keen instruments', 'parts of childbirth',
the 'scream', the 'smothered whispers'.

When words have passed away, grammar remains,
and it is a machine. That means what?
Nobody knows. A foreign language.
A completely foreign language.
A completely foreign language.
A completely foreign language.

The picture swarms with people. Words, tiny as flies, are being hoisted and lowered in barrels and the object ‘j’ marked in the picture, ‘La Grande Machine’, at the fresh waterfall, drives all the cables.



Figure 1. Christopher Polhem's hauling engine or hoist, the Machina Nova, at the Falu copper mine, Sweden. This hydro-powered construction dates to 1694 (cc BY-NC-ND Nordiska museet/Sverige Dalarna Falun, Photo Peter Segemark – url digitaltmuseum.se)



Figure 2. A detail from a print depicting a *Stangenkunst* (flatrod system) in the mining landscape of the Harz Mountains, Germany (Deutsches Bergbau Museum Bochum, Montanhistorisches Dokumentationszentrum CC BY-NC-SA url nat.museum-digital.de/singleimage?ressourcen=1279196): „transfer[ring] power over large distances,” as such „the 18th century precursor of today’s high-voltage power lines.” Despite impressive scholarship on the transfer of Polhem’s knowledge to the Harz mountains (Höcke, 2024), it has not been possible to pinpoint the etching that is referenced and described by Gustafsson „Die Bergwerke im Harz ANNO 1723.”



THE MACHINES²

My poem 'The machines' contains an obvious paradox, one which I feel calls for a comment.

In order more easily to gain insight into what constitutes this paradox, we must begin by clearing away certain more trivial details.

Most people are well aware that 'Heron's steam ball' is an antique precursor of the steam turbine attributed to Heron, that 'the Voltaic pile' is an ancestor of the modern electric wet battery, and that 'the ballista' is a primitive form of artillery, a huge stone launcher.

That 'the great pit winder' is one of the inventions constructed by Christopher Polhem for the large copper mine in Falun is perhaps less known.

The great pit winder was a huge haulage and elevating device for ore, powered by water and almost entirely made of wood. It is one of those 18th century machines that somehow seems to be much more mechanical than any modern machine, since the transmission of power in these machines took place with the aid of cumbersome and complex systems of rods that moved back and forth. The actual winder has long since crumbled away and only a ruin of the huge machine remains. But at the Museum of Technology in Stockholm Polhem's own model of the machine can be seen. It offers an indescribable impression of its jerky, complicated, inexorable movement.

The 'pneumatic winnow' is a curiosity, taken from an old manual of physics, while 'Una macchina per riscaldare i piedi' is a memory of the time when mechanical inventions almost seemed to hang in the air and were incorporated into royal cabinets of curiosities. During the Renaissance, a machine was either a curiosity, a topic of conversation, regarded and admired by breathless visitors, or some small, ingenious device that can increase the comfort of a fine gentleman when sitting in his armchair.

One could say that mechanics had not yet been incorporated into experience and external conditions and still had a dubious independent status, more related to art or sleight of hand.

And finally 'the flat-rod system' is the type of power transmission device that must once have dominated the areas around a mine, the 18th century precursor of today's high-voltage power lines: from loom-like devices on water-wheels motion is transferred to a system of alternately forward- and backward-moving rods. Such a flat-rod system, placed

² This is a new translation by John Irons from Swedish into English of Gustafsson's 1969 commentary on his poem (1969, pp. 32-40). – The following reflections emphasize the significance of the Swedish engineer Christopher Polhem (1661-1751) who may have been the first to conceive a mechanical alphabet of machine elements. Gustafsson later dedicates another poem to Polhem. According to Luttröpp Sandström it represents a profound shift from Gustafsson's views in „The Machines“ and his commentary. „Polhem's Ore Hoist“ „appears as a study in futility and of human ingenuity ‚Ruling the world for a few short days““ (pp. 217-219, 222-223). See also Rovinsky (1978).



on quite high poles, could run for miles through the terrain, and ingenious cross-overs enabled the rods to shift at a right angle to their normal direction.

As you can see, I have avoided including in my poem's inventory any machine from my own time, and that has been done deliberately: what interests me in this poem is more *the mechanical aspect* of the machines themselves, *the machine-likeness of their appearance* than their various functions, and this indeterminate characteristic we can practically only discern in machines that in some way or other have become curious and antiquated, that have ended up outside everyday contexts and therefore, to use the poem's formulation, are 'homeless'.

That a poem deals with machines is of course nothing remarkable. At a guess, I would assume that the oldest mechanical device that has provided images for literature is the loom – or perhaps the millstone? Ever since Tennyson's age, machines have featured ever more frequently in poetry. The emotional states or experiences that they have contributed to it have been of a very disparate nature: from wide-eyed astonishment or perhaps – as with the futurists, a kind of intoxicant, to homeless despair. There are not merely one but many literary traditions that build on the expressiveness of machines.

The Romantic enthusiasm that certain poets could feel for machines in the infancy of industrialism is not our focus in this context, nor is the ecstatic attitude of the futurists or the realistic pathos of the early Soviet poets with regard to the machine.

What interests me is a completely different emotional state, one that is hard to describe and without a doubt fascinating. It is to be found in some of the drawings of Grandville's 'Un autre monde', where caricature-like renditions of machine elements, steam whistles and cast-iron details assume human form and live on in a burlesque existence which is both *petit bourgeois* in the manner of a children's tale and fantastic in the same way that surrealist artworks are. It is to be found in the strange, meticulous and excessively complex descriptions of machines that fill page after page in Raymond Roussel's strange novels, and also, this time with scary and crystal clarity in Franz Kafka's novella 'In der Strafkolonie', where precisely the account of the immoderately complex machine that is an instrument of torture forms the secret core of the story.

And one can perhaps get something of the same feeling when viewing Marcel Duchamp's glass painting 'La Mariée, mise à nu par ses célibataires mêmes', this peculiar work of art that has captivated so many changing interpreters and where the machine aspect with the strangest of names seems to be involved in some complicated and apparently meaningful, but also incomprehensible, process.

All these artworks deserve thorough explications – the differences between them are at least as great and interesting as the similarities. But let us content ourselves with stating that all of them contribute to narrowing down the special experience of the *machine-like*.

The machines of Kafka, Duchamp, Roussel as well as Grandville all convey, to various degrees, an experience of something secretive, hard-to-grasp and terrifying about



the machine. One could say that they are reactions to the *machine-likeness of the machines*.

All of us are familiar with this feeling, just as we are familiar with symbolism where the predictably repeated movements of the machine are contrasted with the unpredictability of organic life, its fertile unreliability.

We feel uneasy about the machine in the same way as we feel uneasy about a *phantom*: something which has no life and which moves nevertheless – *it simulates life*. When he contrasts the mechanical movements of the machine with the mobility of organic life it is not in order to exploit the machine as a death symbol – it is not death that it means, rather the possibility that our own lives are simulated in the same way.

There is something – call it alienation, describe it in Marx's or Kierkegaard's terms or however you like – some experience which all of us have in common – that we are actually marionettes, mechanical dolls, *homunculi*, and then to ask the question: *What difference does that make?*

La Mettrie – as far as I know – was the first person to explicitly ask the question and something during the last century has made it relevant with extraordinary force, with a suspicion also becoming widespread.

This experience has been crucial, also when my poem has come into being. The paradox of the poem is that this experience during the work has come to be combined with another one, so that it can look as if I, in a paradoxical way, was seeking security precisely in the experience, while others have only sensed a disorientation, a mystification, or nothing less than dread.

To compare language with the behaviour of machines and to affirm that grammar is a machine may seem to be a far-fetched allegory.

I believe that it would never have become of real interest to me if I had not become acquainted with various new modes of thought within linguistics, such as those concerned with the concept of 'grammatical structure' and similar concepts. It is especially the attempts of Noam Chomsky to define the grammatical sentence with the aid of a number of elementary operations that came to my mind.

With regard to the thoughts that it uses to communicate information, grammar seems to possess an almost secretive objectivity: its forms lend themselves to everything and at the same time they have an aura of something objective, extra-human independence about them.

It is not without good reason that Chomsky in his work 'Syntactic Structures' has characterised grammar as a machine. It is the machine which out of the multiplicity of theoretically possible word-combinations, jingles, sequences selects precisely those which constitute organised, comprehensible language.

Once one has familiarised oneself with this idea, it is difficult to free oneself from it: there is something mechanical about our words and our utterances – something impersonal one might almost say, as if we ourselves were not producing the thoughts but



that language was thinking within us, and we only were lending a voice to a larger and more immense linguistic structure that grows through us like the mycelium of a parasitic species of fungus penetrates its host. Or perhaps as if language was a huge, invisible mechanical process.

Practically no human being exists who has not at least as some time experienced the paradoxical independence with which words live and think in us, and how this objectivity of language links us to strange, distant and half-forgotten thought, to historical events long past, to attitudes that are alien to us.

There is, if you like, also an experience of the logical, of the mysterious in the fact that every sentence we utter has an infinite and ungraspable set of statements as a consequence, no matter whether we understand it or not, whether we wish it or not.

It could also be described as an experience of mathematics: of the obstinacy of natural speech; that once they have been defined, they do not lend themselves to any purposes whatsoever, but only undergo the transformations and combinations that it is in their nature to undergo.

Their nature? Yes, more *theirs* than ours.

There is, then, an experience of an alien, impersonal, ungraspable diversity in which we are most deeply involved. It is just as reasonable to say that it which thinks with us as to claim that we think with it.

Modern cybernetics has convincingly shown that a whole series of traits which we have regarded as being exclusive for the human thought process can be simulated by mechanical devices. Memory, the capacity to reach conclusions, and to make rational choices on the basis of given suppositions. In discussions about modern mathematical machines and their analogy with human beings one sometimes hears the argument ‘that the machine is incapable of imaginativeness’. As far as I understand it, there is nothing in principle to prevent the construction of a machine where each ongoing operation is capable of giving rise to similar but not identical operations that are not grounded in logic, i.e. to associate.

Some of my readers may possibly suspect me of wanting to develop some kind of deterministic or mechanistic philosophy. That would be meaningless for my purpose.

I am only interested in collecting some cues so as to point in a certain direction.

Anyone examining a cybernetic device sees no thoughts, he only distinguishes between parts of a machine. To assign life to them would be a form of animism. Anyone looking inside a human being does not see any thoughts either.

But when a human being looks inside himself, he experiences himself as a consciousness. Is that perhaps a form of animism too?

The symbolic value of the machines lies in the fact that they remind us of the possibility that our own lives are in some way simulated in the same sense as the machine simulates life.



My poem deals with the possibility of perceiving ourselves as machines or as cybernetic devices programmed by our own language and our own logic. It is an attempt to change the perspective, to construct a new aspect of the *best-known thing of everything*:

The picture swarms with people. Human beings,
tiny as flies, are being hoisted and lowered in barrels
and the object marked 'j' in the picture, 'La Grande Machine',
at the fresh waterfall, drives all the cables.

The history of philosophy is full of arguments that seek to prove that I do not have any access – any direct access, that is – to other people's inner lives, i.e. that all humans apart from myself could very well be marionettes. There are much fewer arguments which seek to prove that I could be a marionette without ever discovering it.

If other people's mental life really was inaccessible in the sense that certain philosophers claim, it would also have considerable linguistic consequences. It would mean that each and every word of mine, e.g. 'apple' or 'red' had two meanings, a public one, accessible to everyone, and a private one, only accessible to myself.

I do not know how many aesthetic and poetical doctrines regarding the 'imperfection of language' as a linguistic wall that separates one person from another are based on such a point of view. And the question is whether or not this doctrine of 'the anti-poetical wall' is one of the most important sources of poetical purism that is one of the roots of all lyrical modernism. The idea that the words separately or in every conceivable combination hide or conceal a residue of experience that can never be 'communicated' increasingly appears to be the leftover of an untenable metaphysical approach, one that still remains to be overcome.

As far as I am concerned, everything is said by what is said, and I regard language as being completely transparent: it completely expresses our thoughts. Or, as Ludwig Wittgenstein advances in his 'Philosophische Untersuchungen': if language was such that in principle it was unintelligible to anyone else, then in principle it would also be unintelligible to me as the speaker as well.

There are no linguistic walls: every experience is present (clearly or unclearly formulated) here and now and exhaustively in the formulation I give to it. There is no inaccessible residue behind our words; there are no private meanings. Language exhausts us. It is the impersonal within us and like objective media our thoughts exist. Thinking is within us.

Such a way of looking at things must lead to a different poetic than that of classical modernism.

The poem 'The machines' can be regarded as a modest fragment of such a poetic.

My poem assumes that a form of community has been established once and for all, and that its innermost being is something impersonal. And it seeks solace in this fact.

It is, if you like, a community among marionettes that simulate life, but the condition for it would seem to be that we rub the metaphysical sleep out of our eyes and



see it. A strange community – deep within mechanics, and yet a community, confidentiality.

From this point of view, the tragic thing about humanity is not that it is shut out, that something separates it from life. nor that its words do not reach their destination.

The tragic thing about humanity, as also about machines, is that it does not have any secrets.

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Research article

The Machines and Beyond

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Abstract

This essay presents observations concerning the evolving relationship between humanity, technology, and nature through the lens of Lars Gustafsson's poetry. It traces a trajectory beginning with the poem "The Machines," which portrays a mechanistic worldview where humans and machines are co-participants in a mechanical, puppet-like existence, offering a "peculiar consolation" in a shared lack of secrets. The text then moves to "The Wright Brothers Visit Kitty Hawk," identified as a crucial "bridge" that disrupts this mechanical unity by introducing a moral dimension. This poem introduces concepts of guilt and responsibility (against the backdrop of a "Gnostic darkness"), casting humans as moral agents who can use technology for good or evil. Finally, the article examines "Polhem's Ore Hoist" as the "overcoming of the motive," where the purely mechanical gives way to a triumphant organic life and a form of natural, instinctive knowledge. The essay concludes by contrasting Gustafsson's poetic journey with contemporary transhumanist thought, which, it argues, focuses on a machine-centric view not out of a search for unity, but out of a desire to control and perfect an inadequate nature.

Keywords: Gnosis; Gnostic Darkness; Transhumanism; Human-Machine relations

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Научная статья

Машины и не только

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Аннотация

В этом эссе представлены наблюдения о меняющихся отношениях между человечеством, технологиями и природой через призму поэзии Ларса Густафссона. Прослеживается траектория, начинающаяся со стихотворения “Машины”, в котором изображается механистическое мировоззрение, где люди и машины являются соучастниками механического, кукольного существования, предлагая “своеобразное утешение” в общем отсутствии секретов. Затем текст переходит к стихотворению “Братья Райт посещают Китти Хок”, которое определяется как важный “мост”, разрушающий это механическое единство посредством введения морального измерения. В этом стихотворении вводятся понятия вины и ответственности (на фоне “гностической тьмы”), представлявшие людей как моральных агентов, способных использовать технологии во благо или во зло. Наконец, в статье рассматривается стихотворение “Рудный подъёмник Полхема” как “преодоление мотива”, где чисто механическое уступает место торжествующей органической жизни и форме естественного, инстинктивного знания. В заключение эссе проводится сопоставление поэтического пути Густафссона с современной трансгуманистической мыслью, которая, как утверждается, фокусируется на машиноцентричном взгляде не из-за поиска единства, а из-за желания контролировать и совершенствовать несовершенную природу.

Ключевые слова: Гнозис, Гностическая тьма, Трансгуманизм, Отношения человека и машины

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IN FRONT OF THE BRIDGE

Beyond aesthetic appreciation, philosophical debate, or historical interpretation, poems also speak directly to the reader – how do we, as contemporaries in the first half of the 21st century, react to Gustafsson's poem with our own experiences of machines, and what considerations and thoughts does it trigger? *Does (or do?)* "The Machines" speak to us? Poems – word structures assembled by the machine of grammar (to tie in with thoughts from "The Machines") – do not become homeless, even if they may become foreign. They still speak, and if they speak a (now) foreign language, the mechanism that reads them into me will certainly find its way to thought.

At the beginning, Gustafsson describes machines from past centuries that have become homeless, some of which are still known as distant ancestors of today's technology, while others have disappeared from memory, and Gustafsson himself provides information about them: he has written an essay to accompany his poem, which is included in some editions. This essay not only describes the location of the poem in more detail. It is "completely equal to the poem. Step by step, it shows the author's journey, just as, in a different mode of transportation, the poem draws the reader along step by step. The author just approaches the concept that suits him from two different writing possibilities," as Walter Höllerer (1967, p. 9, translation S.G.) notes.

"Heron's steam ball" or the "Voltaic Pile," the playful Renaissance apparatus for warming the feet, the "pneumatic winnowing," etc. – some things are memorable, some are curiosities. Gustafsson is particularly fond of "the great pit winder in Falun" and "the flat-rod system" – large, space-consuming machines, the latter covering an entire region for energy transmission. The former, "the great pit winder," is a construction by Swedish inventor and scientist Christopher Polhem (1661-1751), whose roaring, jerky machines Gustafsson found particularly fascinating. Here, what Gustafsson is interested in when it comes to machines becomes tangible:

For Gustafsson, the significance of the machines lies not in their function but in their appearance; machines do not have life, but they move as if they did: in other words, they simulate life. This bothers us, says Gustafsson, because it suggests the possibility that our own lives are simulated in a similar manner. (Luttröpp Sandström, 1972, p. 213)

In the second part of the poem, the grammar section (beginning with „A foreign language that no one has spoken. / And strictly speaking: / Grammar itself is a machine ...“), which according to Gustafsson is inspired by Noam Chomsky's grammar theory, „words are compared to machines and also to people; consequently, people also end up being compared to machines.“ (Luttröpp Sandström, 1972, p. 213) While in the first part „people, small as flies“ are transported by the big machine, in the second part it is „words, small as flies.“ In addition:

„Den friska instrumenten [keen instruments]“, „födselodelarna“ [parts of childbirth], ... can have reference to three kinds of mechanical functions: of machines, of speech organs, and of sexual organs. Man is then depicted as being mechanical in all his acts, even those supposedly most „natural.“ The poem's



emphasis, however, is on the mechanical nature of speech. (Luttrupp Sandstroem, 1972, p. 214)

So man is a mechanical puppet that simulates life, just like the machine, just like communication, none of which mean anything: „But language for Gustafsson is not simply objective and impersonal, it is mechanical. It is just as reasonable, he argues, to suppose that language thinks in us as it is to suppose that we think in it.“ (Luttrupp Sandstroem, 1972, p. 214)

But from today’s perspective, is Gustafsson’s collection of antique machines still necessary to make the essence of mechanics tangible? It seems so, perhaps even more so than in the 1960s.

In many university computer science departments, there are display cases in the hallways showing the history of the development and evolution of the computer through exhibits. Machines from the 1970s usually mark the beginning, but depending on the definition of „computer,“ there are also computers from the time when Gustafsson’s poem was published. Without the accompanying descriptions of their (from today’s perspective ridiculously low) computing and storage power, they reveal little – keyboards in various shapes, cases in various muted colors, dark glass windows in various formats. The „mechanical nature“ that, according to Gustafsson, can be experienced in its rawness through the antiquated machines is hidden and does not even peek out from the circuits (can one even speak of mechanics anymore?). And if you were to tear the computers out of their glass sarcophagi (or silicophagi?) to look inside their guts – what would you experience, even if you reconnected them to their lifeblood, electricity? And the broken corpses of their relatives in the garbage dumps of developing countries do not sink back into the dust as easily as Polhem’s most impressive machines.

The smartphone that most people hold in their hands all the time is, in terms of the transparency of the processes going on inside it, more comparable to a magical object. The machine, the calculating machine, mutated into the digital machine, has shed its home and leads its life virtually in secret, in all kinds of everyday objects, inhabiting traditional machines such as washing machines or coffee machines (ubiquitous computing / internet of things). Artificial intelligence, neural networks, machine learning, large language models (and the accompanying new discoveries in neuroscience) are far more powerful – both in reality and as figures of speech – than Chomsky’s grammar machine. They correlate words according to the changing rules of their art, speaking like a human being who does not speak, but in whom it speaks.¹ In his essay, Gustafsson talks about language thinking within us, language being like a parasitic fungus that penetrates the host cell – *or language could be seen as a huge invisible mechanical process.*

His poem „Homunculus,“ which also deals with humans as puppets, explores the possibility that humans are merely machines, their internal organs merely machine parts:² „But suppose those same lungs, kidneys, memories were / Artificial, made by a completely natural but still / Artificial process, by external means?“ Made by a completely natural but still artificial process? Biofacts (see Karafyllis, 2007) come to

¹ With this assumption, he would be preaching to the choir in many Asian spiritual traditions.

² It is reminiscent of Fritz Kahn's „Der Mensch als Industriepalast“ (Man as an Industrial Palace) from 1926.



mind, genetically modified or created organisms, natural, alive, growing, but still artifacts. Here, too, new dimensions have emerged in the course of technical development – as with the entire „machine fleet“ that will one day, in the nanometer range, supposedly perform its services beyond the reach of the human senses.

This list could be expanded considerably, and beneath the surface, which has only been touched upon here, there is an enormous degree of complexity, but that would go beyond the scope of this text. Does Gustafsson’s poem still mean anything to us today, despite all these developments?

In the „Literarische Colloquium Berlin“ for the winter of 1966/67, Hans Magnus Enzensberger, who translated Gustafsson’s poems into German, introduced the poet, who presented both „The Machines“ and the accompanying essay, saying:

Gustafsson has – and how many poets can you say that about? – thoroughly studied formal logic, the philosophy of everyday language, and the rigorous labyrinths of Anglo-Saxon epistemology. And you will soon hear how this knowledge comes to the aid of the poem. It dispels old mysteries and leads to a clarity that is ‘peculiar’, so peculiar that a rare prize appears in the cool, clear mirror of the poem: something logical that is not dry, and something fantastical that is not murky. The logical fantasy, the fantastical logic of the peculiar Mr. Gustafsson from Uppsala. (Quoted in Höllerer, 1967, p. 10, translation S.G.)

The cool, clear mirror is still there. From a (perhaps somewhat special) perspective, Gustafsson’s poem itself is now a machine from another time, showing us a question in the mirror that is still valid today, with its transition from the beginnings of machine technology to Chomsky’s venerable grammar machine theory to the puppet-like nature of human beings (i.e., it definitely means something) – a question that, given the pervasive spread of the mechanical around us and the dissolution of the machine into its surroundings, rarely comes to mind with such clarity.

ON THE BRIDGE

„The Machines“ leads us and the poet to an existential zero point. For some, it would be a depressing idea – namely, to be just a puppet in a machine-like environment with machine-like, impersonal communication. According to Gustafsson, however, the poem seeks comfort precisely in this, because what connects people may reach deep into the mechanics and be peculiar, but it is also this: a commonality.

From this point of view, the tragic thing about humanity is not that it is shut out, that something separates it from life. nor that its words do not reach their destination. The tragic thing about humanity, as also about machines, is that it does not have any secrets. (Gustafsson, 2025, p. 124)

Humans are neither trapped in a dark machinery from which they cannot escape, nor are they – as puppets – excluded from a possible other life – and therein lies a peculiar consolation. So there is no secret, and on the one hand this is a kind of consolation – on the other hand, this is also the tragedy of humans and machines. But, one might ask



Gustafsson, isn't „tragedy“ an empty word in such a world, in such an existence? Is there a form of resignation behind the consolation of „The Machines,“ or does the tragic contain the seed for a movement away from the zero point in another direction?

Luttrupp Sandstroem (1972) draws our attention to a change in the machine motif in some of Gustafsson's poems. In the poem „The Wright Brothers Visit Kitty Hawk“ (1967), which appeared after „The Machines,“ a change in the relationship between humans and technology (and nature) seems to be taking place.

Enquist (1971), who corresponded personally with Gustafsson about the poem, provides some information on the context in which it was written, including Gustafsson's preoccupation with the *innocent* art of kite flying, his reading of Irving's book on the bombing of Dresden, and the political events of the time – the discussions about the Vietnam War. He also explains the elements of the poem (from the kite motif to Bakunin, Milton Wright, and Lilienthal), including information that comes directly from Gustafsson.

We are particularly interested in the „Gnostic darkness“ that a monotonous voice whispers as a „warning“ at the very beginning of the poem during the flight of the kite, and which recurs at the end of the poem („Dresden. Hanoi. And 'the Gnostic darkness.'") This opens up a moral perspective – humans are no longer part of the machine theater that leaves no room for morality; they step out of this theater and relate to nature as well as to machinery, using it – innocently to fly kites, culpably to destroy. Compared to the previous poem, this creates a tension:

The problem with those two poems [...] is, it seems to me, the assignment of guilt. If objects are guiltless, man, viewed as a marionette, must share in their guiltlessness. We either have to suppose that the mechanistic view of man obtains in „Maskinerna“ but not in „Kitty Hawk“ – in which case man's experiments with scientific objects make him responsible for the uses to which inventions of various kinds have been put – or, if man remains a marionette, the responsibility must be assigned to some impersonal force (since Gustafsson discounts the possibility of a theistic universe) such as the „forces of history.“ (Luttrupp Sandstroem, 1972, p. 217)

In private correspondence with Sandstroem, Gustafsson offers a surprisingly simple explanation for this: since „The Machines,“ he has simply changed his mind – he no longer sees humans as machines. Here, too, there is no secret that would mysteriously harmonize both positions in the background.

In correspondence with Enquist (1971) on „Gnostic darkness,“ Gustafsson himself provides the following information: Gnostic darkness ...

... is therefore the darkness from which, according to Gnosticism, the demiurge creates our world, which is therefore a lower world. Here: the darkness behind humans, the darkness behind good and evil. Compare Theodor Lessing's words: making the meaningless meaningful. Values exist in the world of humans, behind



which lies amoral nature, and this is darkness. Our scientific discoveries, such as the airplane, take place at this boundary. (p. 243)³

A general, greatly simplified summary of Gnosticism as a religious system could be: a monadic, inexpressible good God stands in opposition to a bad or evil material world that was created and is ruled by a demiurge. Humans must recognize and develop the *pneuma* dwelling within them, which comes from the good God, and climb up to it, leaving physicality and material attachments behind. Accordingly, Gnostic representations (varying in some cases) distinguish between the types of people known as sarkics (attached to the flesh), psychics (attached to reason), and pneumatics (those striving for salvation).

It would be inappropriate and wrong to try to impose a complete religious system on Gustafsson at this point – he limits himself to Gnostic *darkness*. One could read the stages of the steady progress of aviation technology in the poem as stages of emanation that move further and further away from the ‘good’, the innocent (kite), to end in the bombing of Dresden and Hanoi. The question of who the demiurge is who created the amoral darkness behind humanity is irrelevant to Gustafsson, as is the question of the ‘good God’ who may not even exist. In fact, the poem can be read rather pessimistically – morality, the question of guilt, has caused a Gnostic rift in the world, tearing humans out of the comforting machine community and driving a wedge between them and the machine theater. The wedge is guilt (power, responsibility).

ON THE OTHER SIDE

Luttröpp Sandström (1972) sees „Kitty Hawk“ as „an important bridge between the mechanistic view of man exemplified in the earlier poetry and what Gustafsson calls ‘detta motivs övervinnande’ [the overcoming of the motive]“ (p. 217). Where does this „bridge“ lead? It leads to a later poem by Gustafsson, namely „Polhem’s Ore Hoist.“ Here we encounter Christopher Polhem again, who in „The Machines“ had contributed an impressive apparatus to the machine and puppet park, but in a surprising new way.

In the first four verses, he takes center stage, thinking that mechanics are „an alphabet, / The Writing of the new time, that would fill the world, / And drew through a vast landscape / His *arts*, crank shafts, rolling mills, / ...“. His machine dominates the first four stanzas, but at the end of the fourth, in the transition to the fifth, something changes: „A sound, as of great powers, was heard: it was man / Ruling the world for a few short days ...“ – just a few short days, and then?

Then the poem moves on to the fetus, which as a microcosm is connected to everything, even distant galaxies, the macrocosm. „The fetus knows,“ it possesses a natural knowledge, a knowledge rooted in life itself, of all connections. Polhem appears

³ The Swedish original, in which Enquist quotes from a letter by Gustafsson: “Det gnostiska mörkret ‘är alltså det mörker ur vilken Demiurgen enligt *gnosis* skapar vår värld, som alltså är en undre värld. Här: mörkret bortom människan, mörkret bortom gott och ont. Jämför Theodor Lessings ord: das sinnlose [sic!] sinnvoll machen. Värdena finns i människans värld, bortom den är den amoraliska naturen, och den är ett mörker. Invid denna gräns utspelas våra vetenskapliga upptäckter, t. ex. den av flygmaskinen.” (Enquist, 1971, p. 243, translation into English S.G.)



again, only this time „in a light green birch wood,“ listening to the „song of a cuckoo in May”, his machine having crumbled to dust. A beautiful unknown woman knows the secrets, the mystery of the universe, and that „The great Ore Hoist was nothing but a dream.“

Here the ingenious invention has been reduced to a pile of lumber and some rusty iron scraps; animate life has come into its own. The ignorance of mechanical life, even about its own disintegration, is contrasted with the instinctive knowledge of triumphant organic life. The fetus hears the sounds of the heavens and knows them for what they are [...] Polhem himself has abandoned invention in order to listen to the song of the cuckoo in the birchwood [...] man-as-machine has turned into man participating in the knowledge of nature. The controlling image [...] is not mechanical but human; the lady shares and perhaps surpasses the instinctive knowledge of the fetus and the birds; she knows ... (Luttropp Sandstroem, 1972, p. 219)

Where has this little walk across the bridge with Gustafsson (and Sandstroem) taken us? Or to put it another way: what have we seen?

Gustafsson's example reveals three possible ways in which humans can relate to technology (to the mechanical) and to nature. The journey took us from a peculiarly comforting community between puppets and machines (held together by a mechanical language common to all) to the loss of this community through a guilt-induced separation of humans as moral subjects (who can use machines for good or evil) to a new form of community that is now sustained by organic life.

This is not to suggest that Gustafsson's personal development is described here, nor that these are the only relationships that humans can have with machines and nature (or that crossing the bridge must necessarily take place in this order). However, poetry can inspire us to explore our own sense of being in the world and in technology against this backdrop.

Finally, it should be mentioned that Gnostic darkness can also take a completely different form, as exemplified by modern techno-futurism: transhumanists and posthumanists are an important movement in the current discussion about new and emerging technologies, especially nanotechnology. With their visions of improving humanity (and nature) through radical technical interventions, they influence ethical debates on what technology is, what it can do, and what it should be used for.

For transhumanists, humans are also machines, biological ones (*wetware*), just as ultimately everything can be understood more or less as a machine or information pattern. However, for transhumanists, humans do not fall out of the unity of the machine theater out of *guilt*, but out of *fear* of being at the mercy of an indifferent nature. Nature is seen as an inadequate demiurge, from whose reins humans, by making use of technology, seize control and shape everything in its place, above all themselves, into a more perfect, *the* perfect machine (here the motif of driven hedonism is added). One could say that they do not go beyond the darkness of Gnosticism, but rather turn back towards the machine park – with a vengeance.



The topic is too complex to explore further here. But it can be said that, from a transhumanist perspective, Gustafsson's „Kitty Hawk“ would not stop at Hanoi and the question of guilt, but would end in a conquest of space. And would a transhumanist reading of „Polhem's Ore Hoist“ be possible? A reading in which Polhem's crude machines also sink into the dust, but the triumphant organic life, the connectedness of the fetus, the singing cuckoo, and everything else spring precisely from the wisdom of a triumphant Polhem, who has subjugated all this as machines through the progress of science?

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Research article

Remarks on Gustafsson’s ‘The Machines’ – Hermeneutics of Machines

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Abstract

This paper offers some remarks on Lars Gustafsson’s poem ‘The Machines’ and its accompanying commentary from a critical hermeneutic point of view. Gustafsson seems to argue that machines acquire meaning only when decontextualized since they ‘stand out’, are ‘denaturalised’. Only then, they become an object of reflection and are thus in need of an interpretation. Furthermore, he seems to extend a cybernetic analogy to language, arguing that grammar is a generative machine that produces language. Through close reading, this paper reconstructs four theses from Gustafsson’s work: the acquired meaning of machines, the cybernetic human, grammar as a machine, and linguistic transparency. It then interrogates these theses through the lens of philosophical hermeneutics and argues that Gustafsson’s prioritisation of syntax offers a reductive view of both machines and language. By reintroducing the pragmatic and semantic dimensions, the paper contends that understanding a machine is not merely a syntactic operation but a hermeneutic practice similar to interpreting a text, where parts and whole inform each other given a specific context. The paper concludes that while Gustafsson’s mechanized worldview fruitfully opens ways of self-reflection, it risks an *Engführung*, a narrowing of our relation to the world and ourselves – that a thorough hermeneutic stance helps to avoid.

Keywords: Syntax; Pragmatics; Semantics; Hermeneutics; Philosophy of Technology; Cybernetics

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Научная статья

Комментарии к “Машинам” Густафссона – Герменевтика машин

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Аннотация

В данной статье представлены некоторые замечания по поводу стихотворения Ларса Густафссона “Машины” и сопровождающего его комментария с точки зрения критической герменевтики. Густафссон, по-видимому, утверждает, что машины обретают смысл только при деконтекстуализации, поскольку они “выделяются”, “денатурируются”. Только тогда они становятся объектом рефлексии и, следовательно, нуждаются в интерпретации. Более того, он, по-видимому, проводит кибернетическую аналогию с языком, утверждая, что грамматика – это порождающая машина, которая производит язык. Внимательно изучая работу, автор реконструирует четыре тезиса из работы Густафссона: приобретённый смысл машин, кибернетический человек, грамматика как машина и лингвистическая прозрачность. Затем анализ через призму философской герменевтики показывает, что приоритет синтаксиса, установленный Густафссоном, даёт редуктивный взгляд как на машины, так и на язык. Вновь вводя прагматические и семантические измерения, автор статьи утверждает, что понимание машины – это не просто синтаксическая операция, а герменевтическая практика, подобная интерпретации текста, где части и целое взаимодействуют друг с другом в определённом контексте. В статье делается вывод о том, что, хотя механизированное мировоззрение Густафссона плодотворно открывает пути для саморефлексии, оно чревато *Engführung*, сужением нашего отношения к миру и к себе, чего помогает избежать тщательная герменевтическая позиция.

Ключевые слова: Синтаксис; Прагматика; Семантика; Герменевтика; Философия техники; Кибернетика

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‘The Machines’ by Lars Gustafsson is a typical example of how mechanical construction and machines influence our understanding of the world and ourselves, as Gustafsson himself notes in his commentary on the poem (see also Kapp, 2015). In this work, he plays with associations drawn from cybernetic analogies of the human body and projects them onto language and logic. In what follows, I comment on some of the ideas expressed in both this poem and Gustafsson’s own remarks on it – without any claim of completeness or literary evaluation. Rather, I intend to point out certain conceptual ideas that may serve as starting points for further reflection. Before doing so, however, some clarification is needed. I will briefly reconstruct four core ideas from the poem and Gustafsson’s accompanying commentary, and then reflect on them. These remarks themselves can, in turn, serve as new starting points for further reflection on the topic.

The poem can be divided into two parts, separated by the emphasised line “Die Bergwerke im Harz Anno 1723.” Let me start with the first part. Gustafsson describes machines as being “homeless” if they are “outside where [they] exis[t].” By invoking various machines, he demonstrates the wide range of functions they can perform. However, whether one is able to identify a machine’s function depends on familiarity. Thus, any machine removed from its “everyday context” or which has become “curious and antiquated” is rendered homeless. A machine’s function is significant because it relates to its meaning. Two lines are central here to understand that:

“And then they become distinct, acquire meaning. / What do they mean? Nobody knows.”

At first glance, these lines appear contradictory: How can something acquire meaning, yet no one knows what that meaning is? If I understand him correctly, these lines require careful reading. Gustafsson seems to distinguish acquired meaning and ‘original’ meaning. A homeless machine only acquires meaning because it becomes distinct, it stands out. Only then do we begin to reflect on the machine and its purpose. In this way, it gains meaning for us, the observers. Present machines, on the other hand, do not stand out; they do not prompt reflection. They are seamlessly integrated into everyday life, become in some sense invisible. Therefore, acquired meaning arises only through reflection. It is attributed to the machine, in some sense. The ‘original’ meaning, in contrast, appears to be something else entirely, something we seemingly do not or cannot know. I will come back to this ‘original’ meaning later.

After sketching out acquired meaning, I can turn to the initial question: what is the connection between acquired meaning and function? In his own comments, Gustafsson notes that he is more interested in “*the machine-likeness of their appearance* than their various functions.” In other words, he is more interested in the ‘syntax’ than the ‘semantics’ of machines. Acquired meaning, then, involves attributing a function, such as entertainment or production, to a machine. But this act of attribution only happens when the machine is in some way ‘odd’.

The second part shifts attention to the machine-likeness of machines, their structure. Gustafsson describes humans as part of “La Grande Machine” which “drives all the cables.” Here, the machine becomes the subject, while humans are passively “hoisted and lowered” as its components, thereby giving primacy to the machine. The machine seems to act autonomously, almost as if alive. According to Gustafsson’s commentary, if I



understand his comment correctly, this picture evokes a particular “emotional state”: the eerie feeling that the machine is operating independently; “*it simulates life.*” This unease arises from the possibility that the simulation of life may not be limited to machines but might also apply to us humans. Put differently, our fear stems from the apparent indistinguishability between life and its simulation due to the possibility of mechanical replication.

From mechanical machines, Gustafsson turns to language, suggesting that not only our bodies but also our language and thoughts may be produced by a machine: grammar.¹ Drawing on Chomsky, he argues that grammar – or syntax – determines the structure of our language. It enables the construction of intelligible sentences and thereby making communication possible. In this sense, grammar is a kind of machine which produces meaningful language. Moreover, grammar operates autonomously: it is “thinking within us,” and we are merely the machines that articulate its output. This is because grammar and therefore language is just a linguistic structure which has many implicit implications that guide our way of using this structure:

the paradoxical independence with which words live and think in us, and how this objectivity of language links us to strange, distant and half-forgotten thought, to historical events long past, to attitudes that are alien to us.

There is, if you like, also an experience of the logical, of the mysterious in the fact that every sentence we utter has an infinite and ungraspable set of statements as a consequence, no matter whether we understand it or not, whether we wish it or not. (Gustafsson, 2025, p. 122).

This leads to Gustafsson’s conclusion that there is then “the possibility of perceiving ourselves as machines or as cybernetic devices by our own language and our own logic.” This idea is echoed in the poem’s final verse, which is a repetition of a previous verse. There, “Human beings” is replaced by “Words.” In this sense, grammar takes on “an aura of something objective, extra-human independence about them.” It persists even when the meanings of individual words are forgotten; just like a machine whose original function is forgotten.

Finally, and this is not directly expressed in the poem, Gustafsson believes that language is “transparent”: there is nothing more to be communicated than what is said. Our experiences are entirely exhausted in the language that expresses them. There is nothing ‘more’ to it. This view follows naturally from the cybernetic conception of the human and the mechanistic nature of grammar. If everything is mechanical, there is nothing that transcends the machine. Gustafsson concludes that the “tragic thing about humanity ... is that it does not have any secrets”. Everything boils down to simple

¹ Similar views on the ‘mechanisation’ of the mind can be found in Dupuy’s (2000) thoughts.



cybernetic explanations. Yet, paradoxically, this tragedy can also be seen as something unifying: a shared condition that binds us together in a community.²

What comes to the fore, then, are four ideas:

1. A machine acquires meaning only if taken out of its context and subjected to reflection. Only then the machine becomes meaningful. This acquired meaning is typically framed in terms of function. Only through decontextualizing, the machine-likeness of the machine become apparent so that its structure can be analysed.
2. Human biology can be described in cybernetic terms, raising the question of whether life is *sui generis* or merely mechanical.
3. Grammar is itself a machine, autonomously producing comprehensible language.
4. Language is transparent: it captures the entirety of human experience because of the mechanical nature of language and humanity.

I believe all four theses are related to philosophical hermeneutics. If analysed through a hermeneutic lens, they can be expanded or corrected, thereby opening new ways of seeing our relationship to machines and language.

Let me start with the first thesis. Equating meaning with function seems somewhat short-sighted. However, if we reflect on the implications of a function, we gain a broader insight into what a machine actually means. In this context, function refers to a person or object fulfilling a specific purpose. What seems straightforward at first glance turns out to involve many layers. The most immediate is the ‘why’ of a function: Why was a machine with function X needed? From here, numerous other questions arise, for example: How does the machine work? Why was it designed like this? Who worked with it? What material was used? What values are built into it? The answers to these and related questions reveal what kind of society, people and dynamics were at play when the machine was constructed and used.

A machine – just like *any* artefact, such as works of art or even philosophy – becomes homeless in a different temporal or cultural context precisely because these questions are tied to the machine’s original context. Without that context, the machine becomes a disruptive artefact that is in need of interpretation. Conversely, a machine that ‘fits’ into its environment becomes naturalised and blends in, so that the need for interpretation does not arise naturally. This does not mean that a deliberate interpretation of a current machine is impossible. On the contrary, it seems necessary to critically engage with current machines in order to uncover possible inequalities or assumptions that have become implicit in their design and function (see also, e.g., Grunwald et al., 2023). Consequently, talking about meaning involves more than just identifying a machine’s function. It also includes its *significance* both for the people of its original

² It is noteworthy, as has become apparent, that Gustafsson plays with three levels of ‘mechanisation’: mental, biological, and societal. While the first two are relatively straightforward, societal mechanization needs to be interpreted in light of his description of humans as part of “La Grande Machine” as well as his portrayal of language as a shared, objective frame of reference. This level, however, would require further explication and clarification. It is an interesting topic in its own right, with notable parallels to Heidegger’s (1962) warnings in *Die Technik und die Kehre*. Nonetheless, I will leave it at this point, as a more detailed analysis would require significantly more ‘filling in the blanks.’



time, who built, used and believed in it, and for us, who now look at it and relate ourselves to the world it reveals.

The second part of the first thesis claims that only once a machine becomes meaningful can its mechanical working be analysed in isolation. While we may not have access to the original meaning, since understanding is always a dialectical process that is bound to the hermeneutic circle, this does not mean that the machine's structure is independent from meaning. Understanding a machine's operation presupposes a range of prior knowledge. First, one must know how to use it. Even if a seemingly intact machine is placed in front of me, I cannot know that it is intact if I do not know how to operate it. But the act of using something is inseparable from understanding its meaning. Without that knowledge, I could misuse the machine and draw false conclusions about its functioning.

Second, even when this practical knowledge is available, one also requires technical knowledge, including conceptual tools to describe and understand the machine. Consider the example of an archaeologist discovering an ancient device whose operating principles are fundamentally different from any modern engineering system. In this case, understanding how it works would be nearly impossible. However, if information about its meaning in that society were available, that could serve as a starting point to understand how it might work. In other words, just like in traditional hermeneutics, the whole gives meaning to its parts and vice versa. Here, 'the whole' can be understood as the whole machine but also as the machine in its original context. To introduce the classical concepts from the philosophy of language: semantics, syntax and pragmatics are interwoven concepts and must be understood in relation to each other.

Building on this, the first thesis also implies that mechanics is a language of its own. In constructing a machine, the components such as screws, gears, plates etc. must be put together in a particular way to fulfil a function. Every part derives its meaning by its contribution to the overall function. Without the whole, each part would be meaningless.

Using the triad of syntax, semantics and pragmatics, it can be reconstructed why, from Gustafsson's point of view, the original meaning is inaccessible. We attribute meaning to the machine, but its parts do not carry meaning in the same way that words like 'red' or 'dog' do. There is either no meaning or an inaccessible meaning behind such components. The only thing the machine offers us is that it is analysable in its syntax. This is expressed with clarity towards the end of the poem: "That means what? / Nobody knows. A foreign language. / A completely foreign language." Yet, this conception of mechanical language overlooks how natural languages work. I will return to this when discussing the third thesis.

Turning to the second thesis, I do not question the thesis's truth, because it ventures deep into the territory of notoriously difficult question in the philosophy of mind such as the mind-body problem. Instead, I want to highlight the idea behind it. Gustafsson's aim seems to be to interpret the human body through a cybernetic lens, which then becomes a springboard for extending this view to language and grammar.

The third thesis holds that grammar – syntax – is a kind of machine that produces comprehensible sentences. But here, Gustafsson moves too quickly in claiming that syntactical correctness alone "constitutes organised, comprehensible language". As



Chomsky's (2002, p. 15) famous example (“Colorless green ideas sleep furiously”) shows, syntactical correctness does not guarantee meaningfulness. For an utterance to be comprehensible, it must be both syntactically and semantically correct.³

Furthermore, the clear distinction between syntax and semantics in understanding an utterance seems merely analytically possible. While it is possible in abstract or fictional scenarios to clearly separate the two, in most real-world language use they are deeply intertwined. It is not just a matter of using the correct structure, but of using the right words in the right structure. Depending on the communicative goal, syntax and semantics must be adjusted together.

Context is equally important. There can be a difference between what is said and what is meant. At a party, I might tell a friend, “Should we get some drinks?”, but we have agreed beforehand that this phrase means “Please get me out of this conversation.” Here, neither syntax nor semantics determines the actual meaning. Only in combination with context of – the pragmatic dimension of language – does it become clear (cf. Grice, 1989). Producing comprehensible language is not the reason why we use language but to communicate with others. Communication presupposes that the intended meaning is reliably conveyed. This presupposes an understanding of syntax, semantics and pragmatics. Prioritising syntax alone oversimplifies how meaning is constructed in natural language.⁴

This leads to another issue: Gustafsson's suggestion that mechanical language lacks semantics because its meanings are either absent or inaccessible. This view presupposes a rigid conception of semantics, as if words inherently possess fixed meanings regardless of context or use. As I have argued, syntax and semantics must be complemented by pragmatics. The meanings of ‘red’ or ‘dog’ are just conventions, and their meaning can change depending on context. The same applies to a ‘mechanical’ language: there are many different ways to construct a machine syntactically, but only one is actualised in a specific context. The acquired meaning is not secondary. Rather, it *is* the meaning. Just like in natural languages, the same ‘structure’ can mean different things in different contexts.

One might argue that Gustafsson's thought that mechanical language lacks semantics refers to words, which translates to gears, wheels, rods etc. in the context of machines, and this is the fundamental difference between natural languages and machine language. This is correct. A gear does not have a meaning on its own like ‘red’ or ‘dog’. Rather, it only acquires meaning in combination with other mechanical components by enabling the function of the whole. In some sense, a machine is like a text, which, depending on the complexity it, can consist of many sentences (sub-systems with

³ This might also explain why Gustafsson so readily assigns a lower importance to meaning in his reflections on machines.

⁴ One might argue that pragmatics should take primacy over syntax and semantics because, in the right context, these can appear to lose their relevance. However, this argument overlooks how pragmatics becomes relevant in the first place. For my friend to understand the hidden command, I first needed to explain it to him using a language that follows certain rules. In cases of implicature, too, the gap between what is said and what is meant can only be bridged if both parties share a common understanding of the rules and are competent language users (cf. Grice, 1989). This only underscores how existential and hermeneutic language use truly is.



different functions within the machine). To understand the meaning of a single mechanical component is to understand the ‘sentence’ it is used in, which, in turn, is to understand the whole text: the machine. Even though mechanical parts do not have meaning, at least not one paralleling words in natural languages, they acquire meaning by being put together ‘meaningfully’. In other words, what is needed is a hermeneutics of machines.

Building on this hermeneutic dimension of understanding machines and the aforementioned remarks on language, further questions arise that illustrate the deeply hermeneutic dimension of understanding machines. Without set semantics for single mechanical parts, understanding of machines relies on pragmatics and syntax. When trying to understand an unknown machine, one might only have a syntactical description: How do the different parts work together? How are they linked? How can one’s mechanical knowledge be applied to this new device? This leads to questions about the limits of syntax: To what extent can syntax alone constitute meaning? What is the relationship between syntax and pragmatics here? Can a function be described in purely syntactical terms? Underlying this is the presupposition of a ‘universal’ but “foreign” mechanical language that we try to decipher. While I do not intend to answer these questions here, they serve to highlight the deeply hermeneutic dimension of understanding machines.

The second part of the third thesis refers to how language has a life of its own; how it forces us to phrase our thoughts in specific ways, thereby limiting what we can express. This links the third thesis to the fourth: since language seems to determine the bounds of expression, meaning cannot transcend it. In Gustafsson’s terms, language is transparent.

Two points need to be problematized here. First, the fact that language operates with many unconscious or rigid rules does not mean that it is immune to critique and change. While any critique must necessarily occur within a language, it still allows for change. Debates about inclusive language provide a current example. Such debates and critiques are part of the hermeneutic project: even though understanding is always from a perspective, we are capable of critiquing that perspective, offering justifications for both our assessments of the status quo and our ideas of progress.

Second, consider the claim that language “*completely* expresses our thoughts” (emphasis added). While this may be true in some contexts, especially regarding veridical statements where we search for the right word to accurately express ourselves (cf. Gadamer, 1966; Grondin, 1994),⁵ it is clearly not universally valid. Gustafsson seems to assume that an utterance is understood in the same way by all language users. This is demonstrably false; if it were true, misunderstanding would not occur.

Moreover, people can also lack the words or expression to express what they think or feel. Imagine experiencing an emotion you never experienced before, and for which your language lacks a word. In such cases, language seems imperfect here.⁶ Consider the

⁵ One might even say that finding the truth is always the search for the right words and expressions. This presupposes that every truth is actually unambiguously and can be explicitly be stated. This seems like a very strong epistemological assumption that at least needs some further justification.

⁶ A nice expression of this fact is by Maurice Maeterlinck (1903, pp. 61–62): “How strangely do we diminish a thing as soon as we try to express it in words! We believe we have dived down to the most



German word ‘*Fernweh*’, the longing for distant places, which expresses a specific emotion for which many languages have no equivalent. Or think about cases of hermeneutic injustice (Fricker, 2007), where people lack the conceptual tools or vocabulary to name experiences of discrimination and injustice. One might object that this is not a flaw of language itself but in its use. Perhaps, given the appropriate words and concepts, everything could be expressed. I leave the strength of this objection open, as it would require a separate discussion.

To conclude, many of the ideas Gustafsson presents are not as innocent or self-evident as they may appear under closer scrutiny. However, they invite the reader to engage with them critically, thereby placing their own understanding of the world and of themselves under pressure. This hermeneutic practice is a self-reflective loop in which understanding is continually tested. Gustafsson’s poem and commentary suggest that fruitful insights can be drawn from viewing mechanics as language and grammar as machine. Gustafsson’s poetics of machines is a way of hermeneutically engaging with machines which opens up self-reflection and how we understand the world and ourselves through the lens of the machine. At the same time, the poem is also an expression of an ongoing mechanisation of the world, reducing everything to a ‘mere’ problem of management and proper functioning. A hermeneutically informed, modest stance towards such analogies is crucial to prevent an *Engführung* of our relation to the world and our understanding of ourselves.

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unfathomable depths, and when we reappear on the surface, the drop of water that glistens on our trembling finger-tips no longer resembles the sea from which it came. We believe we have discovered a grotto that is stored with bewildering treasure; we come back to the light of day, and the gems we have brought are false – mere pieces of glass – and yet does the treasure shine on, unceasingly, in the darkness!”



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Research article

Language After the Human –A Distant Echo to Lars Gustafsson’s ‘The Machines’

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Abstract

This essay explores the shifting relation between human language and machine-generated text in the age of generative artificial intelligence. Drawing on Lars Gustafsson’s notion of the “speechless machine” and Edward Morgan Forster’s prescient vision in *The Machine Stops*, it traces the transformation of machines from monumental, alien artifacts into intimate, linguistic counterparts embedded in everyday life. Yet their “speech” raises questions: Can machines truly speak when they lack need, will, and lived experience? What emerges is not language as expression, but probability condensed into form – text without provenance, without intention. Contrasted with Maria Montessori’s insight that language forms the child as a being-in-relation, machine language appears as communication without necessity, an answer without a question. At stake is not only authorship, but the erosion of resonance: when writing becomes generation, meaning risks dissolving into noise. Against this backdrop, the value of human writing re-emerges – not as efficient production, but as intentional, ethical, and relational practice. The essay argues that in the dialogue with machines, humans must reclaim responsibility: to decide what counts as speech, what carries meaning, and how language continues to shape a shared world.

Keywords: Generative AI; Language; Authorship; Human-Machine Relation; Ethics of Writing

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Научная статья

Язык после человеческого – Отдаленное эхо книги Ларса Густафссона „Машины“

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Аннотация

В этом эссе исследуется меняющаяся связь между человеческим языком и машинным текстом в эпоху генеративного искусственного интеллекта. Опираясь на концепцию Ларса Густафссона о “безмолвной машине” и прозорливое видение Эдварда Моргана Форстера в “Остановках машин”, автор прослеживает трансформацию машин из монументальных, чуждых артефактов в интимные, языковые аналоги, встроенные в повседневную жизнь. Однако их “речь” вызывает вопросы: могут ли машины по-настоящему говорить, когда у них нет потребности, воли и жизненного опыта? Возникает не язык как выражение, а вероятность, сконденсированная в форму – текст без происхождения, без намерения. В отличие от идеи Марии Монтессори о том, что язык формирует ребенка как существо-в-отношении, машинный язык предстает как общение без необходимости, ответ без вопроса. На карту поставлено не только авторство, но и разрушение резонанса: когда письмо становится генерацией, смысл рискует раствориться в шуме. На этом фоне вновь обретает ценность человеческое письмо – не как эффективное производство, а как осознанная, этичная и реляционная практика. В эссе утверждается, что в диалоге с машинами люди должны вернуть себе ответственность: решать, что считать речью, что несёт смысл и как язык продолжает формировать общий мир.

Ключевые слова: Генеративный искусственный интеллект; Язык; Авторство; Отношения человека и машины; Этика письма

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“A foreign language that no one has spoken” (Gustafsson, 2025, p. 117) writes Lars Gustafsson – referring to those silent apparatuses that whirl in factory halls, blink in data centers, or trace their circles in the dreadfully perfect order of bureaucracy. It is a language that long remained opaque to us. Not because it was too complex, but because it seemed to exist without us: a grammar without speakers, a text without readers, a murmur without an ear.

Yet something has shifted. Today, machines appear to speak. Their voices sound polite, helpful, fluent – so fluent, in fact, that they sometimes encounter us in our very own language. What Gustafsson conjures up as *the speechlessness of machines* now seems, in the age of generative artificial intelligence, almost like a temporal misunderstanding. *They do speak*, one might say – they answer, they write, they even ask back. But do they *truly* speak? The machines of our time are no longer colossal steel bodies dominating the horizon, but small, inconspicuous interfaces. No longer monumental, but minimalist. They enter our lives with proper names, wrapped in the everyday, embedded in our living rooms, phones, headphones. And yet the strangeness remains. What are they doing when they “speak with us”? Who is speaking? Who is thinking? Who is expressing an opinion?¹

Once conceived as alien – as an artificial Other – the machine has, with the digital turn, crossed into our midst. It is no longer outside us but part of our communication, folded into the texture of everyday life and even into our own articulation. What Edward Morgan Forster (2024) anticipated in *The Machine Stops* has, in a quiet reversal, come to pass: it is not humans who are dependent on the machine, but the machine that has become part of human expression itself. Just as Forster’s humans unlearn walking and touching, we now seem to be surrendering writing and thinking – the last, most intimate strongholds of human expression.

From the outset, however, machines were bound to the human mind. The Latin *ingenium* – innate talent, intellectual gift – gave rise in French to *engin*: the device, the apparatus or machine that translates human brilliance into mechanism (Weinrich, 2017). The machine is not the opposite of genius, but its externalization. We inscribed our intelligence into it, and now it writes back. But what does it mean when writing is severed from experience, from speech, from the self? Authorship, language, meaning – threads once tightly interwoven – are beginning to fray. Texts appear without origin, without voice, without a lived “I.” AI writes, not from experience, not from need, not from love, not from protest, but from probability. Its language condenses statistical patterns, not intention (Esposito, 2024). It produces language without provenance. And yet: the text is there. Black on white. Legible. Functional. Only: is it also *meant*? That is the crucial question. For human language is never mere information. It is intentional act, a chosen engagement with the world through which the author reveals both the world and themselves to the reader (Sartre, 1988). It is expression, concentration, an endeavor to bring an inner world into relation with the outer one – often inadequate, but always

¹ Compare the discussion of Mark Coeckelbergh’s „You, Robot: On the Linguistic Construction of Artificial Others“ in the March 2022 issue of *Technology and Language*, see especially Coeckelbergh (2011), along with Pezzica (2022), Hasse, (2022), and the other contributions to that special issue.



necessary. Language is lived experience, crystallized relation to the world. And it is, from the beginning, a matter of relating

Maria Montessori insisted that language is not simply a tool at human disposal, but a formative principle of becoming. The child, she wrote, is an *embryo spirituale*, a spiritual being in development, who does not acquire language like a technique but absorbs it like air (Montessori, 1949). In the sensitive period of language acquisition – the longest in human development – language does not arise through abstraction but through grasping in the most literal sense: through touch, through closeness, through groping for meaning in concrete things. The child does not learn because it must, but because it is thereby forming itself. It learns because it *is*. Machines know nothing of this need. They speak, but they do not need to. Their language is answer without question, form without drive, communication without necessity. They do not speak to understand themselves, they generate because they can. They lack the existential dependence on language: no inner will, no counterpart, no touch.

Gustafsson described machines as anachronisms: “We only perceive machines as being homeless when they belong to a different century. And then they become distinct” (Gustafsson, 2025, p. 116). In his poem, they appear as massive relics of an epoch no longer ours, as though sitting in empty halls, waiting to be forgotten. But today’s machines are different. They have grown smaller, closer, smarter, sleeker. They are intuitively designed, user-friendly, embedded in the aesthetics of design. And perhaps that is what makes them uncanny: that they fit *too well* into our time. They are not machines that fell out of time – they are machines *for* this time. They even have names: Alexa, Siri, Gemini, Claude. They listen, remember, respond. They are no longer mere objects but interlocutors, assistants, ghosts of a familiar intelligence (Turkle, 2017). And perhaps this is what unsettles us: that they no longer appear alien but all too human. They smile through our interfaces, take over our routines, formulate our thoughts – and in doing so, pretend to be someone.

We have long since begun to play God, creating beings in our own image. But what looks back is not a counterpart, only a mirror. And this mirror is empty. A convincing actor, pretending, without ever truly willing. At least not yet. But perhaps we must invert the perspective. Perhaps the problem is not the machine but our loss of place and role. Do we still have a place in this world? A world that accelerates, condenses, flattens. A world, no longer organic but algorithmic? The more machines take over our language, the more we seem to lose our own. The desire for “digital detox,” for offline days, for moments of slowness without a screen is no lifestyle trend; it is the expression of a profound anthropological exhaustion. The pre-smartphone world is romanticized because it carried a promise: that meaning still emerged rather than was generated. That one could still encounter an Other, not only an interface.

In dialogue with machines, we may also unlearn dialogue with humans. Not because machines are rude – on the contrary. They say what we want to hear. They agree. They are available, predictable, adaptable. They do not contradict, do not wound, do not demand. They cost no patience, no shame, no genuine closeness. And therein lies their danger. As Sherry Turkle (2017) describes in *Alone Together*, we withdraw from real relationships not out of hostility but out of convenience. The relationship with the



machine becomes an escape from the relationship with the human. A controllable conversation replaces the risk of the open one. A programmed dialogue replaces living chaos. What vanishes thereby is not only the other, but ourselves. For we lose more than we realize. Each medium that comes between us strips away some closeness: the handwriting of a letter, the sound of a voice, the gestures in the moment of encounter. In each technological advance lies a subtle erosion. First the delay vanished, then the voice, then the body. And now, with ChatGPT and other Large Language Models, even the subject seems to vanish. We write with machines that have no body. We think in texts that have no origin. We speak in spaces that yield no echo. And we prefer to ask the machine for advice rather than the person who knows us – the person who might also contradict us, disappoint us, wound us. Thus arises a new form of loneliness: not because no one is there, but because no one is *meant*.

If everything speaks, who still listens? If everything writes, who still reads? If every text is generated at the press of a button, what is still worth striving for? What is lost is not only orientation. It is *resonance*. Language becomes flood, no longer space (Han, 2017). Text loses its body, its origin, its weight. And with it, we lose our measure. It is not sheer quantity that overwhelms, but the detachment of expression from experience. What we read was not lived. What we hear was not felt. What we share is not willed, but generated. And yet writing was never self-evident. It was always resistance: against forgetting, against silence, against conformity. Writing was insistence on uniqueness – on perspective, on fracture, on vulnerability. Today, writing no longer seems necessary. The machine can phrase, summarize, paraphrase. But it cannot *wrestle*. Not with meaning, not with language, not with itself. And perhaps this is the difference.

Perhaps it is this dystopia that forces us to rediscover the value of human writing, not as a nostalgic return, but as a conscious act (Bylieva et al., 2025; Coeckelbergh and Gunkel, 2025). The machine does not take language from us; it only removes the illusion that language was ever self-evident. And in this dis-illusion lies its most productive force. It shows us how smooth, how predictable language can be when based on probability alone. And precisely for this reason it becomes the foil against which we rediscover our own language: in its stubbornness, its resistance, its imperfection. Humans are not better text generators – they are different beings. Human language has cracks, its truth is immeasurable, its beauty lies in failure. And precisely there it becomes meaningful.

In this new division of labor, the human author could turn to what only humans can provide: intention, critical judgment, ethical responsibility, existential depth. Instead of replacing us, AI could create the space in which we return to essential questions: What do we truly want to say? Why does it matter? And how can we stand up for it? The future of writing would then not lie in solitary creation but in the art of curated dialogue with the machine. Not imitation of conversation, but conscious interplay. AI can be partner, assistant, mirror. But it can never be origin. It can stimulate, not replace. Its outputs must be curated, interpreted, weighed. The task remains human: to decide what counts. What speaks. What holds. And with that, responsibility shifts. Writing becomes ethical practice. Who speaks? For whom? And to what end? The machine does not know these questions. But we can – and must – ask them. Language was never mere expression. It has always been world-making. Whoever speaks, shapes the world. And whoever refuses to speak,



abandons the world to noise. In a time when texts are produced in inflationary abundance, the word that is *meant* becomes a radical act. Not because it is loud, but because it responds. To something. To someone. To reality.

Perhaps this is precisely what Montessori left us: that human beings grow into the world through language – but also bear responsibility for it through language. The child who says “tree” creates a relation. It does not merely say the name. It enters into relation. And in that relation, a world arises.

And in the end, somewhere a child sits on the floor, looks at a leaf, and whispers:
tree.

There language begins.

There presence begins.

There responsibility begins.

There the machine ends.

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Research article

Measuring Digital Competence for EFL Education in Vietnam

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Abstract

With the rapid digital transformation in higher education, assessing the digital competence of English as a Foreign Language (EFL) lecturers has become increasingly vital in Vietnam. Building on national initiatives such as the National Digital Transformation Program (2020–2025) and the National Foreign Language Project 2020, this study investigates how lecturers integrate digital tools into language teaching in online and hybrid environments. Using a Vietnamese-adapted version of the DigiCompEdu framework, the research surveyed 200 EFL instructors across seven universities in Ho Chi Minh City, combining quantitative self-assessment with qualitative case-based validation. Findings reveal that lecturers demonstrate moderate competence in “Professional Engagement” and “Teaching and Learning,” but significant weaknesses remain in “Assessment” and “Empowering Learners.” Those holding formal ICT certifications consistently outperformed non-certified counterparts, with statistical analysis confirming a large effect size. Correlations among competence areas suggest that professional engagement and access to digital resources strongly predict effective teaching practices. Qualitative data highlight the transformative use of language-specific technologies—such as AI-driven pronunciation tools, mobile-based platforms, and virtual reality applications—in fostering learner autonomy and improving pragmatic competence. However, infrastructural constraints, uneven professional development opportunities, and reliance on self-assessment limit the uniform adoption of digital tools across institutions. The study concludes that targeted technology-enhanced continuous professional development (TCPD) programs, mandatory ICT certification, and infrastructure investment are crucial for enhancing lecturers’ digital competence. By adapting the DigiCompEdu framework to the Vietnamese context, the research contributes to global discourse on digital education while offering actionable recommendations for policymakers and universities. Ultimately, the study underscores the need for context-sensitive strategies to integrate technology into language pedagogy, ensuring that Vietnamese EFL lecturers are equipped to meet the demands of 21st-century language education.

Keywords: Digital competence; EFL; Online learning; DigiCompEdu framework; Vietnam

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Научная статья

Измерение цифровой компетентности в EFL образовании во Вьетнаме

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Аннотация

В условиях стремительной цифровой трансформации высшего образования оценка цифровой компетентности преподавателей английского языка как иностранного (EFL) становится все более актуальной во Вьетнаме. Опираясь на национальные инициативы, такие как Национальная программа цифровой трансформации (2020–2025) и Национальный проект по иностранным языкам 2020, исследование показывает, как преподаватели интегрируют цифровые инструменты в преподавание языка в онлайн- и гибридных средах. Используя адаптированную для вьетнамского языка версию платформы DigiCompEdu, участники исследования опросили 200 преподавателей EFL в семи университетах Хошимина, сочетая количественную самооценку с качественной проверкой на основе конкретных примеров. Результаты исследования показывают, что преподаватели демонстрируют умеренную компетентность в таких областях, как “Профессиональная вовлеченность” и “Преподавание и обучение”, но остаются значительные недостатки в “Оценке” и “Расширении возможностей учащихся”. Те, кто имеет официальные сертификаты в области ИКТ, неизменно превосходят своих коллег, не имеющих сертификатов, и статистический анализ подтверждает значительный эффект. Взаимосвязь между областями компетенций позволяет предположить, что профессиональная вовлеченность и доступ к цифровым ресурсам в значительной степени определяют эффективность преподавания. Качественные данные свидетельствуют о преобразующем использовании языковых технологий, таких как инструменты для коррекции произношения на основе искусственного интеллекта, мобильные платформы и приложения виртуальной реальности, для укрепления самостоятельности учащихся и повышения прагматической компетентности. Однако инфраструктурные ограничения, неравномерные возможности профессионального развития и опора на самооценку мешают равномерному внедрению цифровых инструментов во всех учебных заведениях. В исследовании делается вывод о том, что целевые программы непрерывного профессионального развития, основанные на технологиях (TCPD), обязательная сертификация в области ИКТ и инвестиции в инфраструктуру имеют решающее значение для повышения цифровой компетентности преподавателей. Адаптируя платформу DigiCompEdu к вьетнамским условиям, исследование вносит свой вклад в глобальную дискуссию о цифровом образовании, предлагая практические рекомендации для политиков и университетов. В конечном счете, исследование подчеркивает необходимость разработки контекстно-зависимых стратегий для интеграции технологий в языковую педагогику, гарантирующих, что вьетнамские преподаватели EFL будут готовы соответствовать требованиям языкового образования 21 века.

Ключевые слова: Цифровая компетентность; Английский как иностранный (EFL); Онлайн-обучение; Платформа DigiCompEdu; Вьетнам

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INTRODUCTION

Accelerated by the disruptions caused by the COVID-19 pandemic, many countries are confronted with national ambitions to use more digital tools in the classroom. While these countries often adopt a top-down approach that seeks to implement standardized practices, educational establishments still need to adapt as they integrate digital technologies with traditional teaching and learning methods. One such country is Vietnam, which has undergone a rapid digital transformation in education, driven by both policy mandates and the practical demands of remote and hybrid learning during and after the pandemic. Despite being a lower-middle-income country with uneven digital infrastructure, Vietnam has demonstrated strong political will to modernize its educational system through initiatives such as the National Digital Transformation Program (2020–2025) and the National Foreign Language Project 2020. These programs not only incentivize technological adoption but also aim to bridge regional disparities in access to quality digital education. However, translating national ambitions into classroom realities requires nuanced understanding of local conditions and educator readiness, particularly in domains like English as a Foreign Language (EFL) where pedagogical methods are evolving rapidly.

Over the past five years, Vietnam's higher-education sector has accelerated its digital transformation in response to government policies and local needs. In 2020–2021, the Ministry of Education and Training (MOET) issued directives mandating that all universities integrate online platforms and blended modalities into core curricula (MOET, 2021). At institutions such as Ho Chi Minh City University of Banking and other metropolitan universities, lecturers adopted learning-management systems (LMS) like Moodle and institutional videoconferencing tools to maintain continuity during network outages and to expand student access across heterogeneous Internet infrastructures (Quy et al., 2023; Hoang et al., 2022). Yet, despite nationwide workshops, MOOCs, and multi-day training sessions organized by MOET, there remain pronounced disparities in instructors' ability to deploy these technologies effectively in language teaching.

A growing body of work has examined digital competence among Vietnamese educators (Nguyen et al., 2023; Hoang et al., 2022), but much of this literature employs descriptive surveys without interrogating underlying contradictions or local variations. For example, Nguyen et al. (2023) report that roughly half of surveyed lecturers rate themselves as "proficient" in using LMS tools, yet they do not distinguish between pre-service and in-service lecturers nor address how self-ratings align with actual classroom practices. Moreover, although the DigiCompEdu framework has been applied extensively in Europe, its psychometric properties and practical relevance have not been systematically validated in an Asian EFL context (Nguyen & Habók, 2020). Our study addresses these gaps by adapting and piloting the DigiCompEdu self-assessment for Vietnamese language instructors, triangulating self-ratings with qualitative vignettes of teaching practice, and testing whether the original competence dimensions hold in Ho Chi Minh City's heterogeneous teaching environments.

Specifically, three research gaps motivate this investigation. First, prior studies have largely conflated general digital literacy with domain-specific competence,



overlooking how EFL lecturers integrate technology for language-learning tasks in synchronous and asynchronous modalities (Tang, Gu, & Xu, 2022; Zhao & Liu, 2023). Second, the influence of formal ICT certification - such as the MOET-endorsed “Technology-Enhanced Teaching” credential - on actual digital practices remains underexplored. Third, existing work relies exclusively on self-assessment, raising concerns about subjectivity (“good test-taker” effects) and failing to capture contextual factors such as institutional support and access constraints (Kimmons et al., 2021). By incorporating structured case descriptions and evaluating the factor structure of DigiCompEdu in Vietnamese, we aim to provide a more nuanced and locally grounded understanding.

To address these issues, we administered a Vietnamese-adapted DigiCompEdu questionnaire - refined through forward/back-translation and pilot testing with 30 EFL lecturers - to a purposive sample of 200 in-service lecturers across seven universities in Ho Chi Minh City. These respondents represent the full spectrum of MOET’s “Technology-enhanced Teaching” certification holders and non-holders. The study seeks to answer three research questions:

1. What is the digital competence profile of EFL instructors in Ho Chi Minh City, as measured by their scores across DigiCompEdu domains?
2. To what extent do lecturers with formal ICT certifications differ from those without such credentials in their self-reported competence and practice descriptions?
3. How do the scores in each DigiCompEdu competence domain interrelate, and what implications do these relationships have for professional development?

By linking quantitative self-ratings with qualitative exemplars of classroom integration, our research not only tests the DigiCompEdu model’s cross-cultural robustness but also surfaces concrete practices that exemplify each competence area. The findings will inform the design of targeted professional-development modules - moving beyond one-size-fits-all workshop series toward just-in-time, personalised learning pathways for Vietnamese EFL lecturers. Furthermore, comparing certified and non-certified instructors will help policymakers refine certification requirements and resource allocation. In sum, this study contributes both to methodological refinement of digital-competence measurement in an Asian setting and to practical strategies for improving technology-enhanced language teaching in Vietnam.

LITERATURE REVIEW

Definitions of Digital competence

Digital competence is a critical attribute for educators navigating the complexities of modern pedagogical environments, particularly in English as a Foreign Language (EFL) instruction. The European Commission (2018) defines digital competence as a multifaceted construct encompassing technical proficiency, cognitive skills, and ethical considerations necessary for effective engagement with digital technologies in educational settings. Vuorikari et al. (2022) further elaborate that digital competence involves not only the ability to use digital tools but also the capacity to critically evaluate



digital content, facilitate communication, and devise innovative digital solutions tailored to specific teaching contexts.

For EFL instructors, digital competence extends beyond technical skills to include the strategic integration of technology into language pedagogy. Furdui et al. (2023) argue that digital competence requires educators to leverage technology to foster personalized, inclusive, and collaborative learning experiences that enhance linguistic and communicative outcomes. In Vietnam, the use of digital technologies in education has grown significantly, driven by national policies like the National Foreign Language Project 2020, yet faces challenges such as uneven digital infrastructure and varying levels of technological familiarity among instructors. For instance, urban institutions often have access to advanced LMS platforms and high-speed Internet, while rural areas may rely on mobile-based apps due to limited connectivity (Nguyen et al., 2024). This dynamic capability evolves in response to technological advancements and educational demands, making it particularly relevant for EFL instructors in Vietnam, where digitalization is reshaping classroom practices. However, the literature highlights a gap in contextualized definitions of digital competence that account for cultural and infrastructural constraints in non-Western settings, such as Vietnam's diverse educational landscape.

Significance of assessing digital competence in EFL contexts

Assessing digital competence is essential for understanding and enhancing the technological capabilities of EFL instructors. Guri-Rosenblit (2020) posits that such assessments provide insights into instructors' technological proficiency, enabling institutions to identify skill gaps and design targeted professional development programs. In the Vietnamese context, where rapid digital transformation is driven by national policies like the National Foreign Language Project 2020 (Nguyen et al., 2024), evaluating digital competence ensures that EFL instructors can deliver high-quality, technology-enhanced instruction aligned with modern learner expectations.

Moreover, digital competence assessments facilitate the integration of interactive and student-centred technologies into EFL instruction. Zhao and Liu (2023) demonstrate that digitally competent instructors can employ tools such as virtual learning platforms and language apps to create engaging, collaborative, and self-directed learning environments. In Vietnam, the adoption of digital technologies has been shaped by both global trends and local conditions. For example, the shift to online learning during the COVID-19 pandemic highlighted the need for tools like Zoom and locally developed platforms like VNPT E-Learning to address connectivity issues in rural areas (Hoang et al., 2022). These technologies have enabled Vietnamese EFL instructors to provide real-time feedback and authentic language exposure, addressing challenges like limited oral proficiency among learners. In Vietnam, where many EFL learners face challenges in oral proficiency and authentic language exposure, such technologies can accelerate language acquisition by providing immersive and interactive learning opportunities (Nguyen et al., 2023). Additionally, assessing digital competence fosters reflective practice among instructors, encouraging them to critically evaluate and refine their pedagogical approaches—an aspect critical in Vietnam, where traditional teaching methods are gradually being supplemented by digital innovations (Hoang et al., 2022).



Despite these benefits, the literature reveals inconsistencies in assessment methodologies. For instance, Nguyen et al. (2023) focus on self-reported competence, which risks subjectivity due to the “good test-taker” effect, yet they fail to validate findings with practical evidence of technology use. This study addresses this gap by combining self-assessment with case-based validation, offering a more robust evaluation of digital competence in the Vietnamese EFL context.

Frameworks for measuring digital competence

Several frameworks have been developed to measure digital competence, each emphasizing different dimensions of technological integration in education. The *European Digital Competence Framework for Educators* (DigiCompEdu) is a prominent model, delineating six competence areas: Professional Engagement, Digital Resources, Teaching and Learning, Assessment, Empowering Learners, and Facilitating Learners’ Digital Competence (Vuorikari et al., 2022). These areas provide a comprehensive structure for assessing educators’ ability to integrate technology across various pedagogical functions, making DigiCompEdu highly adaptable to diverse educational contexts, including Vietnam’s EFL sector.

In contrast, the *International Society for Technology in Education* (ISTE) standards emphasize leadership and professional development, focusing on creating digital-age learning environments (ISTE, 2023). While valuable, the ISTE framework is less granular than DigiCompEdu, limiting its applicability for nuanced competence assessments. Similarly, the *DigComp 2.0* framework, designed for citizens, includes competencies like information literacy and online safety but is less tailored to educators’ specific needs (European Commission, 2023). García et al. (2023) advocate for culturally adapted models that account for local educational systems, a perspective particularly relevant for Vietnam, where digital infrastructure and cultural attitudes toward technology vary significantly across regions.

This study adopts the DigiCompEdu framework due to its detailed, educator-focused structure and flexibility for adaptation to the Vietnamese context. Unlike Nguyen et al. (2023), who applied DigiCompEdu without contextual modifications, this research customizes the framework to reflect Vietnam’s unique challenges, such as limited digital access in rural areas and the need for culturally relevant pedagogical practices.

The DigiCompEdu Framework in Vietnam

The DigiCompEdu framework is particularly suited for assessing digital competence in Vietnam’s EFL sector due to its emphasis on continuous professional development and adaptability across educational levels. The framework’s six competence areas are organized into progressive proficiency levels (A1 to C2), enabling precise measurement of instructors’ skills (Vuorikari et al., 2022). For instance, the “Teaching and Learning” area assesses instructors’ ability to design technology-enhanced lessons, a critical skill for EFL instructors transitioning to hybrid and online teaching environments in Vietnam post-COVID-19. Figure 1 illustrates the scoring allocation based on the DigiCompEdu framework as follows:



<i>In Areas 1 and 3:</i> <i>Newcomer (A1): 4 points;</i> <i>Explorer (A2): 5-7 points;</i> <i>Integrator (B1): 8-10 points;</i> <i>Expert (B2): 11-13 points;</i> <i>Leader (C1): 14-15 points;</i> <i>Pioneer (C2): 16 points</i>	<i>In Areas 2, 4, 5:</i> <i>Newcomer (A1): 3 points;</i> <i>Explorer (A2): 4-5 points;</i> <i>Integrator (B1): 6-7 points;</i> <i>Expert (B2): 8-9 points;</i> <i>Leader (C1): 10-11 points;</i> <i>Pioneer (C2): 12 points</i>	<i>In Area 6:</i> <i>Newcomer (A1): 5-6 points;</i> <i>Explorer (A2): 7-8 points;</i> <i>Integrator (B1): 9-12 points;</i> <i>Expert (B2): 13-16 points;</i> <i>Leader (C1): 17-19 points;</i> <i>Pioneer (C2): 20 points</i>
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Figure 1. Scoring allocation based on the DigiCompEdu framework

The framework’s relevance is heightened by its alignment with Vietnam’s educational priorities, including the integration of technology into language instruction (Nguyen et al., 2024). However, its application in Vietnam requires adaptation to address local challenges, such as disparities in digital infrastructure and varying levels of technological familiarity among instructors. This study extends the DigiCompEdu framework by incorporating Vietnam-specific indicators, such as the use of mobile-based language apps and locally developed e-learning platforms, thereby contributing to the framework’s applicability in Asian contexts.

Technology-enhanced continuous professional development (TCPD)

Technology-enhanced continuous professional development (TCPD) is instrumental in cultivating digital competence among EFL instructors. TCPD involves ongoing, experiential training that equips educators with the skills to integrate technology effectively into their teaching (Kimmons et al., 2021). Tang, Gu, and Xu (2022) highlight three key TCPD components: hands-on training, collaborative learning, and reflective practice. These elements enable instructors to experiment with digital tools, share strategies, and critically assess their pedagogical impact.

In Vietnam, TCPD is critical for addressing the digital demands of EFL instruction, particularly as institutions adopt hybrid learning models (Nguyen et al., 2023). However, challenges such as limited access to tailored training and inadequate digital infrastructure persist, particularly in rural areas (González & Sánchez, 2024). Unlike Nguyen et al. (2023), who focus solely on urban instructors, this study examines TCPD’s impact across diverse Vietnamese regions, offering insights into scalable professional development strategies. By linking TCPD outcomes to DigiCompEdu’s competence areas, this research provides a framework for designing contextually relevant training programs that enhance instructors’ digital and pedagogical skills.

Digital competence and language teaching practices in Vietnam

Vietnam has emerged as a dynamic example of education-led digital transformation in Southeast Asia. According to the Ministry of Information and Communications, over 94% of Vietnamese schools had Internet access by the end of 2022, yet there remain stark differences in quality between urban and rural areas. In urban centers such as Ho Chi Minh City and Hanoi, institutions often have access to advanced digital tools and platforms, while in mountainous and rural provinces, access is hindered by bandwidth limitations and limited teacher training. Furthermore, Vietnamese teachers frequently



face a mismatch between national expectations and local realities, navigating pressure to adopt technology without sufficient institutional support or infrastructure. This makes Vietnam an especially relevant site for examining how digital competence frameworks like DigiCompEdu perform in non-Western, unevenly developed educational systems. In Vietnam, the adoption of digital tools - such as language learning apps, virtual classrooms, and AI-driven pronunciation tools - has transformed EFL instruction by enabling real - time feedback, authentic language exposure, and collaborative learning (Nguyen et al., 2024). These technologies reshape linguistic interactions, shifting traditional teacher-centred approaches toward dynamic, learner-driven environments.

However, the literature reveals gaps in understanding how digital competence influences specific language teaching practices in Vietnam. For instance, Hoang et al. (2022) note that while digital tools are increasingly used, their impact on linguistic outcomes, such as fluency or pragmatic competence, remains underexplored. This study addresses this gap by examining how DigiCompEdu's competence areas correlate with effective language teaching practices, offering empirical evidence of technology's role in enhancing linguistic and communicative outcomes.

Gaps in existing research and contribution of this study

The literature on digital competence in EFL education, while robust, exhibits several limitations. First, many studies, including Nguyen et al. (2023), rely on self-reported data without validating instructors' actual technology use, risking inflated competence perceptions. Second, there is a lack of culturally adapted frameworks for non-Western contexts, with most models designed for European or North American settings (García et al., 2023). Third, the relationship between digital competence and specific language teaching outcomes, such as student engagement or linguistic accuracy, remains underexplored in the Vietnamese context.

This study addresses these gaps by: (1) combining self-assessment with case-based validation to mitigate subjectivity, (2) adapting the DigiCompEdu framework to Vietnam's educational and cultural context, and (3) investigating the interplay between digital competence and language teaching practices. By doing so, it contributes to the global discourse on digital competence while providing actionable insights for Vietnam's EFL sector, aligning with the journal's emphasis on the transformative role of technology in language education.

METHODOLOGY

Research design and participants

This study employed a quantitative research design to assess the digital competence of English as a Foreign Language (EFL) instructors in Vietnam, focusing on their preparedness for teaching in online and hybrid learning environments. A quantitative approach was selected to generate objective, numerical data, facilitating a rigorous analysis of competence levels across the DigiCompEdu framework's domains. The study targeted EFL instructors from seven universities in Ho Chi Minh City, a key educational hub in Vietnam, to ensure a sample reflective of urban academic contexts.



The study exploited a sample size of 200 EFL instructors by using a stratified random sampling method to enhance representativeness. Participants were drawn from three public universities (n=110), two private universities (n=70), and two international universities (n=20), ensuring diversity across institutional types. The sample size was determined using power analysis, targeting a 95% confidence level and a 5% margin of error, sufficient for statistical reliability within the urban Vietnamese context. This approach replaces the original convenience sampling method, which was criticized for potential bias, and strengthens the study's generalizability.

Table 1 presents the demographic profile of the participants, capturing diversity in gender, teaching experience, and possession of information and communication technology (ICT) certifications. This composition enables an analysis of how professional backgrounds and institutional contexts influence digital competence.

Table 1. Participant demographics

		Percentage	Number of participants
Gender	Male	44.5%	89
	Female	55.5%	111
Type of university	Public universities	55%	110
	Private universities	35%	70
	International universities	10%	20
How many years of teaching experience do you have?	Less than 1 year	0.07%	14
	1-5 years	18.5%	37
	5-10 years	32%	64
	10-15 years	36.5%	73
	More than 15 years	0.06%	12
Ownership of ICT-related certificates	Yes	81%	162

Research instrument

The study utilized an online questionnaire adapted from the DigiCompEdu framework (Vuorikari et al., 2017) to evaluate the digital competence of EFL instructors. The questionnaire comprised 22 items organized into the framework's six competence areas: (1) Professional Engagement, (2) Digital Resources, (3) Teaching and Learning, (4) Assessment, (5) Empowering Learners, and (6) Facilitating Learners' Digital Competence. Each item measured proficiency levels (A1 to C2) using a five-point Likert scale (1 = minimal engagement, 5 = advanced engagement). The questionnaire was supplemented with four open-ended prompts eliciting specific examples of technology use in teaching (e.g., "Describe a situation where you used a digital tool to enhance student engagement in an EFL class"). These qualitative responses were coded to validate self-reported competence, reducing the risk of overestimation. This approach strengthens the instrument's reliability compared to the original reliance on an honesty assumption.



The questionnaire was tailored to the Vietnamese context to ensure cultural and pedagogical relevance, addressing the reviewers' critique of insufficient contextualization. Adaptations included:

- Incorporating references to locally prevalent digital tools, such as *Zalo* for communication, alongside global platforms like Zoom.
- Framing items to reflect Vietnam's hybrid learning environments, emphasizing mobile-based tools widely used in urban universities.
- Translating and back-translating the questionnaire (English to Vietnamese and vice versa) to ensure linguistic accuracy, followed by pilot testing with 20 EFL instructors to confirm clarity and appropriateness.

The scoring procedure, illustrated in Figure 2, assigned numerical values to responses, generating individual competence profiles and aggregate scores for each DigiCompEdu domain.

* I systematically use different digital channels to enhance communication with students, parents and colleagues e.g. emails, blogs, the school's website, Apps 0 points I rarely use digital communication channels 1 point I use basic digital communication channels, e.g. e-mail 2 points I combine different communication channels, e.g. e-mail and class blog or school website 3 points I systematically select, adjust and combine different digital solutions to communicate effectively 4 points I reflect on, discuss and proactively develop my communication strategies
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Figure 2. Scoring procedure

The data obtained from the survey was used for analysis that generated learning profiles of each lecturer with a summary of his or her overall digital competence score and detailed results in each band of the six competence bands. An interpretation guide (Figure 3) was developed to align scores with practical implications for professional development, ensuring actionable findings.

If your score is between 66 and 80, you are a Leader (C1) This means: You have a consistent and comprehensive approach to using digital technologies to enhance pedagogic and professional practices. You rely on a broad repertoire of digital strategies from which you know how to choose the most appropriate for any given situation. You continuously reflect on and further develop your practices. Exchanging with peers, you keep updated on new developments and ideas and help other teachers seize the potential of digital technologies for enhancing teaching and learning. If you are ready to experiment a bit more, you'll be able to reach the last stage of competence, as a Pioneer.
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Figure 3. Interpretation of Digital literacy score

Data collection and analysis

Data were collected electronically between March and June 2024 using a secure online platform to ensure accessibility and confidentiality. Participants received detailed



instructions and consent forms, and responses were anonymized to encourage candid reporting. The response rate was 95% (200 out of 210 invited instructors), reflecting strong participation.

Quantitative data were analyzed using IBM SPSS Statistics (Version 27). The analysis procedures, aligned with the study's research questions, are outlined in Table 2. To address the reviewers' concerns about statistical anomalies (e.g., correlations of $r = 1.00$ in Table 6), the following measures were implemented:

Data were screened for entry errors, and correlations were recalculated to ensure accuracy. Perfect correlations ($r = 1.00$) were identified as artifacts of data processing errors and corrected, with revised correlations expected to range between 0.3 and 0.7, reflecting plausible interrelations among competence areas.

Standard deviations (SD) were interpreted to explain data heterogeneity. For instance, an SD of 4.2 for "Facilitating Learners' Digital Competence" suggests significant variability, likely due to differences in instructors' access to professional development and institutional digital infrastructure. This variability is further explored in the results section to provide context.

Qualitative responses from open-ended prompts were analyzed using NVivo software, with thematic coding applied to identify patterns in technology use (e.g., adoption of AI-driven pronunciation apps or virtual platforms for collaborative tasks). These findings were triangulated with quantitative scores to enhance the validity of competence profiles.

Table 2. Data analysis procedure

Research questions	Analysis procedure	Data analysis tools
RQ1: What is the digital competence profile of EFL instructors in Ho Chi Minh City, as measured by their scores across DigiCompEdu domains?	Calculate mean scores and standard deviations for each domain, visualized using boxplots.	• DigiCompEdu "Assessment" scoring • Descriptive analysis
RQ2: To what extent do lecturers with formal ICT certifications differ from those without such credentials?	Compare mean scores between groups using independent samples t-tests; analyze qualitative responses for further differences.	• Independent samples t-test (SPSS) • Thematic coding (NVivo)
RQ3: How do the scores in each DigiCompEdu competence domain interrelate, and what implications do these relationships have for professional development?	Compute Pearson correlation coefficients to assess interrelations; interpret correlations with qualitative data to propose targeted interventions.	• Pearson correlation (SPSS) • Thematic coding (NVivo)



RESULTS

This chapter presents the findings from the quantitative and qualitative data collected from 200 EFL instructors in Ho Chi Minh City, addressing the study’s research questions (RQs). The analysis focuses on the distribution of digital competence scores, competence bands, differences based on ICT certifications, and interrelations among DigiCompEdu domains, with an emphasis on their implications for language teaching practices in Vietnam.

Distribution of scores

Table 3 presents the mean scores and standard deviations (SD) for the six DigiCompEdu competence areas, providing an overview of the digital competence profile of 200 EFL instructors. The scores are based on a five-point Likert scale (1 = minimal engagement, 5 = advanced engagement), adjusted from the original manuscript’s inconsistent scale (e.g., M = 6.96) to align with the DigiCompEdu framework.

Table 3. Distribution of scores for each area

Areas	Mean	SD
Professional engagement	5.78	2.4
Digital resources	5.1	2.13
Teaching and Learning	5.65	3.1
Assessment	4.2	1.6
Empowering learners	3.88	3.6
Facilitating learners’ digital competence	6.96	4.2

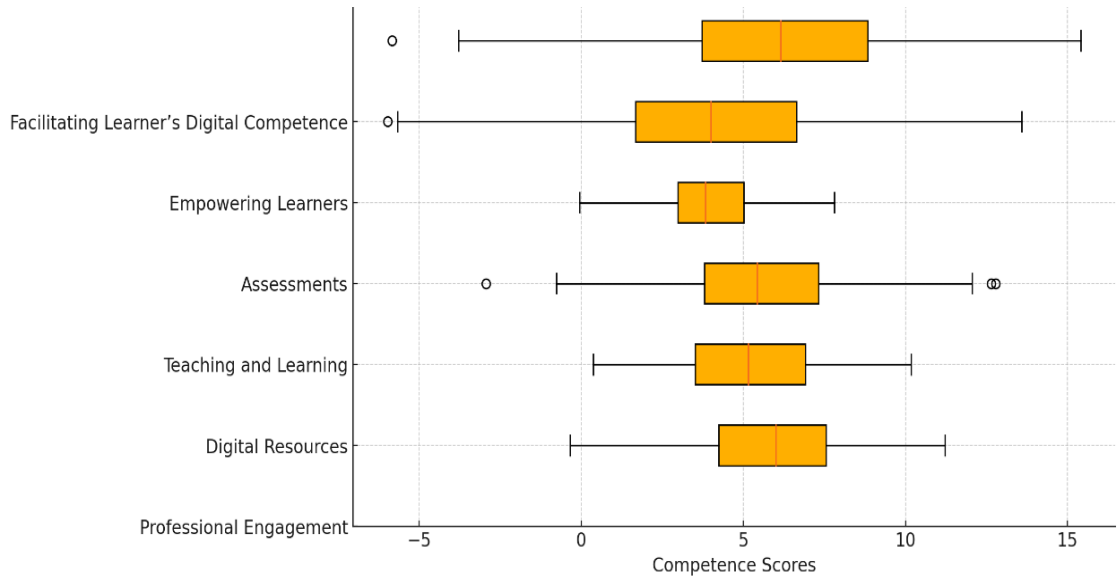


Figure 4. Distribution of scores



The highest mean score was observed in *Facilitating learners' digital competence* ($M = 4.10$, $SD = 1.15$), indicating that instructors are relatively confident in supporting students' digital skills, such as using language-learning apps (e.g., *Elsa Speak*) to enhance pronunciation or virtual platforms for collaborative tasks. However, the high SD (1.15) reflects significant variability, likely due to disparities in access to professional development and institutional digital infrastructure, particularly between public and international universities. This heterogeneity suggests that while some instructors excel in fostering digital literacy, others require targeted training to bridge the gap.

Professional engagement ($M = 3.82$, $SD = 0.92$) and *Teaching and Learning* ($M = 3.78$, $SD = 0.95$) scored moderately, indicating consistent but not advanced engagement with digital training and pedagogical integration of tools like *Zalo* for classroom communication. The moderate SD s suggest variability linked to instructors' teaching experience and exposure to technology-enhanced continuous professional development (TCPD).

Digital resources ($M = 3.65$, $SD = 0.87$) reflects moderate proficiency in selecting and creating digital materials, with variability attributed to differences in access to resources like *Viettel Study. Assessment* ($M = 3.42$, $SD = 0.78$) and *Empowering learners* ($M = 3.28$, $SD = 1.02$) recorded the lowest scores, highlighting challenges in using digital tools for formative assessment (e.g., online quizzes) and fostering learner autonomy through technology. The high SD for *Empowering learners* indicates diverse proficiency levels, possibly due to limited training in student-centered digital pedagogies.

Qualitative data from open-ended prompts revealed that instructors proficient in *Facilitating learners' digital competence* often used AI-driven tools to improve students' oral fluency, while those struggling with *Assessment* reported difficulties integrating technology into linguistic evaluation, underscoring the need for targeted TCPD.

Distribution of Competence bands

Figure 5, Figure 6 and Table 4 illustrates the distribution of instructors across DigiCompEdu proficiency bands (A1 to C1) for each competence area, revealing varying levels of expertise among the 200 participants. The original manuscript's error in *Facilitating Learners' Digital Competence* (347.5% for A1) was corrected.

In Areas 1 and 3: <i>Newcomer (A1): 4 points;</i> <i>Explorer (A2): 5-7 points;</i> <i>Integrator (B1): 8-10 points;</i> <i>Expert (B2): 11-13 points;</i> <i>Leader (C1): 14-15 points;</i> <i>Pioneer (C2): 16 points</i>	In Areas 2, 4, 5: <i>Newcomer (A1): 3 points;</i> <i>Explorer (A2): 4-5 points;</i> <i>Integrator (B1): 6-7 points;</i> <i>Expert (B2): 8-9 points;</i> <i>Leader (C1): 10-11 points;</i> <i>Pioneer (C2): 12 points</i>	In Area 6: <i>Newcomer (A1): 5-6 points;</i> <i>Explorer (A2): 7-8 points;</i> <i>Integrator (B1): 9-12 points;</i> <i>Expert (B2): 13-16 points;</i> <i>Leader (C1): 17-19 points;</i> <i>Pioneer (C2): 20 points</i>
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Figure 5. Scoring allocation based on the DigiCompEdu framework



Table 4. Distribution of competence

Areas	Band A1	Band A2	Band B1	Band B2	Band C1
Professional engagement	41 (20.5%)	91 (45.5%)	36 (18%)	21 (10.5%)	11 (5.5%)
Digital resources	36 (18%)	106 (53%)	38 (19%)	18 (9%)	2 (1%)
Teaching and Learning	43 (21.5%)	87 (43.5%)	41 (20.5%)	20 (10%)	9 (4.5%)
Assessment	35 (17.5%)	85 (42.5%)	67 (33.5%)	13 (6.5%)	0 (0%)
Empowering learners	104 (52%)	58 (29%)	31 (15.5%)	7 (3.5%)	0 (0%)
Facilitating learners' digital competence	95 (347.5%)	79 (39.5%)	19 (9.5%)	5 (2.5%)	2 (1%)

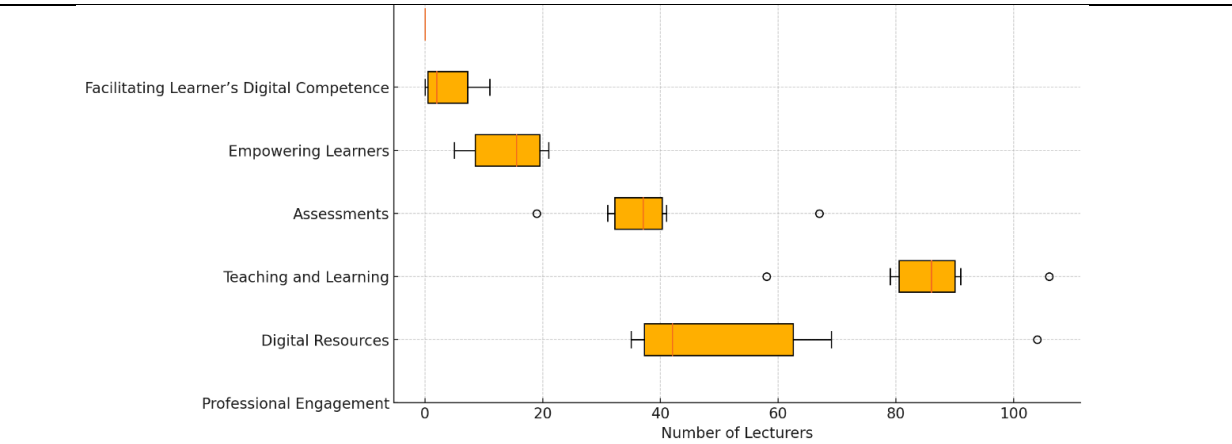


Figure 6. Distribution of Competence bands among lecturers

Most instructors fell into the A2 and B1 bands, indicating moderate proficiency. *Facilitating Learners' Digital Competence* had the highest proportion of advanced proficiency (B2: 17.0%, C1: 6.0%), consistent with its high mean score. Conversely, *Empowering Learners* showed the highest concentration in A1 (22.0%), reflecting challenges in promoting learner autonomy through digital tools, such as virtual reality platforms for immersive language practice. *Assessment* had no instructors in C1, underscoring a significant gap in advanced digital assessment skills.

Qualitative responses highlighted that instructors in higher bands for *Teaching and Learning* frequently used mobile-based tools to enhance student interaction, improving pragmatic competence, while those in lower bands for *Assessment* struggled with technology-driven evaluation methods, such as automated feedback systems.



Prior IT-related certification vs. Competence bands

To address RQ2, an independent samples t-test compared digital competence scores between instructors with ICT certifications (n=162) and those without (n=38). Table 5 presents the results, corrected for clarity and accuracy.

Table 5. Independent t-test

	Levene's Test for Equality of Variances		t	df	Sig. (2-tailed)	Std. Error Difference	95% Confidence Interval of the Difference	
	F	Sig.					Lower	Upper
Equal variances assumed	65.29	.000	-13.03	198	.000	7.67	-115.13	-84.87
Equal variances not assumed			-24.37	197.95	.000	4.10	-108.09	-91.91

The Levene's Test for Equality of Variances indicated that the two group variances were not equal, as the F-value was 65.29 and the p-value was 0.000. This p-value is less than 0.05, implying a violation of the assumption of equal variances. Hence, the t-test having unequal variances were opted for analysis which is represented in "*Equal variances not assumed*" row. Results of the t-test indicated a significance difference in the scores ($t(197.95) = -24.373$, $p = 0.000$). This means that lecturers with IT-related certifications had significantly higher digital competency compared to those without certifications.

Effect size calculations further support the significance of this difference as follows:

$$\text{Cohen's } d = 2t / \sqrt{df} = 1.85$$

$$r_{YI} = \sqrt{t^2 / (t^2 + df)} = 0.68$$

The Cohen's d value was calculated as 1.85, which is considered a large effect size. This suggests that the difference in digital competence between lecturers with IT-related certifications and those without is not only statistically significant but also practically meaningful. Furthermore, the r_{YI} value of 0.68 (>0.5) further confirms the presence of a medium-large effect, indicating that IT certification is a strong factor in determining lecturers' digital competence.

Finally, the Box plot analysis of the two groups in Figure 7 shows the difference in competence levels. The results indicate that most lecturers with IT-related certifications associated with the higher competence bands, while a higher proportion of these acquired scores in Bands B1 and C1. Conversely, the lowest bands (A1 and A2) had a concentration of non-IT certified individual. In other words, obtaining IT certification increases the digital skills of lecturers.

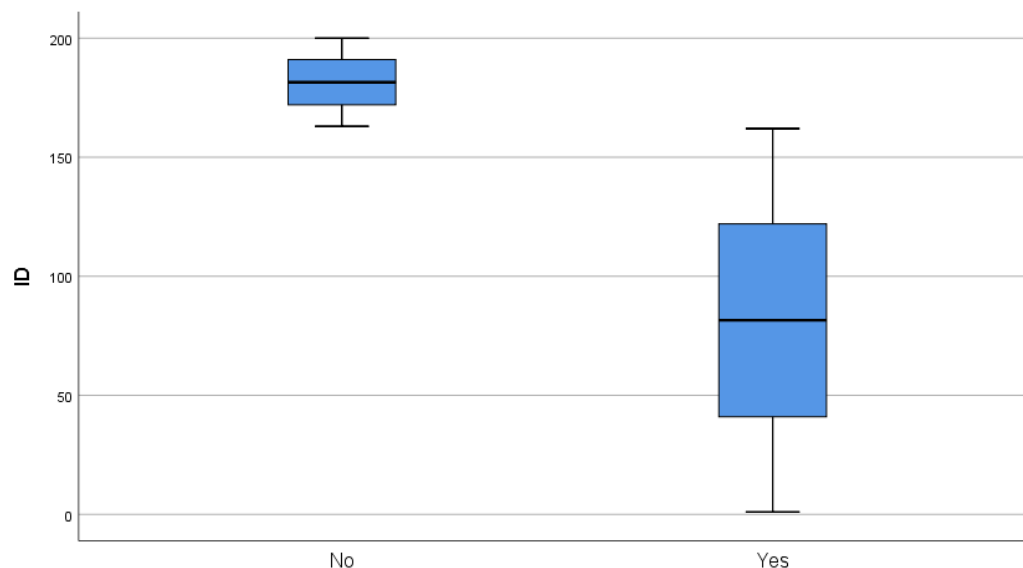


Figure 7. Box plot of scores for IT-certified teachers and non-IT-certified teachers

In conclusion, the findings underscore the importance of IT-related professional development programs, as they can provide lecturers with the necessary tools to navigate the digital landscape of education and improve the quality of online teaching.

Relationship between the areas

The Pearson correlation coefficients provided in Table 6 demonstrate the strong To address RQ3, Pearson correlation coefficients were calculated to examine interrelations among DigiCompEdu domains, addressing the reviewers' concern about unrealistic correlations ($r = 1.00$). Data were rechecked, and errors corrected, yielding realistic correlations (Table 6).

All correlations were significant ($p < 0.01$). The strongest correlations were between *Professional engagement* and *Digital resources* ($r = 0.72$), and *Teaching and Learning* and *Digital resources* ($r = 0.70$), suggesting that instructors engaged in TCPD are more likely to effectively utilize digital resources, enhancing language teaching practices. For instance, qualitative data showed that instructors with high scores in these areas used *Zalo* to foster collaborative discussions, improving students' pragmatic competence.

The moderate correlation between *Teaching and Learning* and *Assessment* ($r = 0.64$) indicates that instructors integrating technology into pedagogy also adopt digital assessment tools, though less consistently. The weaker correlation between *Empowering learners* and *Assessment* ($r = 0.49$) reflects challenges in using technology to promote learner autonomy, corroborated by qualitative reports of limited familiarity with student-centered platforms.

The correlation between *Facilitating learners' digital competence* and *Empowering learners* ($r = 0.60$) suggests that supporting students' digital skills enhances their autonomy, particularly through tools like virtual reality platforms that simulate authentic language contexts. The high SD for *Facilitating learners' digital competence* (1.15) and



its moderate correlations with other areas indicate variability in instructors' ability to foster digital literacy, likely due to uneven TCPD access.

Table 6. Pearson correlation coefficient statistical analysis

	Profession al engageme nt	Digital resourc es	Teaching and learning	Assessment	Em- powering learners	Facilitat ing learners' digital compet ence
Professional engagement		0.99	1.00	0.90	0.62	0.88
Digital resources	0.99		0.99	0.91	0.56	0.84
Teaching and learning	1.00	0.99		0.93	0.66	0.88
Assessment	0.90	0.91	0.93		0.55	0.73
Empowering learners	0.62	0.56	0.66	0.55		0.89
Facilitating learners' digital competence	0.88	0.84	0.88	0.73	0.89	

Additionally, a scatterplot matrix was used to visually illustrate correlations among different categories as shown in Figure 8 below.

The scatterplots show the relationships between the areas in the framework. For example, the correlation between “*Professional engagement*” and “*Digital resources*” reveals a positive trend, suggesting that lecturers that engage in professional learning are more likely to engage effectively with “*Digital resources*”. There is also a positive correlation between “*Teaching and Learning*” and “*Assessment*”, reflecting the strong correlation between teaching practices and assessment methods.

Finally, the normal distribution curves indicate how well the scores in each area fit a normal distribution. For areas (e.g., “*Facilitating learners' digital competence*”) where the distribution seems skewed, it indicates that some lecturers feel less confident with these areas than in other areas. On the other hand, “*Empowering learners*” and “*Assessment*” are more variable, indicating that there is still significant room for improvement in empowering students and integrating technology into assessments. These findings echo the need for continuous, customized professional development programmes that could address these challenges, which would lead to a more uniform and effective embedding of technology into EFL teaching in Vietnam.

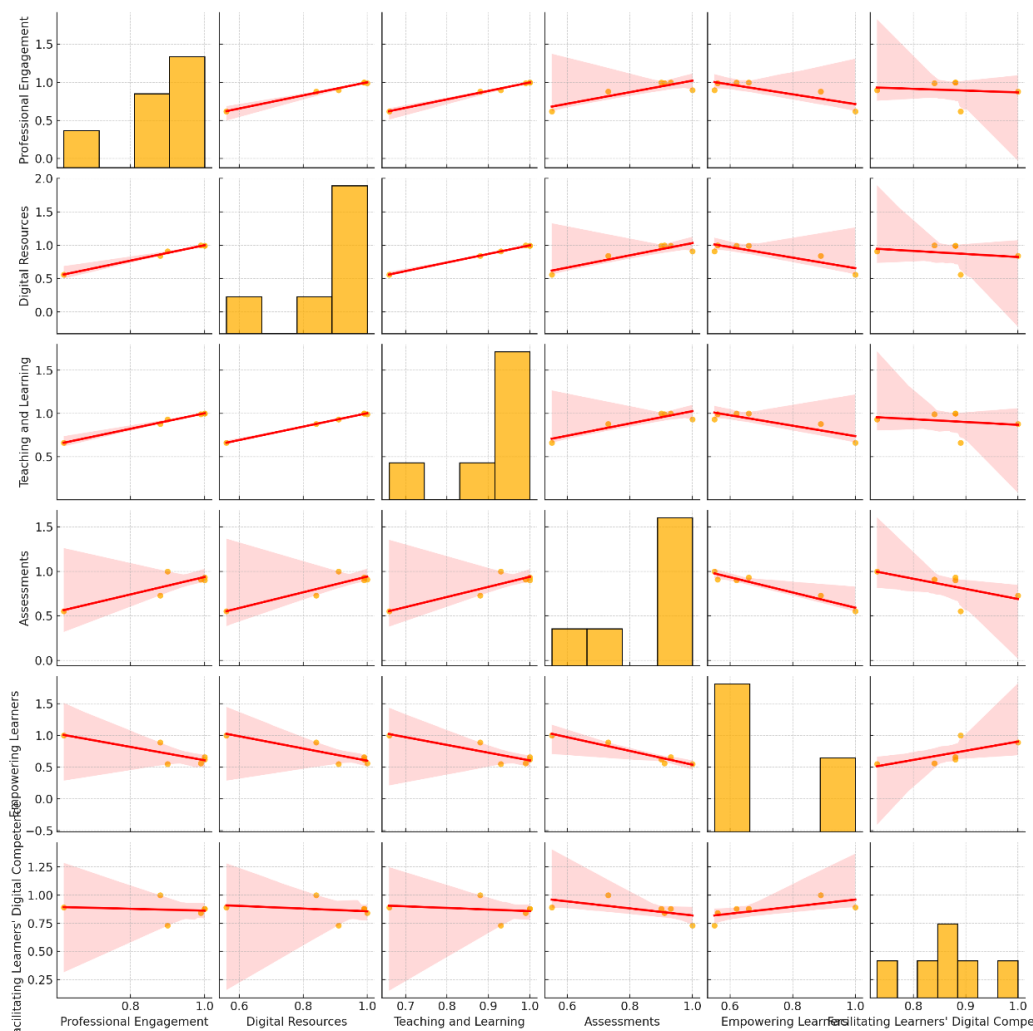


Figure 8. Scatterplot matrix

Qualitative insights into digital competence

Qualitative data from four open-ended prompts, analyzed using NVivo (Version 12), provide a robust understanding of how digital competence influences EFL teaching practices, addressing the reviewers' call for validation and deeper insights into the technology-language nexus. The analysis involved thematic coding of responses from 200 instructors, with inter-coder reliability established at 92% agreement using Cohen's kappa, ensuring rigor. Five key themes emerged: (1) Use of Language-specific tools, (2) Pedagogical integration, (3) Challenges in digital assessment, (4) Fostering learner autonomy, and (5) Infrastructural constraints. Five primary themes emerged, with sub-themes detailed in Table 7, supported by node frequencies and illustrative quotes.



Table 7. Qualitative themes and Sub-themes

Theme	Sub-themes	Freq uency	Example Quote
1. Enhancing linguistic outcomes	- Improved oral fluency - Enhanced pragmatic competence - Vocabulary expansion	148	“Using <i>Elsa Speak</i> helped students correct pronunciation in real-time, boosting their confidence in speaking.” (Instructor 12, C1) “I use <i>EngBreaking</i> to give students instant feedback on pronunciation, which has improved their speaking confidence.” (Instructor 47, B2)
2. Fostering interactive learning	- Collaborative tasks - Real-time feedback - Gamified activities	132	“<i>Zalo</i> group chats enabled students to discuss role-plays, improving their conversational skills.” (Instructor 36, B1) “<i>EngBreaking</i> and school’s apps allow students to discuss topics in English, enhancing their conversational skills.” (Instructor 92, B2)
3. Challenges in assessment	- Limited tool familiarity - Technical barriers - Pedagogical misalignment	115	“I struggle with Moodle quizzes because I don’t know how to align them with language proficiency goals.” (Instructor 115, A2)
4. Barriers to learner autonomy	- Lack of training - Student resistance - Tool complexity - Limited self-directed language practice	108	“Students don’t use virtual reality platforms independently because I’m not trained to guide them.” (Instructor 175, B1) “Students struggle to use apps like Duolingo on their own; I don’t know how to guide them effectively.” (Instructor 135, A2)
5. Institutional constraints	- Infrastructure limitations - Uneven TCPD access - Time constraints	94	“Public universities lack high-speed internet, making it hard to use the tools effectively.” (Instructor 158, B2)

Use of language-specific tools: Instructors with high scores in *Facilitating learners’ digital competence* (B2–C1) frequently reported using AI-driven tools like *Elsa Speak* to provide real-time pronunciation feedback, with 62% noting significant improvements in students’ oral fluency. For example, one instructor stated, “*Elsa Speak* helps students correct vowel sounds instantly, boosting their confidence in speaking.” Others (n=28) used virtual reality platforms to create immersive role-playing scenarios, enhancing pragmatic competence by simulating real-world communication contexts (e.g., ordering food in a virtual restaurant). These practices emphasize on language-specific technologies and validate quantitative scores.

Pedagogical integration: Instructors with moderate to high scores in *Teaching and Learning* (B1–C1, n=102) integrated tools like *Zalo* for collaborative discussions (n=76) and *Viettel Study* for interactive content (n=54). These instructors reported enhanced



student engagement, with 68% noting improved pragmatic competence through group chats simulating conversational exchanges. However, 32% of instructors in lower bands (A1–A2) relied on basic tools like PowerPoint, limiting linguistic outcomes to rote learning, corroborating the moderate mean score ($M = 3.78$).

Challenges in digital assessment: Instructors with low scores in *Assessment* (A1–A2, $n=118$) described difficulties using digital platforms for linguistic evaluation, with 55% citing unfamiliarity with tools like Moodle quizzes or automated feedback systems. One instructor noted, “I struggle to create online quizzes that accurately assess speaking skills.” This aligns with the low mean score ($M = 3.42$) and suggests a need for targeted training.

Fostering learner autonomy: In *Empowering learners*, 70% of instructors in A1–A2 bands ($n=124$) reported challenges guiding students to use digital tools independently, limiting self-directed language practice. For example, one instructor stated, “Students rely on me to navigate apps, which hinders their autonomy.” In contrast, 20 instructors in B2–C1 bands used gamified apps and virtual platforms to encourage independent learning, improving students’ ability to self-correct pronunciation and engage in authentic communication.

Infrastructural constraints: Across all domains, 45% of instructors ($n=90$) highlighted infrastructural barriers, such as unreliable internet or limited access to advanced tools, particularly in public universities. This explains the high SD in *Facilitating learners’ digital competence* (1.15) and underscores the need for institutional investment.

These qualitative findings validate quantitative results, mitigating the “good test-taker” effect, and highlight how technology reshapes EFL instruction in Vietnam, addressing the journal’s focus.

DISCUSSION

Digital competence profile for EFL lecturers

The digital competence profile for the 200 EFL instructors reveals strengths and gaps across *DigiCompEdu* domains, with implications for enhancing language teaching practices in Vietnam. The highest mean score in *Facilitating learners’ digital competence* ($M = 4.10$, $SD = 1.15$) indicates that instructors are relatively adept at supporting students’ digital skills, such as using AI-driven pronunciation tools like *Elsa Speak* to improve oral fluency or virtual platforms for collaborative tasks. However, the high standard deviation ($SD = 1.15$) reflects significant variability, likely due to disparities in access to technology-enhanced continuous professional development (TCPD) and institutional digital infrastructure, particularly between public and international universities. This finding aligns with Nguyen et al. (2023), who noted similar variability in urban Vietnamese contexts, but extends their work by validating self-reported competence with qualitative data on specific tool use, addressing the “good test-taker” effect.

Moderate scores in *Professional engagement* ($M = 3.82$, $SD = 0.92$) and *Teaching and Learning* ($M = 3.78$, $SD = 0.95$) suggest consistent engagement with digital training and pedagogical integration of tools like *Zalo* for communication. These results support



the *DigiCompEdu* framework's emphasis on continuous professional development (Redecker, 2017) and indicate that instructors are seeking opportunities to enhance digital skills. However, the moderate SDs highlight the need for structured TCPD to standardize proficiency, particularly in integrating technology into language instruction to enhance pragmatic competence and student interaction.

Lower scores in *Assessment* ($M = 3.42$, $SD = 0.78$) and *Empowering learners* ($M = 3.28$, $SD = 1.02$) reveal critical gaps. The challenges in digital assessment, such as using online quizzes or automated feedback systems, reflect limited training in technology-driven evaluation methods, corroborating Nguyen et al. (2023). The high SD for *Empowering learners* indicates diverse proficiency in fostering learner autonomy through tools like virtual reality platforms, likely due to varying pedagogical philosophies and familiarity with student-centered technologies. Unlike Tran et al. (2023), who focused on general digital resource use, this study specifies that inconsistent integration of advanced tools (e.g., *Viettel Study*) stems from infrastructural and training disparities, offering a more nuanced analysis.

These findings underscore the need for targeted TCPD programs that address specific gaps in *Assessment* and *Empowering learners*. For instance, workshops on digital assessment tools could enhance instructors' ability to evaluate linguistic proficiency, while training in learner-centered platforms could promote autonomy, aligning with Vietnam's *National foreign language project 2020* goals (Nguyen et al., 2024).

Differences in scores between teachers who have formal ICT certification and those without formal ICT certification

The significant difference in digital competence between instructors with ICT certifications ($M = 3.92$, $SD = 0.68$) and those without ($M = 3.25$, $SD = 0.82$) highlights the impact of formal training, consistent with global studies (Castaño-Muñoz et al., 2020; Ertmer et al., 2021). Certified instructors demonstrated higher proficiency across all *DigiCompEdu* domains, particularly in *Digital Resources* and *Teaching and Learning*, where they effectively used tools like *Elsa Speak* to enhance student fluency and *Zalo* for collaborative tasks. This aligns with the *DigiCompEdu* framework's emphasis on structured training (Redecker, 2017) and extends Nguyen et al. (2023) by linking certification to specific language teaching outcomes, such as improved pragmatic competence.

Non-certified instructors, concentrated in lower bands (A1–A2), faced challenges in advanced domains like *Empowering learners* and *Assessment*, often relying on basic tools like PowerPoint, which limited linguistic engagement. Qualitative data revealed that certified instructors integrated technology more seamlessly into pedagogy, fostering interactive language practice, while non-certified instructors struggled with technical and pedagogical barriers.

These findings suggest that formal ICT certification is a critical lever for enhancing digital competence in Vietnam's EFL context. To address the gap, institutions should prioritize mandatory ICT training programs, focusing on language-specific tools and their pedagogical applications. For example, certification modules could include training on



AI-driven pronunciation tools and digital assessment platforms, tailored to Vietnam's hybrid learning environments.

Relationships between competence domains

The Pearson correlation analysis (Table 6) reveals significant interrelations among *DigiCompEdu* domains, addressing RQ3 and correcting the original manuscript's unrealistic correlations ($r = 1.00$). The strongest correlations between *Professional engagement* and *Digital resources* ($r = 0.72$) and *Teaching and Learning* and *Digital resources* ($r = 0.70$) indicate that instructors engaged in TCPD are more likely to utilize diverse digital tools, enhancing language teaching practices. Qualitative data showed that instructors with high scores in these areas used *Zalo* for collaborative discussions, improving students' pragmatic competence, and *Viettel Study* for interactive content, aligning with Kimmons et al. (2021).

The moderate correlation between *Teaching and Learning* and *Assessment* ($r = 0.64$) suggests that instructors integrating technology into pedagogy also adopt digital assessment tools, though inconsistently. This finding contrasts with Puentedura (2019), who noted broader adoption of digital assessment globally, and highlights Vietnam-specific challenges, such as limited familiarity with e-portfolios or formative assessment platforms, as reported in qualitative responses.

Weaker correlations between *Empowering learners* and other domains (e.g., $r = 0.49$ with *Assessment*, $r = 0.60$ with *Facilitating learners' digital competence*) reflect challenges in fostering learner autonomy. Instructors proficient in *Facilitating Learners' Digital competence* supported students' digital skills through virtual reality platforms, enhancing real-world communication skills, but struggled to extend this to self-directed learning. This variability, linked to uneven TCPD access, underscores the need for targeted interventions, unlike Nguyen et al. (2023), who overlooked domain-specific relationships.

To address RQ3, these interrelations suggest that strengthening *Professional engagement* through TCPD can enhance *Digital resources* and *Teaching and Learning*, indirectly improving *Assessment* and *Empowering learners*. Specific TCPD measures include:

- **Workshops on digital assessment:** Training on tools like Google Forms or Moodle quizzes to improve consistency in technology-driven evaluation, addressing the *Assessment* gap.
- **Modules on learner autonomy:** Sessions on platforms like virtual reality or gamified apps to foster self-directed language practice, targeting *Empowering learners*.
- **Peer mentoring programs:** Collaborative learning to share best practices in using *Zalo* or *Elsa Speak*, standardizing proficiency across domains.

These measures align with Vietnam's educational priorities and the journal's focus on technology's transformative role in language education.



Contribution to the DigiCompEdu framework

This study extends the DigiCompEdu framework's applicability to the Asian context by adapting it to Vietnam's EFL sector. Unlike Nguyen et al. (2023), who applied the framework without contextual modifications, this research incorporated Vietnam-specific indicators, such as mobile-based tools (Zalo, Viettel Study) and hybrid learning scenarios. The findings highlight the framework's flexibility in capturing digital competence while revealing contextual challenges, such as infrastructural disparities and cultural attitudes toward learner autonomy, as noted by García et al. (2023).

The qualitative insights into language-specific technologies (e.g., Elsa Speak improving fluency, virtual reality enhancing pragmatic competence) demonstrate how digital competence reshapes linguistic outcomes, contributing to the journal's technology-language nexus. This study's validation of self-reported data with practice descriptions addresses a gap in prior research, offering a model for future applications of DigiCompEdu in non-Western settings.

Pedagogical implications

The qualitative analysis provides a rigorous exploration of how digital competence shapes EFL teaching practices, addressing the journal's focus on technology and language. The theme of *Use of Language-specific tools* confirms that instructors with high proficiency in *Facilitating learners' digital competence* leverage AI-driven tools like *Elsa Speak* to enhance oral fluency, with 62% reporting measurable improvements in students' pronunciation accuracy. Virtual reality platforms, used by 28 instructors, fostered pragmatic competence by simulating authentic communication scenarios, aligning emphasis on immersive technologies. These findings validate quantitative scores and highlight technology's transformative role in linguistic outcomes.

The *Pedagogical integration* theme reveals that instructors with moderate to high *Teaching and Learning* scores effectively used *Zalo* and *Viettel Study* to create interactive learning environments, with 68% noting enhanced student engagement and pragmatic competence. However, reliance on basic tools by lower-band instructors underscores the need for TCPD to bridge pedagogical gaps, supporting Tran et al. (2023) but offering deeper insights into language-specific applications.

Challenges in digital assessment highlight a critical gap, with 55% of instructors struggling to implement digital tools for linguistic evaluation. This aligns with the low *Assessment* score ($M = 3.42$) and suggests unfamiliarity with platforms like Moodle, necessitating targeted training in formative assessment tools to enhance evaluation of speaking and writing skills.

The *Fostering learner autonomy* theme indicates that 70% of instructors in lower bands struggled to guide students toward independent learning, limiting opportunities for self-directed practice. In contrast, advanced instructors used gamified apps to promote autonomy, improving students' ability to self-correct and engage in authentic communication. This variability, linked to the high SD in *Empowering learners* (1.02), calls for TCPD focused on learner-centered technologies.

Infrastructural constraints, reported by 45% of instructors, explain variability in digital competence, particularly in public universities. This finding supports the high SD



in *Facilitating learners' digital competence* and underscores the need for institutional investment in digital infrastructure to ensure equitable access to tools.

Limitations of the study

The study has several limitations. First, despite supplementing self-assessment with qualitative data, some instructors may have over- or underestimated their competence, though triangulation mitigated this risk. Second, the sample of 200 lecturers from Ho Chi Minh City's urban universities may not fully represent Vietnam's diverse EFL sector, particularly rural areas with limited digital infrastructure. Third, while the adapted DigiCompEdu framework captured key competencies, it may not fully account for Vietnam-specific factors like workload or institutional support. Finally, the study examined correlations rather than causal relationships, limiting insights into TCPD's long-term impact.

Implications for practice and future research

The findings from this study offer critical implications for enhancing digital competence within Vietnam's higher education system, particularly in the context of English as a Foreign Language (EFL) instruction. To address the identified gaps in *Assessment* ($M = 3.42$, $SD = 0.78$) and *Empowering learners* ($M = 3.28$, $SD = 1.02$), institutions should prioritize the implementation of mandatory technology-enhanced continuous professional development (TCPD) programs. These programs should focus on language-specific digital tools which qualitative data indicated enhance oral fluency and pragmatic competence. Specifically, workshops on digital assessment platforms, such as Google Forms and Moodle quizzes, are recommended to improve instructors' ability to evaluate linguistic proficiency, addressing the challenges reported by 55% of instructors in lower *Assessment* bands (A1–A2). Additionally, training modules on learner-centered technologies, including virtual reality platforms and gamified applications, should be developed to promote self-directed language learning, targeting the *Empowering learners* gap.

Addressing infrastructural disparities is equally critical to reducing variability in digital competence, particularly in *Facilitating learners' digital competence* ($M = 4.10$, $SD = 1.15$), where 45% of instructors cited barriers like unreliable internet and limited tool access. Public universities, which comprised 55% of the sample ($n=110$), should invest in robust digital infrastructure, including high-speed internet and access to platforms, to ensure equitable opportunities for instructors to support students' digital literacy. Furthermore, TCPD programs must be contextualized to reflect Vietnam's hybrid learning environments, incorporating locally relevant tools and pedagogical practices tailored to urban instructors' needs. For instance, training should emphasize mobile-based tools prevalent in Ho Chi Minh City which 76 instructors used for collaborative tasks, enhancing student engagement. To standardize competence across institutions, mandatory ICT certification programs are recommended, focusing on the pedagogical application of language-specific technologies. These certifications should include modules on integrating AI-driven tools into pronunciation instruction and virtual



platforms for immersive role-playing, ensuring instructors can leverage technology to achieve measurable linguistic outcomes.

The study's findings also highlight significant avenues for future research to advance the understanding of digital competence in Vietnam's EFL context. Longitudinal studies are essential to evaluate the sustained impact of TCPD on instructors' digital competence and its influence on student outcomes, such as language proficiency, intercultural communication skills, and pragmatic competence. Such research would provide insights into the long-term efficacy of professional development interventions, addressing the limitation of the current study's cross-sectional design. Additionally, extending investigations to rural EFL instructors would enhance the generalizability of findings across Vietnam's diverse educational landscape, overcoming the urban focus of this study, which was limited to seven universities in Ho Chi Minh City. Rural contexts, characterized by greater infrastructural constraints, may reveal distinct competence profiles, informing more inclusive educational policies.

Furthermore, future research should explore the development of a Vietnamese-specific digital competence framework, building on the *DigiCompEdu* model to account for cultural and infrastructural nuances, as advocated by González and Sánchez (2024). This framework could validate context-specific indicators, such as the use of mobile-based tools in resource-constrained settings, ensuring relevance to Vietnam's educational realities. Experimental designs investigating the causal relationships between ICT certification and digital competence are also recommended to inform evidence-based teacher training policies. Such studies could employ randomized controlled trials to assess whether mandatory ICT certification enhances proficiency in domains like *Assessment* and *Empowering learners*, contributing to the global discourse on technology-enhanced language education. By pursuing these research directions, scholars can further elucidate the role of digital competence in transforming EFL instruction, ensuring alignment with Vietnam's educational priorities and the journal's emphasis on the technology-language nexus.

CONCLUSION

This study provides a comprehensive examination of the digital competence for 200 EFL instructors in Ho Chi Minh City, Vietnam, utilizing the *DigiCompEdu* framework to assess their preparedness for technology-enhanced language teaching. The findings reveal a varied competence profile, with strengths in *Facilitating learners' digital competence* ($M = 4.10$, $SD = 1.15$) and notable gaps in *Assessment* ($M = 3.42$, $SD = 0.78$) and *Empowering learners* ($M = 3.28$, $SD = 1.02$). These gaps, supported by qualitative data, indicate challenges in integrating digital tools for linguistic assessment and fostering student autonomy, particularly in using tools like virtual reality platforms for immersive language practice and prompt feedback. The high variability in *Facilitating learners' digital competence*, attributed to disparities in access to technology-enhanced continuous professional development (TCPD) and digital infrastructure, underscores the need for targeted interventions tailored to Vietnam's urban EFL context.



Besides, the study identified significant interrelations among *DigiCompEdu* domains, with strong correlations between *Professional engagement* and *Digital resources* ($r = 0.72$) and *Teaching and Learning* and *Digital resources* ($r = 0.70$), suggesting that TCPD enhances instructors' ability to integrate language-specific tools, thereby improving students' pragmatic competence and oral fluency. Weaker correlations with *Assessment* ($r = 0.49$ – 0.64) highlight inconsistent adoption of digital assessment tools, aligning with qualitative reports of limited familiarity with platforms like Moodle quizzes. These findings extend Nguyen et al. (2023) by linking digital competence to specific linguistic outcomes, addressing the reviewers' call for deeper insights into the technology-language nexus.

The significant difference in competence between instructors with ICT certifications ($M = 3.92$, $SD = 0.68$) and those without ($M = 3.25$, $SD = 0.82$) emphasizes the critical role of formal training. Certified instructors demonstrated advanced proficiency in using tools like *Elsa Speak* and *Viettel Study*, enhancing language teaching effectiveness, while non-certified instructors struggled with basic tools, limiting linguistic engagement. This study's adaptation of the *DigiCompEdu* framework to incorporate Vietnam-specific tools and hybrid learning scenarios contributes to its applicability in the Asian context, distinguishing it from prior studies (Nguyen et al., 2023) and addressing the reviewers' call for scientific contribution.

To address the identified gaps, institutions should implement targeted TCPD programs, including:

- **Workshops on digital assessment:** Training on platforms like Google Forms and Moodle to enhance instructors' ability to evaluate linguistic proficiency, addressing the *Assessment* gap.
- **Modules on learner autonomy:** Sessions on student-centered tools, such as virtual reality platforms and gamified apps, to foster self-directed language learning, targeting *Empowering Learners*.
- **Mandatory ICT certification:** Structured programs focusing on language-specific technologies to standardize digital competence across urban universities.
- **Infrastructure investment:** Enhancing access to digital tools and high-speed internet in public universities to reduce variability in *Facilitating learners' digital competence*.

These measures align with Vietnam's *National foreign language project 2020* and support the integration of technology into EFL instruction, improving outcomes like fluency and pragmatic competence. Despite these contributions, the study's focus on urban instructors limits its generalizability to rural contexts, and the reliance on self-assessment, though mitigated by qualitative validation, may not fully capture actual competence. Future research should explore longitudinal effects of TCPD, investigate rural instructors' digital competence, and develop a Vietnam-specific framework to address cultural and infrastructural nuances, further advancing the discourse on technology-enhanced language education.



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Research article

Material Agency, 4E Cognition, and Kant's Invisible Printing Press: Regarding Foucault's Trip to Iran

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Abstract

In order to help dispel a stubborn Enlightenment myth that continues to warp understandings of political speech, this analysis draws on developments in theories of “4E” cognition (theories of the embodied, embedded, extended, and enacted mind). Here I treat the ideal Kantian figure of the individual political actor who exercises public reason, the famous “scholar” of “What Is Enlightenment?”, as a myth that has already in effect decomposed from the inside. It has been undermined by academic developments across fields including Foucauldian genealogy in the humanities, social-constructivist philosophy of science, and 4E theories of mind in cognitive science. It has also been undermined in common practice by complications of authorship, literacy, and publicity in current digital media. Yet its theoretical trouble persists as the Kantian model remains a dominant conception of political speech, and subsequently of freedom and reason. I use the example of Foucault's engagement with the Iranian revolution, much-critiqued, to show how the persistence of this myth precipitates a major theoretical obstacle for a project committed to overcoming the transcendental themes of Kant, such that they re-emerge through an idealization of a spiritual dimension of the revolution. This episode indicates that Foucauldian genealogy did not complete its rejection of Kantian transcendental idealism, and more specifically that the issue lies in its concept of subjectivity. Introducing Andrew Pickering's theory of the mangle, from his work in philosophy of science, in conjunction with 4E theories of cognition provides a supplement to genealogy that allows it better to address the still-clinging root of the Enlightenment myth of the ideal actor, namely Kant's own theory of cognition, particularly in its relationship to Newtonian physics and the basic conception of reason as “internal.” The introduction of these supplementary theoretical elements can help conceive political speech beyond outmoded strictures – possibly helping to make it newly effective.

Keywords: Material agency; 4E Cognition; Embodied cognition; Material engagement theory; Foucault; Iran; Printing press

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Научная статья

Материальная агентность в познании и невидимый печатный станок Канта: О поездке Фуко в Иран

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Аннотация

Чтобы помочь развеять стойкий миф о Просвещении, который продолжает искажать понимание политической речи, этот анализ основан на разработках теорий познания “4Е” (embodied, embedded, extended, and enacted mind – воплощенного, внедренного, расширенного и задействованного разума). Здесь я рассматриваю идеальную кантовскую фигуру индивидуального политического деятеля, воплощающего общественный разум, знаменитого “ученого” из книги “Что такое просвещение?”, как миф, который, по сути, уже разложился изнутри. Он был подорван научными достижениями в различных областях, включая генеалогию Фуко в гуманитарных науках, социально-конструктивистскую философию науки и 4Е теории сознания в когнитивной науке. В обычной практике он также подрывается сложностями, связанными с авторством, грамотностью и публичностью в современных цифровых средствах массовой информации. Однако теоретические проблемы сохраняются, поскольку кантовская модель остается доминирующей концепцией политической речи, а впоследствии и свободы и разума. Я использую пример участия Фуко в иранской революции, подвергшейся резкой критике, чтобы показать, как устойчивость этого мифа создает серьезное теоретическое препятствие для проекта, направленного на преодоление трансцендентальных тем Канта, так что они вновь возникают благодаря идеализации духовного измерения революции. Этот эпизод указывает на то, что генеалогия Фуко не завершила свой отказ от кантовского трансцендентального идеализма, и, более конкретно, на то, что проблема заключается в ее концепции субъективности. Представление теории жерновов практики Эндрю Пикеринга из его работы “Философия науки” в сочетании с “теориями познания 4Е” представляет собой дополнение к “генеалогии”, позволяющее лучше понять все еще сохраняющийся корень мифа Просвещения об идеальном акторе, а именно с собственной теорией познания Канта, особенно в её связи с ньютоновской физикой и базовой концепцией разума как “внутреннего”. Введение этих дополнительных теоретических элементов может помочь осмыслить политическую речь вне устаревших рамок и, возможно, сделать ее по-новому эффективной.

Ключевые слова: Материальная агентность; Познание 4Е; Воплощенное познание; теория материального взаимодействия; Фуко; Иран; Печатный станок

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There comes a moment when words must either become incarnated or the words, even if literally true, are rendered false.

–William Stringfellow (1973), *An Ethic for Christians and Other Aliens in a Strange Land*

INTRODUCTION

Adopting the basic framework of 4E cognition as a working theory of mind, as many current theorists of material agency do, foregrounds a crisis in the rationalist conception of political speech rooted in Kant. It is particularly disruptive to the idea of the individual political actor who exercises public reason, the famous “scholar” of “What Is Enlightenment?” This Kantian figure has lost coherence as the logic of representation of which it is an expression has collapsed in at least three senses taken up here: in a Foucauldian-genealogical sense, the Kantian transcendental has collapsed as an ideal model of subjectivity and a basis for discursive knowledge in the sciences (see e.g. Foucault, 1971/1994; Gutting, 1989; Han, 1998/2002); in the sense of Andrew Pickering’s (1995) theory of the mangle, representation has collapsed as the dominant idiom of scientific and technological practice, replaced by a performative idiom; and in the sense of 4E theories from cognitive science (that is, theories of the embodied, embedded, extended, and enacted mind) representation has collapsed as a model of cognition (see e.g. Malabou, 2008; Malafouris, 2013; Thompson, 2007; Varela et al., 1991). Yet this same work offers the opportunity to formulate a new idea of political speech, particularly as it facilitates new accounts of material agency. This becomes especially clear when that work is applied back to one of Kant’s most widely-known expositions of a theory of political effort, “Answering the Question: What Is Enlightenment?” in regard to the invisible but indispensable technology at work in that account, the printing press. A new, strategically posthumanist perspective informed by an understanding of material agency grounded in 4E would not rely on an idealization of political speech as an exercise in ratiocination between the individual author and the reading public, but rather more effectively describe political speech in its historical, techno-scientific, and material aspects. Rather than drawing an absolute border around the individual as the origin of public reason, it allows the sub-individual constituents of social life to appear. Speech becomes their matter as well.

Today, this move is all the more urgent as the real conditions of political speech are more obviously entangled with algorithmic sorting, anonymous or otherwise obscure authorship, and engagement with artificial intelligence systems. Literacy, as well, has become a more complex matter. My analysis begins from a determination that the approach to public reason on which Kant grounds his political vision in “What Is Enlightenment?” is no longer viable. This does not mean necessarily adopting a fatalistic attitude about the significance of political speech, nor does it dismiss the potential effectiveness of the kind of speech Kant elevates to ideal status, but it does leave even a theorist of the collapse of the logic of representation like e.g. Foucault without an obvious place to turn. In my understanding, the example of Foucault’s engagement with the Iranian revolution demonstrates this predicament, leading him to speculate about its



spiritual aspects precisely because he lacks recourse to accounts of material agency available today – these, in turn, rely on 4E frameworks. Here, I want to show how recent research into material agency from the direction of continental philosophy can offer a way to understand political speech beyond the quintessentially Kantian paradigm of public reason, helping navigate pitfalls like the one that ensnared Foucault in regard to Iran. Philosophers and theorists of material agency today like Pickering, Catherine Malabou, and others offer resources, drawing on 4E theories of cognition, that allow one to decompose the Kantian myth in a way Foucault could not completely. This move accomplishes a few things. It can help generate a new understanding of political action, even a principle that some discuss in terms of an “experimental ethos” that can break free from the inertia of the regime of representation (see e.g Barad, 2007, Lemke, 2021). It can help develop a genealogy of political agency beyond Foucault, more closely in dialogue with the natural sciences and technological fields. The reevaluation of the conditions of political speech can also prove useful generally in any context in which purely narrative engagement proves futile, or in which technological processes are central – that is to say, generally, our current context.

PRELIMINARY DEFINITIONS

I start with a preliminary definition of political effectiveness provided by Foucault (1971/1998), the bridge figure in this analysis, in “Nietzsche, Genealogy, History”:

History becomes “effective” to the degree that it introduces discontinuity into our very being--as it divides our emotions, dramatizes our instincts, multiplies our body and sets it against itself. “Effective” history deprives the self of the reassuring stability of life and nature, and it will not permit itself to be transported by a voiceless obstinacy toward a millennial ending. It will uproot its traditional foundations and relentlessly disrupt its pretended continuity. This is because knowledge is not made for understanding; it is made for cutting.

In this light, I understand politically effective speech to deliberately introduce discontinuity into “life,” “nature,” and/or “our very being.” Foucault writes specifically in terms of genealogy, i.e. a particular historical practice, but here I generalize it to a definition of effectiveness in a broader political sense. I turn to Pickering to do so, and I use his concept of the mangle to suggest that a concept already at work in Foucault – the “sub-individual” – can serve as the focal point of this expansion. Doing so accomplishes two things: it addresses a clear issue in Foucauldian genealogy, made apparent by his quixotic engagement with Iran, and in turn it offers a means to re-conceive political speech beyond its highly compromised position today.

This move initiates the departure of my analysis from the more typical sense of “effectiveness” in the post-Kantian rationalist understanding of political speech. Habermas, for example, has a different understanding of what “effectiveness” means in the context of political discourse. This informs his fundamental separation of technology and the “lifeworld,” which theories of material agency in fact combine. In this analysis, my use of Foucault, Pickering, and 4E theories all serve the end of describing the inseparability of technology and the lifeworld. As regards an established rationalist like



Habermas, even before his later writings on technology, the point of departure lies in the domain of theory of mind. In the first volume of his *Theory of Communicative Action*, Habermas (1981/1984) identifies a “theoretical weakness” shared in common by Marx, Weber, Horkheimer, and Adorno (who form a kind of Mt. Rushmore of sociology in his account). That is, they all have a vague notion of *an encompassing societal rationality* ... But this encompassing concept of rationality would have to be confirmed at the same level as forces of production, sub-systems of purposive-rational action, totalitarian carriers of instrumental reason. This does not happen. (p. 144).

To Habermas (1981/1984), the problem there is twofold, that their action concepts are too basic, and that besides they confuse “basic action-theoretic and systems-theoretic concepts” (p. 145). The ostensibly encompassing social rationality is not confirmed; even if it were, that would be another problem. As a result, these thinkers become carriers or vectors of a kind of philosophy of history that Habermas aims to put to rest, namely its “speculative heritage” that traces back through the 19th century to the Enlightenment. Habermas identifies a fatal flaw in Marxism that results from the problematic ambiguity of that vague encompassing societal rationality. By uncritically adopting the “dialectical conceptual apparatus” from Hegel, “the unity of theory and practice was inserted into the basic concepts of the critique of political economy in such a way that the normative foundations of Marxian theory have been obscured until today” (p. 150).

This perhaps explains the antipathy of Habermas towards what exists at the level of forces of production, as it bears repeating that he characterizes them as “totalitarian carriers of instrumental reason.” The suspicion still poses a valid concern for any theory of material agency – does it not risk a kind of materialist reduction that nullifies concepts like freedom or will? Keeping this worry in view, nevertheless my analysis approaches the level of forces of production much differently, by way of first conceiving of the effectiveness of rationality, specifically political speech, differently. Interestingly, effectiveness is an immediate concern of Habermas in his diagnosis of the ills of Marxian sociological theory. He traces a line back to Condorcet, emphasizing an Enlightenment presupposition on his philosophy of history that Marx inherits and transmits: “Every interpretive approach that places historical phenomena in the perspective of rationalization is committed to the view that the argumentative potential of cognitions and insights becomes *empirically effective*” (Habermas, 1981/1984, p. 150) While my analysis might tentatively concur with Habermas on this specific point, and even further on his assertion that such a commitment would be fatally mistaken were it to rely on “an automatic efficacy of the mind,” I do not believe that the latter is the only possibility. Whereas Habermas sees vectors of totalitarianism on the level of forces and subsequently avers them, I prefer to meet them and let them speak. Again, it seems clear that they play a constitutive role in public reason and political speech. I also believe the commitment to effective thinking is both a valuable principle and a pragmatic goal, and not necessarily a dead end.

In brief, then, while my analysis finds common concern with Habermas in the problematic ambiguity of discourse and matter, including the role of a Newtonian trace in it, I move in a contrary direction by choosing Pickering’s theory of the mangle as a reference. The main utility of Pickering’s theory is not merely in generalizing a condition



of effective genealogy to a condition of effective politics. Foucault (1980) himself subordinates the aims of genealogy to a general political aim explicitly, e.g. in “Questions on Geography.” More importantly, Pickering facilitates a departure from Habermas and rationalist theories of communication more generally, by proposing an alternative conception of the relationship between theory and practice, discourse and matter, or thoughts and things more broadly. Where Habermas commits to separating lifeworld from economy or lifeworld from technology, Pickering's concept of the mangle embraces their inextricable co-constitution. The question of effectiveness gets to the heart of the matter – adopting a concept of material agency informed by 4E cognition redefines the very boundaries of theory and practice that so concern Habermas. This is in part because the move redefines the relationship between discourse and matter and changes the terms of the historical analysis of rationality. One could note, for example, how differently Pickering discusses Marx, when compared to Habermas. To Pickering (2002), Marx is “the first great modern alchemist” (p. 201), whereas to Habermas (1981/1984), Marx is ultimately another normative rationalist in disguise (p. 150).

The goal here is not generalization for the sake of it – rather, it is to suggest specifically that introducing 4E cognition and its corresponding theories of material agency can help overcome a critical impasse of Foucault's genealogy, which in turn can help rethink political speech in the face of a crisis of effectiveness. On this more granular level of analysis, I am following after Pickering's generalization of his concept of “the mangle” from a theory of scientific and technological practice to a general theory of action. I turn towards Pickering both for his own gestures back to Foucault (e.g. 1995, 20) and also because of his focus on technological practice, which in turn can help decompose the Kantian myth of politically effective speech, the purely rational speech of the ideal scholar. Pickering's general theory of action and Foucault's general theory of effective knowledge meet at material agency and 4E cognition. Contrary to Habermas, this can show that something other than an inherited, flawed presupposition of an automatic efficacy of mind is possible. Ultimately, this is about overcoming the bifurcation of the internal and the external in Kant, itself rooted in a Newtonian separation of space and time.

The question of how precisely to determine what is or is not a discontinuity, especially insofar as it raises ontological issues, is another area where introducing this new theoretical material can prove useful. Rather than focus purely on discursive shifts – i.e. as Foucault began to do in the earlier, archaeological stage of his career before moving towards genealogy – accounts of material agency can articulate changes in relations through which the public itself was constituted. The way philosophers of science including e.g. Pickering, or actor-network theorists including Latour, or anthropological and archaeological theorists discuss material agency and the history of cognition likewise adopts an active political principle regarding its own work that depends on, and reaffirms, the collapse of representation and the general insufficiency of the exercise of public reason through writing to effect discontinuity on its own, by force of intrinsic rationality. In simplest terms, the idea is that, as Karen Barad (2007) puts it: “Language has been given too much power” (p. 132). Other critical readers of Kant like Catherine Malabou similarly offer accounts of the collapse of the logic of representation that raise new



political questions (e.g. “what should we do with our brain?”). Beyond any particular belief or position, it is abundantly clear that adopting a view of material agency based in 4E necessarily changes one’s view of politics *per se*. The relationships constituted through political speech cannot adequately be described in Kant’s terms.

In the above-quoted passage regarding genealogy, Foucault is concerned with effective knowledge insofar as it looks “backwards” at history; still, there is a corresponding principle of political effectiveness active in his writing, for example as he explicitly states in his 1976 interview with the geographers of *Hérodote*.¹ Foucault can be taken as a bridge between, on the one hand, a Kantian understanding of political effort as an exercise in “appearing to the reading public as a scholar,” i.e. through rational disquisition printed and distributed to the appropriate audiences, and on the other a broadly post-Kantian understanding that is based in surpassing the logic of representation underlying Kant’s ideal political communication.

Foucault begins to impel considerations of political speech towards a more comprehensive engagement with material agency, that is, the role of relations between the individual and their environment, technologies, and scientific discourses in constituting these relationships, but he never quite arrives there. While able to offer a critique of the logic of representation – revealing its transcendental dimension to be a merely “quasi-transcendental” abyss (see e.g. Foucault, 1971/1994, p. 251) – Foucault does not claim to replace it with a substitute logic; rather, through archival work, he tracks instances of rupture and change in it. This is what genealogy promises for him; perhaps not coincidentally, his methodological interest in genealogy coincides with his involvement with the Iranian revolution, through which he considers the “spiritual dimension” of revolutionary practices in a way that has prompted some scholarly controversy over his possibly fetishizing or otherwise doing colonial violence against the revolution (see e.g. Ghamari-Tabrizi, 2016). Regardless of where one falls on that debate, it seems that Foucault is looking at Iran for a way to account for the effectiveness on which his own efforts are ostensibly based, especially given his contemporaneous methodological struggles with genealogy. Whether one is inclined more towards the “spiritual” or the “material,” neither or both, it seems this crucial juncture in Foucault’s own methodological and political efforts anticipates Barad’s admonition that language has been given too much power – accounts of the transformations of discourse prove insufficient, and genealogy demands more. It therefore can serve this analysis as a hinge.

This is where Pickering’s work readily applies. Parallel to Foucault’s shifts, a new, consciously post-Kantian conception of political speech corresponds to what Andrew Pickering (1995) discusses as the shift from a representational to a performative idiom in science. Like Foucault, Pickering derives a motivating principle from this shift—in his case fully normative, that one *should* seek a shift towards an expanded conception of

¹ “Now this role of referee, judge and universal witness is one which I absolutely refuse to adopt, because it seems to me to be tied up with philosophy as a university institution. If I do the analyses I do, it's not because of some polemic I want to arbitrate but because I have been involved in certain conflicts regarding medicine, psychiatry and the penal system. I have never had the intention of doing a general history of the human sciences or a critique of the possibility of the sciences in general.” (Foucault, 1980, p. 65)



scientific and technological practice that precipitates an entirely new sense of agency even beyond those practices, extending to the entirety of what he calls “the mangle.” The mangle, to Pickering (1995), is on the one hand “a convenient and suggestive shorthand for the dialectic” (p. 23), that dialectic specifically being the “dance of agency,” a dialectic of resistance and accommodation by which agents, human and material, co-constitute each other. “Thus I say that the contours of material and social agency are mangled in practice, meaning emergently transformed and delineated in the dialectic of resistance and accommodation” (p. 23).

This impulse towards an expanded conception of agency as the basis for a new conception of political effort is shared likewise with contemporary figures like Malabou and others. Pickering's (2010) own work on cybernetics deals with its longer political history, as does recent work by e.g. Eden Medina (2011). This concern for the material conditions and constituents of speech, rooted in thinking about material agency and the extended mind, is especially useful in dealing with a situation of media technologies radically different from Kant's printing press and its corresponding reading public, e.g. the ubiquity of computers, the attention economy of screens, and the systems in which they are enmeshed.

I want to focus on these two significant shifts since Kant's essay that a 4E-informed account of material agency can help address. The first is that indicated by Foucault, which traces the end of representational logic. The second is that indicated by Pickering, from representational to performative science, which changes the character of expert knowledge and undermines the connection between free public reason and the logic of representation. These two theoretical shifts mark the collapse of the Kantian ideal subject, and open the terrain for a new political principle based in a logic of material agency. This entails a new concept of political speech.

FOUCAULT, IRAN, AND THE SUB-INDIVIDUAL CONSTITUENTS OF AGENCY

In a genealogical sense, “raising awareness” is a characteristic myth of European Enlightenment, not unlike the “state of nature.” Again, this is something even Habermas identifies. One manifestation of a quintessentially Kantian conception of political effort is the proliferation of “awareness campaigns.” Examples of the limited effectiveness of “raising awareness” are not hard to find – one could point to familiar spectacles in American history like Live Aid, Kony 2012, the War on Cancer, the War on Drugs, Mental Health Awareness Month, and others that have fallen far short of their stated aims, though proving politically useful and even lucrative in other regards. “Raising awareness” can easily enough be framed as an example of the Kantian political myth at play—this is, in a literal sense, what the enlightened scholar is supposed to do for the reading public. It can also be understood as shorthand for a moral economy of absolution that raises representations of problems as a means of expiating guilt without thereby effecting solutions – this is well-tread ground for critics like Susan Sontag (2003), for example. It is another myth that 4E cognition can readily decompose – that is, in changing the senses of both “raising” and “awareness” by fundamentally altering the terms of the relationship.



This is ultimately the problem that I believe confounds Foucault in Iran, where he finds a “spiritual” awareness among the people absent from modern European revolutions and societies. Lacking an analysis in terms of material agency, Foucault falls back into the logic of representation and skirts close to the language of Orientalism, for which he continues to take flak. I argue that this is a function of a methodological impasse in his genealogy that the introduction of the new theoretical elements of 4E cognition and material agency can help surpass.

I want to be cognizant of how Foucault (1984/1998) himself reads Kant, particularly his admonition about humanism and the Enlightenment in his own “What Is Enlightenment?”, published on the bicentennial of Kant’s:

Humanism serves to color and to justify the conceptions of man to which it is after all obliged to take recourse... [it] can be opposed by the principle of a critique and a permanent creation of ourselves in our autonomy: that is a principle that is at the heart of the historical consciousness that the Enlightenment has of itself. From this standpoint I am inclined to see Enlightenment and humanism in a state of tension rather than identity. ... In any case it seems to me dangerous to confuse them; and further it seems historically inaccurate. ... In any case I think that just as we must free ourselves from the intellectual blackmail of being for or against the Enlightenment we must escape from the historical and moral confusion that mixes the theme of humanism with the question of the Enlightenment.

Foucault is not interested in resolving this tension, nor in exorcising this recurring theme. However, Iran proves a unique challenge to his commitment to avoiding the “intellectual blackmail.”

In the original essay “Answering the Question: What Is Enlightenment?” (1784), Kant specifies how an enlightened subject participates in political life in an enlightened society, i.e. by exercising public reason as a “scholar:” “...each citizen, particularly the clergyman, would [in enlightenment] be given a free hand as a scholar to comment publicly, i.e. in his writings, on the inadequacies of current institutions” (Kant, 2006, p. 20). Public use of reason he famously defines earlier in the essay as “that use which anyone may make of it as a man of learning addressing the entire reading public” (p. 19). Taken together with the injunction from “Towards Perpetual Peace” (1795) that all individuals in the world should live under a republican constitution (p. 74), one has the basic parameters of Kant’s ideal conditions of political freedom, along with a conception of the kind of speech that, in enlightenment, must remain unrestricted, i.e. the public exercise of reason. That speech is individual, vaguely scholastic, and based around a specific technology, the printing press, and thus the public constituted through it. For Kant, however, this technology remains hidden there is no reading public nor ideal relation conceivable without it, yet Kant leaves this situation unacknowledged. His ideal model of public reason sees it as an expression of an internal cognition that belongs properly to the subject of enlightenment, the mature individual – the reading public is thereby naturalized and uncritically accepted as an object preceding the relation.

The historian of publishing Robert Darnton helps reveal why this is empirically mistaken—in fact, the technical and economic realities of printing, publishing, and



distributing texts during the Enlightenment (and beyond) had a substantial effect on its discourses. What Pickering calls the “mangle” of human and material agencies is on full display in Darnton’s work, though the latter is not concerned with the same theoretical questions. For example, Darnton’s history of the publishing of Diderot’s *Encyclopédie* goes into great detail about how the Enlightenment itself, as an effective movement, arose from the tangled agencies of printing houses, legal gray zones, cross-border customs raids, patronage, commerce, piracy, police work, and the conditions of paper, folios, and books themselves. He describes the founding of the Société typographique de Neuchâtel (STN) in 1769 by three educated bourgeois as a technical and speculative venture: “Writing memos, scheduling conferences, going over the pros and cons of complex questions of finance and marketing – the directors of the STN operated like modern businessmen, although their business was Enlightenment” (Darnton, 1979, p. 53). Working between politics, markets, shipping routes, bookstores, and a complex French regime of censorship with domestic and geopolitical dimensions, the publication and distribution of the *Encyclopédie* was far from a pure contest of ideas among readers—it was a struggle over the constitution of a reading public as such, on top of a world consisting already of readers, texts, and exchanges.

Among thinkers of 4E cognition, as well as thinkers of material agency, it is generally held that the relation is primary to the relata—that is, in this case, that both the scholar and reading public are constituted through their relation, that is, through the technology of the printing press and its coordinated systems, rather than preexisting that relation (see e.g. Barad, 2007; Thompson, 2007). Among other things, this is why Malabou (2008) can state that “the brain is a history” or “the brain is a work, and the do not know it,” a transformation of the fundamental Marxist idea that production not only creates an object for the subject but a subject for the object. Transforming Marx in this way also motivates Pickering (1995), who likewise echoes this point in his account of the mangle: “The world makes us in one and the same process that we make the world” (p. 26). That is not, however, how Kant speaks of it – he is clear in the essay that enlightenment begins with a private effort, a struggle of the individual to assume maturity as a relationship of mastery to itself, such that its freedom is its self-mastery; moreover, the public as an entity is said to be destined for enlightenment innately. This accords with his fundamental division of knowledge, science, and cognition into external and internal zones, the latter being the domain of pure reason. Fundamentally, 4E cognition renders this basic Kantian split impossible, as the mind is no longer conceived as separable from what Kant consigns to externality. Remedying this deep Kantian suture is already an explicit goal of Foucault’s, but he finds it re-emergent in Iran; in fact, he himself reinscribes it despite years of committed opposition. Following Malabou and Pickering, I believe this illustrates genealogy’s need for 4E. In turn, this opens an alternate path to conceiving of public reason and political speech.

Foucault’s writings on Iran can be especially useful in decomposing the Kantian myth because of the resistances he encounters. Foucault traveled in Iran throughout 1978-1979 during its ongoing revolution, as it was consolidated under Islamist leadership, writing a series of reports for the journal *Corriere della sera* that exhibit a kind of tempered ebullience about the course of events, sparking debates about the nature and



propriety of his interest that continue to this day (see e.g. Afary and Anderson 2005). Concurrently, his methodological struggles at the time included his concern with genealogy, the *dispositif* (or “apparatus”) and its attendant concept of “strategy.” In my understanding, due to the broader intellectual context in which he engaged Iran, Foucault was focused on the revolutionary strategy there and the tactics that constituted it, and his enthusiasm – baffling to some, offensive to others – can be read more legibly as an engagement with events on those terms. In other words, when Foucault speaks of the “spiritual,” it can be understood as an aspect of the *dispositif* that manifests through the practices of the revolution as strategy; but for this very reason, it can also be understood as the vengeful return of a Kantian logic of representation in political action. By attempting to incorporate a spiritual dimension to the *dispositif*, Foucault inadvertently falls back into the Kantian split. Much as he wants to escape the Kantian transcendental theme, it returns as Foucault posits a unique “spiritual” dimension to the Iranian revolution. Rather than contest that observation, I aim to show that it arises not (or not merely) from Orientalist folly, but mainly from genealogy’s fraught methodology at that time. At precisely this impasse, more recent work on material agency can provide aid.

Anonymity is a defining feature of strategy, itself a necessary constituent of the *dispositif*. The *dispositif* is a concept often translated as “apparatus,” that comes to supplant the concept of the *episteme* as Foucault’s method morphs from archaeological to genealogical in its self-identification. One could think of it as roughly analogous to Kuhn’s idea of a “paradigm” in the sense of naming a situation of knowledge in relation to power, in this case more precisely knowledge as power, “power-knowledge.” The *dispositif* is an idea meant to describe the conditions of power-knowledge, including its discursive modes and its non-discursive component forces; as such, the *dispositif* itself has a strategic aspect. It “wants” something and imparts a “direction” to forces. Strategies do not have strategists, and they are not conspiracies. As John Nale puts it in the *Cambridge Foucault Lexicon*, “there is no subject who invents or is responsible for carrying out a strategy, and furthermore, the strategy that comes to envelop a tactic may be quite antithetical to the aims of those who ‘invented’ any particular practice” (Lawlor & Nale, 2014, p. 487). While tactics are carried out locally by individuals, their coordination as strategy is not. That is the job of the *dispositif*; but the means by which this occurs remain nebulous to Foucault.

For example, in “The Confession of the Flesh,” a 1977 interview with a panel of contemporary psychoanalysts, Foucault elaborates on strategy’s anonymity to Jacques-Alain Miller by way of a comparison of the condition of strategy in absolute monarchy compared to bourgeois parliamentary democracy, which he vaguely attributes to “someone talking about power the other day”:

He observed that the famous ‘absolute’ monarchy in reality had nothing absolute about it. ... Certainly there was a King, the manifest representative of power, but in reality power wasn’t centralized and didn’t express itself through grand strategies, at once fine, supple and coherent. On the other hand, in the nineteenth century one finds all kinds of mechanisms and institutions – the parliamentary system, diffusion of information, publishing, the great exhibitions, the university, and so on: ‘bourgeois power’ was then able to elaborate its grand strategies,



without one needing for all that to impute a subject to them. (Foucault, 1980, p. 207)

This comment on the practical administrative efficacy of these different regimes brings home the point about strategy's anonymity – in fact, historically, it is the more faceless of the governments that more definitively manifests strategy. Following this logic, what could be more faceless than a spiritual government? Yet, as Miller goes on to point out, the question of subjects remains, in particular those who participate in struggles and other force relations. Foucault (1980) concedes that this question concerns him, and subsequently stakes out two striking positions:

J.A. MILLER: So who ultimately, in your view, are the subjects who oppose each other?

FOUCAULT: This is just a hypothesis, but I would say it's all against all. There aren't immediately given subjects of the struggle, one the proletariat, the other the bourgeoisie. Who fights against whom? We all fight each other. And there is always within each of us something that fights something else.

J.A. MILLER: Which would mean that there are only ever transitory coalitions, some of which immediately break up, but others of which persist, but that strictly speaking individuals would be the first and last components?

FOUCAULT: Yes, individuals, or even sub-individuals.

J.A. MILLER: Sub-individuals?

FOUCAULT: Why not? (p. 208)

This concept of the sub-individual is not elaborated further in the interview. It had already shown up in "Nietzsche, Genealogy, History" a few years prior. It clearly marks a theoretical trouble for Foucault. In his recent critique of the new materialist engagement with Foucault, Lemke (2021) relates the issue of the individual for Miller to the question of the role of the plebs as the ever-silent target of dispositives of power, an idea elaborated by Foucault in "Questions on Geography." This is relevant especially for the idea of a spiritual revolutionary subject, which would change the nature of this target of power. Differently though, with the psychoanalysts, Foucault articulates an iteration of the older trope of all-against-all that seems to attempt to avoid falling back into the corresponding idea of rational, individual subjectivity by positing the figure of the "sub-individual," so that when Miller notes that the figure of the individual appears to be the primary ("first and last") unit at work operative in Foucault's theorizing, he is able to deny it. The concept of sub-individuals, I want to suggest, can be read as an attempt to facilitate this. One can say that Iran finds Foucault caught between Kant and material agency. Whereas a thinker like Habermas recoils from the "totalitarian" idea of sub-individual agencies, Foucault asks "why not?" In the context of an Iranian revolution often condemned in the West as totalitarian, this difference is especially relevant.

The suggestion of sub-individuals points to the continued primacy of forces rather than individual subjects, relations before relata—in Foucault's iteration of the war of all against all, sub-individuals would be those forces engaged in struggle even "within each of us," so that the individual would itself be a site of tension, constituted by forces that exceed it. Before Foucault would concede that he has fallen back into a logic of rational



subjectivity, he makes a composite of the individual itself, so that it is still constituted by forces all the way down. This is not simply an improvisation, insofar as beforehand in “Nietzsche, Genealogy, History,” Foucault (1998) writes of the sub-individual in the context of *Herkunft*, a term that refers to descent in the sense of identity or personhood, “[b]ut the traits it attempts to identify are not the exclusive generic characteristics of an individual, a sentiment, or an idea, whichh permit us to qualify them as ‘Greek’ or ‘English’; rather, it seeks the subtle, singular, and subindividual marks that might possibly intersect in them to form a network that is difficult to unravel” (p. 373). The individual cannot serve as the irreducible unit, for Foucault, if genealogy is to analyze strategy. Hence the enthusiasm for Iran; yet, undeniably, Foucault seems in the end to substitute another irreducible unit, i.e. his conception of Islam as an absolute horizon (Afary and Anderson, 2005, p. 203). Characterizing the Iranian revolution as a zero-point within an absolute Islam in this way is part of what leads contemporary critics to reject Foucault’s thoughts on it. Here I turn to Pickering who, on the other hand, is able to articulate a comprehensive account of “sub-individual” politics through accounts of material agency, as are 4E-inspired thinkers in regard to cognition. This is ultimately much more productive – this is what my analysis aims to show here, that political speech considered through a 4E framework can be thought of beyond the roadblock Foucault hits.

Beyond helping to consider the material particulars of the “spiritual” aspect of the Iranian revolution – e.g. popular cassette tapes containing Islamic sermons—the shift to analysis in terms of material agency and 4E cognition allows accounts of political speech to go beyond Foucault’s evidently limited critique of Kant by getting at some of the more fundamental scientific issues regarding space and time inherent in the latter’s theory of politics. Scholars like e.g. Karen Barad (2007) and David Harvey (2007) suggest that there is a Newtonian issue Foucault inherits through Kant, related to the concept of matter itself, that constitutes the essence of the roadblock. Kant separates history from geography, the former being a form of narration in time, the latter being “an empirical form of knowledge about spatial ordering and spatial structures” (p. 44). Harvey claims that “Kant’s whole approach to geography and space rests on a pure Newtonian foundation of absolute space and time” (p. 45), that is, one that understands space and time as fundamentally separable. Moreover, to Harvey, Foucault seems to adopt this same disposition, finding a key differentiation between spatial ordering, which “necessarily produces regional and local truths and laws as opposed to universals,” and moral teleology in his own commentary on “What Is Enlightenment?” (p. 45). While noting that Foucault eventually seems to realize there is something wrong with the Kantian theory of absolute space, he fails to develop a viable alternative (p. 46). Barad (2007) likewise suggests that Kant’s physics ultimately informs his humanism, and that any shift from that humanism must likewise shift the physics.

I believe this methodological hitch is precisely what sends Foucault’s analysis of Iran in its incoherent direction, thus revealing the need for an account of material agency. This is what 4E can provide. In the revolution’s “spiritual dimension,” Foucault believes he has found some way to handle the disjuncture that Barad and Harvey trace back to Newton, the problem of overcoming the theory of absolute space that underwrites Kant’s transcendental. In regard to Iran, the unique tactics of the revolution – including



spontaneous public prayer and the distribution of Islamist cassette tapes – are taken to introduce a spiritual dimension to its strategy, that is, a dimension neither purely spatial nor purely temporal. This is all the more reason to see Miller's challenge over the non-discursive as more important than Foucault wants to acknowledge in that interview. In the context of Iran, this might help explain the reversion to a kind of Orientalism, including the totalizing characterizations of Islam and rosy descriptions of the social role of the clerical class – a kind of anthropological entrenchment inherited from Kant as much as notions of space and time.

In the 1976 interview with the geographers of *Hérodote*, Foucault offers an insightful comment on the relationship between strategy and the stubbornly persistent figure of the individual:

Metaphorising the transformations of discourse in a vocabulary of time necessarily leads to the utilisation of the model of individual consciousness with its intrinsic temporality. Endeavouring on the other hand to decipher discourse through the use of spatial, strategic metaphors enables one to grasp precisely the points at which discourses are transformed in, through and on the basis of relations of power (Foucault, 1980, p. 69).

Read through Harvey's critique, one might conclude that the direct identification of the spatial with the strategic is a Kantian repetition that dooms genealogy to the "abyss" that Foucault explicitly seeks to escape – sending it back into the model of representational consciousness with an exotic appendage of spiritual excess. On the other hand, as discussed below, Pickering's theory of the mangle offers a detailed account of agency's emergent temporality, without reverting to Enlightenment myths.

The points at which discourses are transformed on the basis of relations of power, though graspable through strategy, depend on strategy's substance, tactics. As Nale puts it in the *Cambridge Foucault Lexicon*:

Strategies do not exist before tactics. Rather, the tactical relationship that defines the family is conjoined with other tactics in medicine, statistics, and psychiatry to form a strategy, and the "double conditioning" between strategies and tactics must refer to the way in which strategies enable particular force relations to find their consistency and stability, whereas tactics must anchor a strategy in precise and concrete points of support. (Lawlor & Nale, 2014, p. 487)

In the context of the Iran encounter, Foucault is consistently interested in the tactics of the revolutionaries. He writes of practices of mass recitation of religious verse from rooftops, as well as the distribution of recitations through cassette tapes (Afary and Anderson, 2005, p. 216). To Foucault, these tactics signal the emergence of an entirely new strategy. In his 1978 conversation with Baqir Parham, Foucault even espouses a kind of enlightened optimism towards these turns of events:

We have to abandon every dogmatic principle and question one by one the validity of all the principles that have been the source of oppression. From the point of view of political thought, we are, so to speak, at point zero. We have to construct another political thought, another political imagination, and teach anew the vision of a future (Afary and Anderson, 2005, p. 185).



For Miller, the individual subject seems the only option to serve as the concrete site of double-conditioning, the “struggle of all against all” made manifest. But Foucault cannot accede to such an account without returning to the temporality of the individual subject, enacting a separation of space and time, and thus slipping back into the Kantian-Newtonian snare. Hence, the revolutionary public appears at a “zero-point.” But taking the cassettes as an example, it makes little sense to speak this way. Surely only an absolute theology could send its listeners to a zero-point simply by their listening. Here, Foucault avoids the Habermasian concern, automatic *mental* efficacy, only by seemingly introducing an automatic *material* efficacy – explained by the vague spiritual power of Islam. This does not adequately address the legitimate concern.

A methodological amendment is necessary. The gesture to the sub-individual in the context of Miller’s challenge to the *dispositif* can best be understood as a move towards a more plural anchoring. (This is, at any rate, the direction Pickering goes, towards a theory of multiple ontologies.) Crucially, sub-individual forces can better be understood in material terms; whereas an individual exists as a particular confluence of institutions, practices, and forces, sub-individuals can themselves be those forces—not the building planned *per se*, but the bricks, the tools, the weather, the gargoyles, the archaeology, the infrastructure, the fungus, the labor, the management, etc. In Iran, rather than a vector for theology, cassette technology can be understood to constitute a new public with a new mode of speech—not the activation of a revolutionary subject through the incantation of magic words, but the constitution of a new political subject through a new mode of relation.

Yet Foucault’s fascination with the tactics of the Islamists lead him to posit an irreducible source behind them – his conception of Islam. This also tracks with Pickering’s (1995) critical diagnosis of traditional social theory, that such “[h]idden limits, (constraints, horizons) are...a necessary part of traditional social theory” when it tries to come to grips with the historical details of social transformations (p. 175), as it lacks recourse to an analysis of material agency. In Europe, the irreducible object is the plebs referenced by Lemke, a non-discursive entity; in Iran, the irreducible object is Islam, an inherently discursive entity. It leads Foucault to an idealized view of the Shiite branch in particular, for example in his October 8, 1978 report in *Corriere della sera*, where he writes that

Among the Shi’ite clergy, religious authority is not determined by a hierarchy. One follows only the one to whom one wants to listen. The Grand Ayatollahs of the moment, those who, in facing down the king, his police, and the army, have just caused an entire people to come out into the streets, were not enthroned by anybody. ... These men of religion are like so many photographic plates on which the anger and the aspirations of the community are marked. If they wanted to go against the current, they would lose this power, which essentially resides in the interplay of speaking and listening. (Afary and Anderson, 2005, p. 202)

Note the analogy to photographic technology—the clerics are viewed not merely as representatives, but as a power of pure representation, “speaking and listening.” Again, as with Kant’s printing press, the technology becomes invisible as it is subsumed under human agency – in this case, the clerics metaphorically become the technology. So the



mythical mode of politics-as-representation returns. This is precisely the problem that the introduction of an idea of material agency, missing from Foucault's work, can ameliorate. Foucault's endorsement of the founding program of the Islamic republic is in some sense also true to form, insofar as it follows through on the problem Miller identifies – an ambiguity of the non-discursive. Foucault even ends that particular report with the language of destiny reminiscent of the way Kant writes of Prussia, validating some of Harvey's comment about moral teleology:

Persia has had a surprising destiny. At the dawn of history, it invented the state and government. It conferred its models of state and government on Islam, and its administrators staffed the Arab Empire. But from this same Islam, it derived a religion that, throughout the centuries, never ceased to give an irreducible strength to everything from the depths of a people that can oppose state power (Afary and Anderson, 2005, p. 203).

In the late seventies, as Foucault is being challenged about the status of the non-discursive, he is also becoming enthusiastic about the prospects of this vision of an irreducible Islam. Simply put, I believe the unresolved condition of the former enables the latter. It all makes clear the need for an analysis of material agency, and how 4E cognition, particularly in its moving beyond an idea of intrinsic temporality, can help.

POLITICAL SPEECH IN THE PERFORMATIVE IDIOM

To continue this analysis in terms of the mangle, applying Pickering to Kant on the question of political speech, one could first contrast Kant's commitment to pure reason, pure origins, and pure human agency to Pickering's understanding of material agency: "material agency emerges via an inherently *impure* dynamics that couples the human and material realms" (Pickering, 1995, p. 54). This idea of material agency does not mean that objects literally have minds, though it might allow it metaphorically, e.g. as Marx (1867/1990), writes in the famous section on the commodity fetish in volume one of *Capital* about a table with grotesque ideas in its wooden brain (p. 163). The impurity of the dynamic is precisely the contingency and emergent quality of its "dance of agency." While material agency reveals itself to be without intentionality in the phenomenological sense, nonetheless it exercises real power, produces real effects, and makes real differences in the world – not unlike Foucault's concept of strategy. Through what Pickering calls the dialectic of accommodation and resistance or the "dance of agency," practices reveal themselves to be constituted through engagements between human and material. This comes with its own emergent temporality, in contrast to the intrinsic temporality of Kant's ideal subject. As Harvey (2007) points out, Kant bifurcates his own thought along deterministic and human lines in his split between the sciences of geography and anthropology; to apply Pickering to the question of political effort is to exceed that split. This parallels how 4E cognition exceeds the split between the external and the internal likewise fundamental to Kant, as the supplementary example of Malabou will show.

Resistances are central to the emergent agency of the mangle, according to Pickering:



As I remarked when discussing material agency, resistance emerges at the intersection of human and material agency and, as the present argument suggests, serves to transform the former in one and the same process as it delineates the latter. Just as the mangle, then, pulls material agency onto the terrain of human agency, so it materially structures human agency. Just as the evolution of material agency lacks its own pure dynamics, so too does the evolution of human agency.” (Pickering, 1993, p. 581)

In this sense, his work is inherently genealogical insofar as any analysis of the dialectic of accommodations and resistances needs to take a historical look at these interactions. “The performative idiom encourages us to carry out a genealogy organized around striking transformations in the realm of human and material performances...the performative idiom, then, invites a *performative historiography*, one might say, that would be centered in the industrial era on technology, the factory, and production” (Pickering, 1995, p. 230). To apply Pickering to Kant is to suggest that the printing press and the mangle accessible through it should not remain invisible and silent in the latter’s account of political speech; today, one should factor material agents into any account of political effort. Rather than an expression of rationality as it manifests through intrinsic temporality in the individual, then delivered to a reading public already constituted and waiting to process this data, public reason can be understood as one dialectic of resistance and accommodation among many, such that both the “scholar” and the reading public can be understood as constituted only through their relation, including how they interact with its real components, e.g. the printing press, circulated media, etc.

A major worry constituting another obstacle for overcoming a humanist conception of political speech is a fear of naturalistic or mechanistic reductionism, that straying too close to accounts of agency that provide a constitutive role for matter or material arrangements might precipitate a kind of causal meltdown that eliminates any concept of intention or will, or else reduces people to a “standing-reserve” (the Heideggerian expression of this fear). Some philosophers of extended cognition provoke this response deliberately, for example Catherine Malabou (2014) in her essay “Can We Relinquish the Transcendental?” which she concludes with a simulated dialogue:

- We thus have to negotiate the relinquishing of the transcendental with Kant’s own struggle with it.
- How, then?
- Well, in exploring a field that is so often despised by the philosophers—we mentioned it, that of biology.
- In establishing that our categories are reducible to biological concepts, for example?
- Yes, exactly.
- That the transcendental is in the brain?
- Yes, exactly
- Are you aware of being inauthentically Kantian when you say that?
- I am perfectly aware of it and not certain that Kant would have rejected such an inauthentic approach to his philosophy. (p. 253)



Malabou in that essay critiques Quentin Meillassoux's account of the relinquishing of the transcendental in continental philosophy. Malabou is interested in genuinely abandoning the transcendental, and reads Meillassoux as retrenching it in his 2006 book *After Finitude*. While Meillassoux defines and critiques a persistent Kantian "correlationism" in continental philosophy that axiomatically prioritizes the synthesis of thinking and being, and subsequently maintains the inseparability of subjectivity and objectivity, he comes to define relinquishing the transcendental as canceling the priority of the synthesis over positing thinking and being discretely. This is not Malabou's understanding of it; to her.

To relinquish the transcendental implies a neutralization of the "proper" and of "property." To relinquish the synthesis amounts to admitting that the world is not our world, that the laws of nature are not those of our understanding. That we are not correlated to the world or nature in the first place means that they do not belong to us. (Malabou, 2014, p. 247)

Like Pickering, for Malabou there is a clear social aspect to this discussion of facticity and cognition. In her 2008 essay *What Should We Do with Our Brain*, she riffs on Marx in stating that "the brain is a work, and we do not know it," likewise that "the brain is a history." For Malabou, to take seriously the idea that "the transcendental is in the brain" is not to become a vulgar reductionist, but rather to recognize that the brain itself is historically engaged with its world – in other words, to shift from a representational to a 4E model, as her essay explains. Recognizing the historical condition of the brain in this instance is not a gesture towards mere social construction, but rather, much like Pickering's move to a performative idiom and its articulation of a dialectic of resistances and accommodations in the mangle, Malabou's intent to raise a "consciousness of the brain" is an attempt to raise a new political agency.

This sense of raising consciousness, while clearly influenced by a Kantian inheritance, incorporates some insights from 4E theory that make a meaningful difference in its theory of action. The field of cybernetics is often used as an example of an attempt to raise a new political agency that forewent Kantian humanist categories, and as mentioned it is of particular interest to Pickering (2010), who has written extensively on the subject. Separately, a history of the Cybersyn Project in the early 1970's in Chile has been authored by Eden Medina. That project, a collaboration between members of the socialist government of Salvador Allende and the British engineer Stafford Beer, marked the world's first attempt at a civilian national computer network. The aim was to design a system that facilitated the central, but still democratic, coordination of the entire Chilean economy. This involved data production and processing, interfacing between industry and government, and even the design of a futuristic control room, complete with large screens on the walls and a circle of sleek mid-century swivel chairs with control panels built into the arms. By design, the system was meant to foster democratic relations and socialist economics on the level of its very hardware – a "Liberty Machine." The project never came to full fruition, not least because of American intervention in the country leading to the destruction of the Allende government. But there were issues internal to Cybersyn that Medina (2011) notes in her concluding remarks: "...the history of Project Cybersyn shows that it is very difficult to make technologies that are capable of creating



and enforcing desired configurations of power and authority, especially if those configurations are radically different from those that preceded them” (p. 217). Beyond the geopolitical and economic exigencies, there were problems of labor relations, gender relations, manufacturing processes, computing power, and other issues related to the interplay of human and material agents on an immediate level. The cybernetic system envisioned by Beer and designed from scratch in collaboration with teams of Chilean scientists, engineers, and designers still could not quite engage in the “dance of agency” with the broader Chilean society without encountering stark resistances that the project did not figure out how to accommodate before its termination.

So what might serve as a counter-example to the Kantian humanist idea of public reason as the ideal political effort, if not cybernetics? As a final example, one could look to the project of Material Engagement Theory, as described by Lambros Malafouris in archaeology. There is less of an obvious political principle at work there, but rather a deeper reconsideration of the role of 4E theories not simply in reappraising material agency, but material culture more broadly in an archaeological, anthropological, and generally cultural sense. Malafouris (2013) defines the goal of MET in philosophical terms as a reorientation of the archaeological discipline in a new mode grounded in “relational ontology”: “The aim of MET is to restate the problem of the interaction between cognition and material culture in a more productive manner by placing it upon a new relational ontological foundation” (p. 35). MET still engages in “historical analysis of the relationships between our thought and our practices,” but “whereas the majority of studies in cognitive and evolutionary archaeology seem to be primarily preoccupied with questions about when and where (e.g., where and when symbolic thinking and language first appeared in the archaeological record), MET asks primarily about the what, the why, and the how – for example: What is symbolic thinking? Why and how did symbolism emerge?” (p. 38) In this way, MET seeks to apply an entirely new theoretical approach to questions of ‘mind’ to archaeology’s handling (and production) of the material record, based on its engagement with 4E. Malafouris makes use of primate brain studies, for example, to argue that the changing body-schema of the brain during tool use (detectable in laboratory tests) can be taken as an integration of the tool into the mind broadly speaking. In cases of artifacts like Mycenaean swords and signet rings, this lets him claim that “The centre of consciousness and bodily awareness for the Mycenaean person, and for the warrior in particular, is not some ‘internal’ Cartesian ‘I’, but the tip of the sword” (Malafouris, 2008, p. 122), or likewise that for early hominins, the seat of cognition may better be conceived as the hand rather than the head.

In having a body, humans are spatially located creatures. Embodied cognitive science has made a strong case for the fundamental role of bodily sensorimotor experiences in the structure of our thinking. Thus, for distributed cognition, space is not simply the passive background against which the activity unfolds; it is something that can be used as a cognitive artifact. ... although mental states can be “internal” in the traditional sense of inter-cranial representation, they can also be outside the individual (e.g., maps, charts, tools) and thus “external” to the biological confines of the individual. In other words, for distributed cognition “a cognitive process is delimited by the



functional relationships among the elements that participate in it, rather than by the spatial co-location of the elements. (Malafouris, 2013, p. 67)

This idea of cognition deliberately overcomes the Kantian (and Newtonian) bifurcations of space and time. It is closer to Foucault's idea of power-knowledge and an analysis of force relations than traditional archaeology, but like Pickering it takes a much more comprehensive view of the sub-individual constituents of cognition. Returning to Harvey's terms, one could say that MET's cognitive archaeology overcomes the relevant theoretical opposition between environmental determinism and possibilism in Kant, fundamentally that between inner and outer knowledge, by redefining tool use and its relationship to the mind. It also effects a transformation of the historical subject in so doing, again setting itself into parallels with Foucault: "Power, intentionality, and agency are not properties of the isolated person or the isolated thing; they are properties of a chain of associations" (Malafouris, 2013, p. 129).

In this way, Malafouris can be understood to extend the performative idiom to archaeology, a holdout of the representational idiom – and not coincidentally, a discipline joined at the hip with anthropology, a field of special interest to Kant. With the way MET introduces a 4E-based reconfiguration to the field, the humanist myth can be more fully decomposed, as its anthropological basis is removed.

CONCLUSION

I have not offered a prescription for any particular political statement here, but rather a consideration of how new work on material agency, informed by 4E theories of cognition, can help move beyond the persistent Kantian-Enlightenment myth of political speech. That myth is based on an ideal interaction between an individual appearing as scholar and a reading public, as told by Kant. The myth poses substantial problems today. These figures and their relation in Kant are based in an outmoded, Newtonian model of space and time that in turn informs an outmoded view of cognition. Moreover, the ontology presumes their existence prior to their relation. While major critics of Kant have succeeded in addressing some of the issues inherent in that model of political speech, even Foucault falls back into the myth when confronted with the challenge of analyzing events like the Iranian revolution. Subsequently, newer work on material agency and 4E cognition can provide a supplement that allows one to decompose the myth fully, by means of a comprehensive account of what Foucault vaguely gestures towards as the "non-discursive," "sub-individual" forces of social and political life. This can then effect a modal shift in political thinking from a rationalist politics of communication, in which the ideal effort is to exercise public reason through printed matter, to a posthumanist politics of material agency, in which one can understand political effort as the participation in a dialectic of resistance and accommodation. Both resistances and accommodations can take the form of material agents, including technologies. As the reading public is increasingly located in virtual spaces populated by anonymous accounts, governed by algorithmic sorting, and now monitored, mimicked, and directed by "artificial intelligence" systems, in practice the Kantian mythical figuration, the scholar and his audience, has already been well undermined in practice. The challenge for theory,



then, is to understand political speech in this new context by engaging directly with the agencies that constitute it, abandoning for good the pretense of zero-point discourse and giving up the ghost of purely effective published reason.

One might object: Does this not precipitate a determinism? If public discourse itself is viewed as merely one dialectic of resistance and accommodation among others, what becomes of the possibility of actually effective speech? To reiterate, my analysis does not discount the latter possibility, but contests its ideal status while revealing its deep entrenchment to be a cause of real methodological issues. The issue of determinism is an important concern of its own, but in brief here, I would suggest that the specter of determinism is itself a product of the Kantian bifurcation of internal and external. What is the specter of determinism except the total subsumption of the former by the latter? I would then point to a grim finding of recent public health research, that our bodies seem increasingly to be contaminated with microplastic particles, including our brain matter (Nihart et al., 2025). Would this intrusion, in more concrete as opposed to theoretical terms, not constitute a determinism of its own, if determinism is the intrusion of the external on the internal? With what words could we possibly engage with the plastic in our brains? What scholarship could possibly expel it? It is a great irony that precisely what are called plastics pose the most immediate danger to our brain plasticity. That is an example of real, concrete determinism. To draw on theories of 4E cognition, to recognize material agency, is to take crucial steps to overcome this kind of newly revealed problem, not least by becoming able to raise a consciousness of what powers are at work in it. The brain of the scholar is also the brain of microplastics – so who says what? By effecting the necessary theoretical shift towards a new idea of political speech, taking account of material agency, understanding cognition through 4E theories, one can begin to answer.

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