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Posthuman Fatalism and the Reconstruction of Science and Technology Ethics Education

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Abstract: "Posthuman fatalism" describes an emerging social, cultural, and philosophical reality in which technological systems are no longer merely external tools, but have become internalized and autonomous environmental forces that profoundly shape or even determine human cognitive patterns, value judgments, and future evolutionary paths —subjecting human "free will" to an unprecedented crisis of dissolution. When confronting this fatalistic trend, science and technology ethics education falls into the dual dilemma of "radical acceptance" and "conservative prevention." Critical reflection on current practices in science and technology ethics education reveals the ineffectiveness of the binary oppositional thinking framework. Based on this, future science and technology ethics education must transcend the simple "acceptance/prevention" dichotomy and shift toward a "critical navigation" model aimed at reconstructing "limited free will." The core of this education is not to resist fate but to cultivate agency within "fate acceptance" — that is, by acknowledging technology's enormous influence, to carve out a meaningful and dignified space for existence within the new reality of human-machine coexistence through in-depth self-awareness, interdisciplinary ethical speculation, and practical wisdom.

Keywords: Posthuman fatalism; Science and technology ethics education; Free will; Cognitive cycle; Fate acceptance

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1. Introduction

With the accelerated integration of disruptive technologies such as artificial intelligence, gene editing, and brain-computer interfaces, humanity is being drawn into a profound ontological transformation on an unprecedented scale. "Posthuman fatalism" refers to a type of "technological fatalism" rooted in algorithms, data, and network architectures. Cloaked in the critical perspective of posthumanism, it deconstructs the traditional humanist subject, yet builds a cognitive cage dominated by technological logic, one that seems free but offers no escape, amid the ruins [1]. It marks a bizarre cycle in the human cognitive narrative: after spending thousands of years breaking free from an animality constrained by natural laws and briefly touching "god-like" power, humanity may once again return to a new form of "animality," that of a "digital animal" domesticated by the technological environment, fed by algorithmic logic, and responding unconsciously to data stimuli.

Posthuman fatalism reflects humanity's profound anxiety about a potential logical endpoint in the current trajectory

of technological development. It depicts the ultimate paradox: while humanity acquires "God-like" technological power, it may end up becoming a slave to its own creations. Faced with this risk of a cognitive cycle, "from animal to God, then back to animal," this paper aims to explore two questions: How can we theoretically conduct an in-depth analysis of the theoretical construction of "posthuman fatalism"? And how can we, in practice, through the "reconstruction of ethics education," cultivate a new generation of digital citizens who can embrace technological potential while maintaining vigilance over their subjectivity, and ultimately achieve "critical acceptance" rather than "blind submission" to fate? This is not merely an academic issue concerning technological development, but a fundamental epochal question that determines the future direction of human civilization.

2. Theoretical construction of posthuman fatalism

When re-examining the relationship between technology and human society, it can be found that an unsettling paradigm shift is quietly taking place. The classical technological determinism that sparked intense debates in the 20th century, namely, the view that technology exists independently of society and drives historical progress as an almost autonomous linear force, is facing unprecedented challenges to its explanatory power, which is gradually dissipating [2]. The specter of traditional technological determinism, along with the subject-object dualism framework it relies on, still lingers in academic discourse, yet it can no longer capture the true texture of technological penetration in our era. Its core flaw lies in presupposing an "external technology," clearly identifiable outside the human subject, as the "primary driving force" of change. Today, however, technology is no longer a distant horizon; it is the air we breathe. It is not the ship we sail in, but the ocean we are immersed in.

To more accurately depict this emerging reality, this paper proposes the concept of "posthuman fatalism." This is not a simple revival or modification of traditional determinism, but a diagnostic framework whose theoretical core has undergone a fundamental transformation. It can be defined as a form of determinism characterized by "involution" and "ecologization." Within this framework, the deterministic power of technology no longer manifests as an exogenous, revolutionary "impact," but transforms into an endogenous, diffused "shaping." Technology is no longer an external lever for promoting social change; it has evolved into the "ecosystem" of human existential conditions itself, an all-encompassing "techno-biological complex" constructed by algorithms, data streams, intelligent interfaces, and biotechnology.

The profundity of this transformation lies in the fact that human cognitive paradigms, desire structures, social relationships, and even biological foundations have become deeply embedded in, domesticated by, and reconstructed by this omnipresent technological ecosystem. The source of deterministic power has dramatically shifted from "external impetus" to "internal generation." The mechanism of this "internal generation" can be extremely clearly explained through the theoretical lens of post-phenomenology. Post-phenomenology emphasizes that technology is not a transparent medium between humans and the world, but actively participates in and reshapes our experiences, perceptions, and actions [3]. When we perceive the world through smartphones, the phone is not merely a channel for information; its interface design, algorithmic recommendations, notification pushes, and other features actively "mediate" and "co-construct" our understanding of and interaction with reality. It is this ubiquitous technological mediation that forms the "ecologica" foundation of posthuman fatalism. In this technological ecosystem, human free will is not stripped away by a powerful external force, but is guided, shaped, and dissolved in countless micro-level, continuous, technology-mediated practices. The choices we make seem free, yet the scope of these choices, the ordering of options, and even the desire to choose itself have been predetermined and optimized by the algorithmic environment. This leads to the second core characteristic of posthuman fatalism: "involution."

The concept of "involution" was first used by anthropologist Clifford Geertz to describe a social or cultural model that, after reaching a specific form, cannot achieve qualitative breakthroughs and can only engage in endless, refined, and diminishing-marginal-return complexity within its internal structure. We creatively apply this concept to the critical analysis of contemporary technological determinism. If traditional technological determinism still carries a teleological

optimism or pessimism toward a "more advanced" social form, posthuman fatalism reveals a more paradoxical dilemma: the development of the technological ecosystem no longer promises a new utopia or dystopia, but locks us in a closed loop of self-proliferation.

For example, the algorithmic iteration of social media platforms does not aim to lead humanity into a higher-dimensional communication model, but rather engages in infinite internal optimization and refined competition within the framework of the existing "attention economy," through more precise user profiling and more addictive interaction design. Driven by this "involution," the technological system seems to be developing rapidly (with increased computing power and expanded models), but in essence, it engages in "stock competition" within a solidified paradigm, constantly reinforcing existing logic rather than opening up new possibilities. As nodes in this system, humans are forced to participate in this endless optimization race; we must constantly update our digital identities, learn new platform rules, and respond to algorithmic "discipline". Our agency is consumed by adapting to the increasingly complex but non-qualitatively changed system itself, rather than being used to imagine and construct an entirely different system. This is an endless, self-circulating fate, a futile process of constant "intensive cultivation" within the technological cage that never achieves liberation.

In summary, posthuman fatalism depicts a picture: technology has transformed from an external, linear, deterministic force into an ecosystem that completely envelops and penetrates humanity. Within this system, determinism no longer originates from grand historical narratives, but is continuously generated at the micro-level through "technological mediation" in the post-phenomenological sense. Moreover, this generative process exhibits the characteristic of "involution," infinite self-replication and refinement within a closed logical loop, ultimately leading to the hollowing out of human subjectivity. This is a more subtle, harder-to-detect, and thus more solid form of determinism. It no longer requires an external "determinant," because each of us has already become a conspirator and prisoner of this self-determining system. The philosophical analysis of this new type of fatalism is the starting point for us to understand the dilemma of free will in the posthuman era.

3. Core dilemmas of science and technology ethics education

In the field of technological ethics discussions, the Hamlet-like question "Should we accept or prevent a certain technology?" has almost become the starting point for all public debates and policy-making. It presupposes a clear, external, and selectable "technological object," as well as a "human subject" with absolute autonomy who can calmly make decisions on the bank of the technological river. However, when we adopt an interdisciplinary perspective from philosophy and social sciences and turn our attention to the foundations of existence, the boundaries of knowledge, and the realities of educational practice, this seemingly solid binary opposition dissipates like a mirage. This section will demonstrate from the ontological, epistemological, and practical levels that "acceptance/prevention" is not only an inefficient question, but also a misleading pseudo-question that must be deconstructed.

3.1. Ontological dissolution: The illusion of choice lost in the "posthuman ocean"

The ontological presupposition of the question "accept or prevent" is that humans and technology are two clearly separable, independent entities. However, posthumanist thought has long revealed the falsity of this presupposition. We are not judges standing outside technology; we ourselves are products penetrated, shaped, and even constituted by technology. As Donna Haraway stated in her pioneering Cyborg Manifesto, we have long been "cyborgs," hybrids of organisms and machines, where the boundary between nature and artificiality has long been blurred [4]. From pacemakers to smartphones, from gene editing to social media algorithms, technology is no longer merely an "external tool" that extends our senses, but has become a "built-in prosthesis" that reshapes our identity, social relationships, and physiological functions.

Our relationship with technology has become a deep, ontological "entanglement". The co-evolution of technology and humans constitutes an inseparable symbiotic reality. In this context, discussing "whether to accept technology" is like a

fish discussing "whether to accept water," the question itself has lost its premise of validity. We have long been breathing, perceiving, and existing in the "posthuman ocean". Anthropologist Gregory Bateson used the cane in a blind person's hand to metaphorize this extension: when a blind person skillfully uses a cane to navigate, the boundary of their self-perception has extended to the tip of the cane. Similarly, our cognitive boundaries, emotional boundaries, and even ethical boundaries have long extended to the algorithms, networks, and intelligent devices we rely on.

Katherine Hayles further points out that "how we became posthuman" is not a future choice question, but a historical process that has already occurred [5]. The development of information technology has liberated "information" from the constraints of the body and reconstructed our definition of "human". Therefore, the primary task of science and technology ethics education is not to futilely build a wall to "keep technology out", but to cultivate a "deep-sea navigation skill" that transcends anthropocentrism, acknowledging our fate of symbiosis with technology, and learning to navigate consciously and responsibly in this increasingly complex network composed of both human and non-human actors [6]. When we realize that we are already "techno-humans", the binary opposition of "acceptance/prevention" collapses ontologically. In its place emerges a more challenging question: What kind of "techno-humans" do we want to become?

3.2. Epistemological dissolution: Predicting the future in the midst of "emergence"

The binary choice of "acceptance/prevention" implies a second fatal assumption: we can clearly predict the long-term impact of technology and thus make rational, controllable choices. This Newtonian, deterministic view of the future is utterly powerless in the face of contemporary complex technological systems, especially artificial intelligence. The evolution of technology is not a linearly unfolded blueprint, but a chaotic process full of complexity, emergence, and profound uncertainty.

"Emergence" is the core concept for understanding this dilemma. It refers to the phenomenon in complex systems where the interaction of simple rules at the low level spontaneously generates complex behaviors or attributes at the high level that are new and cannot be predicted by simply summing up individual parts. The "intelligent" behavior of large language models, the formation of public opinion storms on social networks, and the strange "gait" of autonomous driving systems on real roads are all typical emergent phenomena. These behaviors are not precisely coded by programmers, but "emerge spontaneously" from the interaction of massive data and complex algorithms.

The world's first fatal autonomous driving accident caused by the Tesla Autopilot system in 2016 is a painful epistemological lesson. In the accident, the vehicle's sensor system failed to distinguish between the white truck cabin ahead and the bright sky under intense sunlight, ultimately leading to the tragedy. This was not a simple program loophole, but a typical "corner case," an emergent failure co-generated by complex environmental factors and inherent system limitations that could not be foreseen during the design and testing phases [7]. Similarly, the 2018 incident in which an Uber autonomous vehicle killed a pedestrian also exposed AI's cognitive blind spots and decision-making errors in atypical scenarios.

These cases eloquently prove that both "complete acceptance" and "total prevention" are based on an "epistemological arrogance" toward the future. We cannot exhaust all possible interaction scenarios, nor can we fully open the "black box" of deep learning to completely understand its decision-making logic. Therefore, any attempt to "prevent" all risks once and for all is doomed to failure, and any optimism about "fully accepting" technology based on its current performance is no different from "touching the elephant blindfolded". The future of technology is shrouded in impenetrable epistemological mist. The goal of ethics education should not be to distribute crystal balls or predict the future through divination, but to cultivate the ability to coexist with uncertainty, a practical wisdom to dynamically correct our relationship with technology through continuous trial and error, reflection, adaptation, and adjustment.

3.3. Practical dissolution: The failure of "moral vaccination" and the call for an integrated framework

Finally, when we shift from philosophical speculation to the real soil of educational practice, the binary framework

of “acceptance/prevention” also reveals its barrenness and ineffectiveness. Traditional science and technology ethics education often adopts a “prevention-oriented,” single-dimensional model. This model usually takes the form of offering an independent “compulsory ethics course” focused on theories and cases, in addition to professional technical courses. The underlying logic of this approach is to provide future engineers and scientists with “immunity” to technological risks through a one-time “moral vaccination.”

However, a large number of educational studies and practical experiences show that this model is largely ineffective. Research indicates that merely taking an independent ethics course has almost no observable significant impact on changing students’ ethical decision-making behaviors in real technological practices. Students may talk eloquently about the “trolley problem” in class, but when writing code, designing products, or processing data, they still regard ethical considerations as secondary “external constraints” that even conflict with technical efficiency. A study on the ACM (Association for Computing Machinery) Code of Ethics even found that explicitly reminding developers to refer to the code in their decisions produced no behavioral difference compared to the control group. This is undoubtedly a heavy blow to the traditional ethics education model.

This dilemma of “separation between knowledge and action” precisely reflects the limitations of the “prevention” logic. It treats ethics as a “prohibition list” that needs to be passively followed, rather than an “internal compass” that needs to be actively integrated into the process of technological creation. In contrast, a more forward-looking educational framework is emerging, which dissolves the opposition between “acceptance/prevention” and shifts toward an integrated, dynamic, and contextualized new paradigm. For example, Harvard University’s pioneering “Embedded Ethics” program no longer offers independent ethics courses; instead, it directly assigns ethicists and philosophy doctoral students to core computer science courses, where they co-design and teach courses with technical instructors. In this model, discussions on data privacy are integrated into database courses, analysis of algorithmic bias is incorporated into machine learning teaching, and reflections on the social impact of technology run through the entire software engineering project.

The success of this integrated framework lies in its revelation from the practical level that “acceptance/prevention” is a pseudo-question. It neither blindly “accepts” all possibilities of technology nor attempts to “prevent” risks through external rules. Instead, it internalizes ethical speculation as a core link in technological design and development, cultivating students’ ability to engage in critical thinking and responsible innovation in specific, complex technological contexts [8]. This is a “third path” that transcends simple binary choices, which requires us to face the reality of human-technology symbiosis (ontology), embrace the uncertainty of the future (epistemology), and jointly shape a more promising future through continuous practice and reflection.

4. Reconstruction of science and technology ethics education

Today, we dwell in a technological ecosystem woven together by algorithms, data streams, and intelligent agents. This system is no longer a toolbox external to human society, but has evolved into an all-encompassing “second nature.” Against this backdrop, the deep symbiotic relationship between humans and technology, as revealed by posthumanist thought, compels us to re-examine the core of human agency, free will. The absolute, autonomous, and externally undetermined pure rational freedom advocated by traditional Enlightenment thought, particularly in Kantian philosophy, faces unprecedented challenges. When our preferences are precisely shaped by recommendation systems, when our decision-making paths are subtly guided by user experience design, and when our cognitive boundaries are invisibly confined by information cocoons, claiming an absolute free will that exists independently of the technological environment is nothing short of a Don Quixote-like fantasy. This raises a fundamental educational question: If “posthuman fatalism” is the recognition that technology’s enormous shaping power over human cognition and behavior has become an irreversible fate, is the backdrop of our era, then what should be the core goal of science and technology ethics education? The answer lies neither in desperate abandonment nor blind resistance, but in shifting toward cultivating a more resilient and practical form of agency: “limited free will” that navigates skillfully within the technological ecosystem.

4.1. Redefining "free will": From absolute autonomy to the wisdom of "dancing with shackles"

Free will in the posthuman context must step down from the lofty altar of Kantian "starry sky and moral law" and enter the muddy waters of human-machine symbiotic reality. It is no longer a transcendent, atomized individual attribute, but a relational, contextualized practical ability. As the "cyborg" concept proposed by posthumanist theorist Donna Haraway reveals, the boundary between humans and machines has long been blurred; we are all hybrids of technology and flesh [9]. Therefore, the practical field of free will must inevitably be within the network composed of both human and non-human actors (such as algorithms and intelligent devices).

On this basis, we can define "limited free will" as a comprehensive ability to engage in conscious choice, critical reflection, and personalized meaning-making (i.e., "dancing"), under the premise of clearly recognizing the enormous shaping power of technological systems (i.e., the "shackles"). The "limitation" of this will manifest in three dimensions: first, the finitude of choices—individuals cannot choose whether to enter this technological ecosystem, and the set of options itself has been largely predetermined by technological architecture; second, the finitude of information—individuals can never fully grasp all the data and algorithmic logic that drive decisions, and information asymmetry is the norm; third, the finitude of cognition, an individual's cognitive framework is continuously shaped and revised through interaction with technology. However, "limited" does not equal "non-existent". As emphasized by Self-Determination Theory, even under external constraints, the perception of autonomy remains key to stimulating intrinsic motivation and achieving mental health. Thus, the core of "limited free will" is not to break free from the "shackles," but to understand the material, structure, and operational mechanism of the "shackles," and on this basis, explore the infinite possibilities of dancing. This is a kind of wisdom that "understands fate" rather than "submits to fate": it internalizes the deterministic power of technology from an oppressive external fate into background parameters that must be considered in individual actions, thereby regaining agency through acceptance.

4.2. Transformation of educational goals: From inculcation of ethical principles to cultivation of practical wisdom

If the definition of free will has changed, then the goal of ethics education aimed at nurturing it must also undergo a profound "Copernican revolution." Traditional science and technology ethics education often focuses on imparting a set of ethical principles and codes of conduct that dictate "what should be done" and "what should not be done." This model becomes increasingly rigid and ineffective when facing emerging technological ethical dilemmas of diverse contexts. For example, regarding the ethical configuration of the "trolley problem" for autonomous vehicles in emergency situations, any preset moral algorithm can hardly exhaust the complexity and moral ambiguity of all real-world scenarios. The goal of education should not be to provide students with a "map of standard answers" to address all future problems, but to equip them with a "critical navigator" that enables them to identify directions even in uncharted territories.

The core of this "navigator" is precisely the "phronesis" (practical wisdom) proposed by Aristotle. Different from theoretical knowledge and technical skills, it is an ability to make prudent judgments and take actions consistent with "the good" in specific, uncertain situations filled with value conflicts [10]. It requires actors to not only understand universal ethical principles but also keenly perceive the uniqueness of specific contexts, weigh various conflicting values, and ultimately make the most appropriate moral choices. This is precisely the core manifestation of "limited free will" in the ethical field: using wisdom to judge and act in complex technological contexts where there is no single correct answer. Therefore, the goal of science and technology ethics education must shift from the transmission of knowledge to the generation of wisdom, i.e., from "principle-centered" to "context-centered"; from "cognitive education" to "holistic education"; from "individual responsibility" to "systemic criticism."

In summary, in the face of the fatalistic landscape of the posthuman era, the way out for science and technology ethics education lies in reorienting its core goal. It no longer futilely pursues an impossible absolute freedom, but is committed to carefully nurturing a resilient and clear-sighted "limited free will" within the tight web of technology. By shifting the focus of education from inculcating rigid ethical principles to cultivating dynamic practical wisdom, we can empower the next

generation to become critical navigators who can deeply understand technological fate while forging a path of freedom and meaning within it, truly learning to "dance gracefully with shackles" in this era.

4.3. Reconstruction of the teacher's role: From "the sage on the stage" to the "ethical companion"

Today, as posthumanist thought sweeps across society, the methods of knowledge production, dissemination, and verification are undergoing a paradigm-shifting earthquake. Knowledge is no longer static truth encapsulated in textbooks, but a fluid, ever-changing form co-woven by humans, algorithms, databases, and global networks. Against this backdrop, the traditional role of teachers as "the sage on the stage," a role rooted in the Enlightenment era, has its foundational basis for existence being undermined at its core. When students can turn to any large language model for "standard answers," the very value of teachers' existence faces an unprecedented ontological crisis. If educators continue to cling to their identity as mere knowledge transmitters, it is equivalent to embracing an isolated island doomed to be submerged in the digital torrent. Educational relationships from a posthumanist perspective, by contrast, demand that people should break down the rigid hierarchical boundaries between teachers and students and establish a new, equal interactive relationship [11].

Reconstructing the teacher's role, shifting from "the sage on the stage" to the "ethical companion," is by no means a mere adjustment of educational strategies in the posthuman era; it is essentially a profound cultural shift and ethical practice. It proactively responds to the widespread sense of fatalism brought about by the accelerated evolution of technology, and shifts the focus of education from the passive question of "how to better adapt to technology" to the active, agentic philosophical inquiry of "what kind of world we hope to co-create with technology." In this great historical process, teachers are no longer craftsmen on an industrial assembly line shaping "qualified citizens," but partners who jointly face uncertainty and share the responsibility of existence with the next generation. Through their own practice, they demonstrate to students a new kind of wisdom of existence: while clearly acknowledging the limitations of human cognition and the partial fatality of technological development, they refuse to abandon the freedom of ethical choice and the fundamental responsibility of being human. This kind of critical navigation based on "Fatalistic Acceptance" is precisely where the ultimate value of science and technology ethics education lies.

5. Conclusion

At the intersection of the twilight of the Anthropocene and the dawn of the Technological Epoch, a profound paradigm shift has already been accomplished. The core of this shift is not the commotion of yet another industrial or information revolution, but a quieter yet more subversive ontological reset. A form of "Posthuman Fatalism" is on the rise; it is not a mere copy or pessimistic variant of traditional Technological Determinism, but a sober understanding of the reality of human-technology symbiosis. This sense of fatalism stems from the fact that technology is no longer a cold object or neutral tool external to the subject; instead, through algorithms, data streams, and ubiquitous intelligent interfaces, it has become an internal environment that shapes human cognition, desires, and even the very structure of existence. It is a diffuse, subjectivity-shaping ontological force. This reality has rendered the binary oppositional discourse of "embrace/resist" or "accept/prevent," which has persisted in science and technology ethics education to this day, nothing but intellectual laziness and practical ineffectiveness. Such discourse cannot capture the complex reality of mutual penetration and co-evolution between humans and technology, nor can it provide an effective mental map for the human subject, who is increasingly disoriented amid algorithmic black boxes and virtual reality. Therefore, the future-oriented landscape of ethics education must transcend this rigid either-or framework. Its mission is no longer to futilely "confront" technology or blindly "surrender" to it, but to unfold an active and resilient intellectual and moral practice on the basis of a profound "Fatalistic Acceptance."

Disclosure statement

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