

Three Dimensions of Techno-Ethics from the Perspective of Philosophy of Technology

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Abstract

Current approaches in techno-ethics, typically grounded in normative ethics, often reduce the field to the application of abstract and delayed ethical principles, limiting their capacity for effective critique of technological practices. This paper draws on postphenomenology, the model of skill acquisition, and the philosophy of cosmotechnics to critique both the limitations of normative approaches and the partial achievements of moral materialisation theory. While moral materialisation, inspired by postphenomenology, bridges the technology-morality divide at the level of concrete action, it can homogenise technological regulation. To address this, we propose a three-dimensional framework: (1) moral materialisation at the behavioural level (postphenomenology), (2) the cultivation of virtue at the individual level based on the model of skill acquisition, and (3) technological-moral diversity at the cultural level rooted in cosmotechnics. These interrelated levels reveal the mutual constitution of technology and morality, establishing a techno-ethical research framework that is both theoretically robust and practically applicable.

Keywords: Ethical norms, Technological Mediation, Moralising Technology, the Model of Skill Acquisition, Cosmotechnics

The unprecedented expansion of science and technology in contemporary society has not only transformed human life but also raised profound ethical questions about how technology shapes, constrains, and enables moral experience. Mainstream techno-ethics, dominated by normative and regulatory perspectives, often encounters significant challenges in addressing the concrete and complex interactions among technological artefacts, social practices, and moral values. Within the fields of philosophy of technology and ethics, there is growing recognition that the mere application of universal ethical norms fails to capture the multi-dimensional and locally embedded nature of techno-ethical issues. Against this background, this study draws on recent developments in the philosophy of technology to establish an organically interconnected, three-dimensional theoretical framework for techno-ethics, encompassing the dimensions of materialising morality, virtue acquisition, and technological-moral diversity.

This paper first critically examines the limitations of normative approaches that reduce techno-ethics to a branch of applied ethics. Building on this critique, it proposes a three-dimensional framework: the first two dimensions—materialising morality at the behavioural level and virtue acquisition at the individual level—focus on the ontic sphere, respectively addressing how specific technologies mediate immediate ethical actions and how stable technical environments shape the diachronic cultivation of individual virtues, allowing for the transcendence of behavioural homogenization. The third dimension, technological-moral diversity, shifts toward the ontological sphere by emphasising that the co-constitution of technology and morality is always grounded in distinctive cultural forms of life. Here, diverse cultures generate plural modes of technology-morality interaction, providing the ultimate foundation and aim for the previous two dimensions. These dimensions are closely interrelated: behavioural and personal formation processes rely upon, and in turn reshape, shared cultural-ontological horizons. Thus, this framework is meant not only to enrich theoretical debates but also to offer practical insights for critically guiding technological development in a multiplicity of social and technological landscapes.

1. Critique of Technology Ethics as Applied and Normative Ethics

Contemporary research in technology ethics often operates—frequently unconsciously—on two fundamental premises. The first is that ethical reflection chronically lags behind technological innovation. The second is the assumption that technology ethics is simply a branch of applied ethics,¹ which treats scientific and technological innovation as mere objects of existing ethical rules. Implicit in these premises are two further positions: (1)

1 Maarten Franssen, Gert-Jan Lokhorst, and Ibo van de Poel, “Philosophy of Technology.” *Stanford Encyclopedia of Philosophy*, March 6, 2023. <https://plato.stanford.edu/archives/spr2024/entries/technology/>.

that technology and ethics are conceptually separable; and (2) that ethics consists, above all, in the construction and justification of normative codes and principles.² Any serious inquiry in technology ethics must begin by subjecting these assumptions to critical scrutiny.

1.1 Philosophical Critique of Normative Ethics as Foundation

From a philosophical perspective, normative ethics—especially when taken as the ultimate foundation for technology ethics—fails to justify its own legitimacy. It is important to clarify that “normative ethics” here refers to frameworks where prescriptive rules are the main foundation for regulating technological conduct. On the surface, ethical norms dictate how we “ought” to act, while implicitly denying the legitimacy of questioning whether we in fact ought to act as such. Yet anyone may question the obligation to comply. When challenged, normative ethics appeals to higher, more abstract rules for justification, but as Zhao argues, “[a]ny norm, whether specific or general, is equally weaker than a sceptical attitude, which means we can always distrust it.” He thus concludes that the “fundamental error of normative ethics is directional.”³ Thus, normative ethics ends up concealing the need for any philosophical basis for ethical rules and falls into the trap of using rules to explain rules, resulting in an ineffective circularity.

Further analysis shows only two possible foundations for such rules: religion and society. From the “religion” perspective, norms derive their validity from the existence of God—a framework which has lost traction since the Enlightenment, eventually replaced by the myth of reason (“anthropotheism”). But both rely on myth rather than critical philosophy, resulting in heightened abstraction and a distancing of ethics from practical life. The “society” perspective, in turn, defines morals as outcomes of social games and mechanisms, fixating on order and quantification.⁴ Such an approach secularizes and formalizes ethics, reducing it to a mere support for modern order and making it vulnerable to political or sociological intervention.⁵ As a result, rule-based ethics always trails real change, reinforcing the view that “ethics lags behind technology.” In short, ethical rules either become abstracted from reality due to mythic origins, or congeal into fixed systems that are outdated. Both are ill-equipped to address concrete technological or social problems. As such, normative ethics is exposed as abstract, delayed, and precarious in its epistemic claims when used as the ultimate subject or standard in technology ethics.

Zhao traces the core error of normative ethics to its epistemological or religious

2 Zhao Tingyang, *On Possible Life* (Beijing: SDX Joint Publishing Company, 2024), 1.

3 Zhao Tingyang, *On Possible Life*, 2.

4 Zhao Tingyang, *On Possible Life*, 7–10.

5 Zhao Tingyang. “Ethical Confusion and the Confusion of Ethics,” *Morality and Civilization*, no. 3 (2020): 7.

orientation to life's problems.⁶ The rule-based, Cartesian approach—already critiqued in light of the failures of symbolic AI—faces persistent challenges in areas such as robot ethics. These problems indicate that ethical norms should not rest on theological or rationalist myth, nor serve merely to maintain social order. Historically, the justification of ethical codes has always been rooted in foundational forms of life, cosmological or ontological understandings—a context in which even “knowing” or “religious” attitudes are ultimately embedded.

1.2 Historical Critique of the Technology-Ethics Divide

The division between “technology and ethics” is, from a historical perspective, a recent development arising in the early modern era, which facilitated the advent of normative ethics. In pre-modern Western thought, natural inquiry and moral cultivation were intertwined: philosophers viewed the moral order as embedded in the cosmos, so that all scientific research belonged within the domain of ethics.⁷ Socrates, for example, believed philosophy aimed at personal transformation, and late antiquity further blurred the boundary between scientific, ethical, and religious concerns. Even for Christianity, the “true philosophy” was first a way of life, from which norms and systems emerged later. Thus, the efficacy of ethical norms depended on their embeddedness in a form of life or worldview.

With the advent of modernity, the cosmos was stripped of immanent value, becoming a mechanical, infinite object for knowledge rather than meaning. Natural inquiry was decoupled from personal virtue, and “science” and “religion” changed from inner qualities to external systems of doctrine or law. This shift led to the displacement of arete (virtue) by codified behavioural norms. According to McDowell and Taylor, the internal dimension of virtue was replaced with conformity or external progress, accompanied by the rise of “disciplinary society.” Sigrid Müller demonstrates that the early modern era witnessed a paradigmatic shift from virtue ethics to normative ethics, with virtue and self-cultivation marginalised in favour of legalistic normativity.⁸

The result was a normative ethics incapable of self-legitimation. As MacIntyre remarks, “the inherited, if partially transformed rules of morality have to be found some new status, deprived as they have been of their older teleological character and their even

6 Zhao Tingyang, *On Possible Life*, 22.

7 Peter Harrison, *The Territories of Science and Religion* (Chicago: The University of Chicago Press, 2015), 27.

8 Sigrid Müller. “From Virtue Ethics to Normative Ethics? Tracing Paradigm Shifts in Fifteenth-Century Commentaries on the Nicomachean Ethics,” in *Between Creativity and Norm-Making*, eds. Sigrid Müller & Cornelia Schweiger (Leiden: Brill, 2013), 9–30.

more ancient categorical character as expressions of an ultimately divine law.”⁹ Modern systems—deontology and utilitarianism—failed to escape the pitfalls of epistemology or “quasi-religious” rationalism identified by Zhao. The technology–ethics divide led to two major problems:

(1) Technology, freed from ethical constraint, advanced through calculation and logic, obscuring “all of the questions that were raised about modernity”¹⁰, reinforcing the claim that “ethics trails technology”.

(2) Calculative thinking gradually became what we understand as “rationality,” that is, a form of technological rationality, taking precedence over other ways of thinking,¹¹ and became “the condition of all conditions, the principle of all principles,”¹² naturally encompassing even the normative ethics of epistemology or religious attitudes.

As Weber noted, “we can in principle control everything by means of calculation... Instead, technology and calculation achieve our ends.”¹³ Thus, the ethics–technology divide, rooted in modernity, produces an ethics unable to critique or guide technological development.

This impotence of ethical critique in the face of technological advance has resulted in the acute environmental and existential crises of the Anthropocene, and calls the presumed status of technology–ethics separation into question. It is therefore necessary to reflect further on the premise that technology ethics should be a mere branch of applied ethics.

1.3 Critique of the Positioning of Technology Ethics

Positioning technology ethics as simply an applied branch of general ethics implies that every technological domain warrants its own immediate application of ethical rules. This leads to a proliferation of subfields—AI ethics, data ethics, robotics ethics, and so on—often characterized by conceptual overlap, redundancy, and little cross-field dialogue.¹⁴ Critics argue that such fragmentation encourages intellectual isolation and repetitive labor, as core issues like privacy or autonomy are reinvestigated independently in each domain.

9 Alasdair MacIntyre, *After Virtue* (Indiana: University of Notre Dame Press, 2007), 62.

10 Michael Allen Gillespie, *The Theological Origins of Modernity* (Chicago: The University of Chicago Press, 2008), 7.

11 Andrew Feenberg, “What is Philosophy of Technology?” in *International Handbook of Research and Development in Technology Education*, eds. Alister Jones and Marc J. de Vries (Leiden: Brill, 2009), 159.

12 Yuk Hui, *The Question Concerning Technology in China: An Essay in Cosmotechnics* (Falmouth: Urbanomic, 2016), 196.

13 Max Weber, *Science as a Vocation* (Indiana: Hackett Publishing Company, 2004), 13.

14 Henrik Skaug Sætra and John Danaher, “To Each Technology Its Own Ethics: The Problem of Ethical Proliferation,” *Philosophy & Technology* 35, no. 4 (2022): 17.

While some urge a return to more general theory, others—such as postphenomenologists—defend this specificity, suggesting each technology’s unique mediations require specialized analysis.¹⁵ Ultimately, both views presuppose that technology ethics is a form of applied ethics; hence, objections to proliferation are themselves insufficient.

Fundamentally, the issue pivots on whether technology ethics is best seen as a domain for the application of ready-made norms, or as the critical interpretation of forms of life shaped by technology.¹⁶ In the philosophy of technology, Hans Jonas and early Carl Mitcham stand out as representative defenders of normative ethics. Jonas’s *The Imperative of Responsibility* articulates an obligation-centered ethics that formulates a universal principle to regulate the moral use of technology. Likewise, in *Thinking through Technology*, Mitcham adopts a humanistic and evaluative stance that presupposes the external application of ethical norms to technological practices. More generally, the analytical and engineering-philosophical traditions—exemplified by scholars such as Joseph Pitt and Ibo van de Poel—tend to support rational, principle-based frameworks for ethical assessment. Policy-oriented approaches to techno-ethical research, such as those emerging from responsible innovation and technology governance discourses, often unreflectively treat technology ethics as a straightforward application of normative ethical frameworks to concrete cases. While all of these perspectives provide indispensable insights into the regulation of technological action, they remain within a paradigm that externalizes ethics from technology itself.

The proper object of technological ethics is not the artifact alone but rather the technology-mediated human practices and purposes. Positioning technology ethics as a straightforward branch of applied ethics neglects the specific ends to which particular technologies must respond, focusing instead on the technologies themselves. In other words, the primary object of techno-ethical inquiry is not the individual artifact, but the totality of human activity mediated and shaped by that particular technology. In this light, technology ethics should be understood as a critical and interpretive discipline, not a mere appendage for the application of general ethical codes.

Normative ethics places excessive emphasis on external rules of conduct, while neglecting the individual’s inner moral renewal and the formation of character. Yet “ethical norms are meaningful if and only if morality exists”¹⁷. Here, the distinction between “ethics” and “morality” is as follows: “ethics” denotes the nature of social norms, whereas “morality” denotes the nature of life’s intrinsic meaning. As Hui observes, “When we see the cosmos

15 Joan Llorca Albareda and Jon Rueda, “Divide and Rule? Why Ethical Proliferation Is Not So Wrong for Technology Ethics,” *Philosophy & Technology* 36, no. 1 (2023): 4.

16 Júlia Pareto and Carme Torras, “To Each Technology Its Own Ethics? A Reply to Sætra & Danaher (and Their Critics),” *Philosophy & Technology* 37, no. 3 (2024): 3–4.

17 Zhao Tingyang, *On Possible Life*, 16.

from the perspective of astral physics, it holds no accounts for either spiritual life or the complex relations between humans and non-humans in cosmologies, which are also the foundation of morality.”¹⁸ Therefore, the primary urgency for technology ethics is not to amass more external regulations, for this can only hasten the system “until we confront a limit”¹⁹ and then collapse, nor is it to “succeed in putting a more elegant administrative facade on old layers of reverse adapted rules, regulations, and practices.”²⁰ Rather, it is to rediscover the lost moral foundation for both technology and ethics.

Summary and conclusion: (1) The dichotomy between technology and ethics is a relatively recent modern notion that has led to the limitations of normative ethics; (2) the validity of ethical norms must be grounded in a form of life or an ontological understanding; therefore, (3) a comprehensive framework for techno-ethical inquiry should comprise three dimensions: ethical norms, moral foundations, and the form of life that undergirds both. Consequently, technology ethics first requires clarifying the interactive relation between technology and ethics. In light of the reorientation of techno-ethics, this interaction is not, as in the premodern world, a matter of directly apprehending the world as imbued with spirit and then ascribing moral meaning to technology. Rather, it is a matter of elucidating the mutual constitution of technology and ethics through the interpretation of technological practices. In other words, techno-ethics must simultaneously draw upon the philosophy of technology as its theoretical basis. Most relevant here is the work of empirical philosophy of technology, particularly Verbeek’s theory of moralising technology, which, by way of technological mediation, rearticulates the integration of technology and ethics and thereby provides a starting point for constructing the three-dimensional framework of techno-ethical research.

2. The First Dimension of Technology Ethics Research: Moralising Technology

Peter-Paul Verbeek’s theory of moralising technology argues that ethical norms should be embedded into concrete technologies through design, so that morality is materialised or “reified” within technological artefacts. Drawing on postphenomenology, Verbeek emphasises that humans and reality co-constitute each other through their interactions, and that technology mediates both human existence and the way the world appears to us. Moral intentions are thus not prior to technology but emerge from the technologically mediated relations between humans and the world. Accordingly, he advocates for involving engineers and the public in the design process to proactively anticipate how technologies will mediate human actions and moral outcomes.

18 Yuk Hui, “This Strange Being Called the Cosmos,” *Foundations of Science* 27, no. 4 (2022): 1409.

19 Yuk Hui, *Art and Cosmotekhnics* (Minneapolis: University of Minnesota Press, 2021), 281.

20 Langdon Winner, *Autonomous Technology* (Cambridge: The MIT Press, 1977), 320.

2.1 Critique of Normative Ethics by the Theory of Moralising Technology

The central contribution of moralising technology is its incisive critique of normative ethics. From the standpoint of normative ethics, ethical norms are decoupled from technology, seeking to regulate a technics understood in instrumental terms from outside the domain of technology itself. In contrast, moralising technology expands the locus of normativity, suggesting that artefacts themselves can embody, constrain, or facilitate moral action. As illustrated by Verbeek's now-classic analysis of the disposable plastic cup, the instruction to "dispose after use" is not effective simply as an abstract norm; rather, the cup's design—rendering it impossible to clean or reuse—enacts and materially enforces that norm.²¹ From the standpoint of normative ethics alone, a user could perfectly well choose to reuse a plastic cup repeatedly in order to secure potential benefits such as unlimited refills. Moralising technology contends that it is not ethical norms themselves but the materiality of the plastic cup that ensures the enactment of ethical behaviour. Consequently, ethical norms do not possess ultimate explanatory primacy; rather, they are grounded in technological mediation. As Hui states, "Nomos is, first of all, technical activity."²² This forms the first major critique: genuine moral normativity cannot survive except through the material and technical pathways that instantiate it.

A second, extended criticism is that, in many everyday contexts, ethical action is largely disconnected from explicit ethical norms and arises instead from technological mediation. Drawing on the postphenomenological concept of "multistability," moralising technology suggests that the real regulatory power of technology manifests only in the lived, context-specific relations between humans and artefacts. The moral functions or intentions engineered into artefacts may not match their actual use—often, new or even contrary practices emerge. For example, the first generation of automobiles was designed for sports or medical uses, and the phone and typewriter were initially developed for people with sensory or communicative disabilities.²³ This demonstrates that concrete ethical actions are emergent: the outcome of complex and evolving entanglements between people and artefacts, not something predictable from the intentions of either in isolation. Moreover, the inherent abstraction of normative ethical codes "excludes nearly all actual situations of life"²⁴ and cannot provide effective guidance for nuanced, real-world practice.

A third, supplemental critique further sharpens this position: concrete ethical action

21 Peter-Paul Verbeek, "Materializing Morality: Design Ethics and Technological Mediation," *Science, Technology, & Human Values* 31, no. 3 (2006): 366–367.

22 Yuk Hui, *Machine and Sovereignty* (Minneapolis: University of Minnesota Press, 2024), 3.

23 Peter-Paul Verbeek, *Moralizing Technology: Understanding and Designing the Morality of Things* (Chicago: The University of Chicago Press, 2011), 58.

24 Zhao Tingyang, "Ethical Confusion and the Confusion of Ethics," *Morality and Civilization*, no. 3 (2020): 8.

always results from human-technology “hybrids.” Modern philosophy’s habitual dualisms (subject vs object, technology vs ethics) are inadequate to account for the mediation of particular moral acts and intentions. Technology configures environments that both invite and discourage specific actions, shaping new forms of subjectivity and new worlds. For example, in Verbeek’s analysis of prenatal screening, the choice whether to abort in case of a foetal abnormality is neither the straightforward product of free will nor determined by the apparatus—it emerges through the mediated and situated relation between people and technology.²⁵ Without the technological mediation of prenatal screening, such a choice—and its moral meaning—would not exist at all. Expectant parents who choose not to have an abortion without ever being exposed to prenatal screening technology, and those who make the same choice after learning their baby has a disease through prenatal screening, are entirely different subjects, face completely distinct environments, and hold utterly different moral intentions. Consequently, the meaning of the ethical norm “prohibiting abortion” also differs completely between the two scenarios. In these two cases, the ways in which the subject, the environment, and the specific ethical action manifest themselves are entirely dissimilar.

Up to this point, the conclusion drawn by the theory of moralising technology in its critique of normative ethics is as follows: ethical norms must be grounded in technological mediation, and to a large extent, they are disconnected from concrete ethical actions; on the contrary, concrete ethical actions arise from the technological mediation of the complex relationships between humans and the world.

2.2 Limitations and Critiques of the Theory of Moralising Technology

Without reverting to animism, the theory of Moralising Technology revives the integration of technology and ethics. However, it also has its own limitations, which are mainly manifested as follows: (1) it confines the understanding of technology to specific technological artefacts; therefore, (2) its understanding of ethics is overly narrow, leading to technological design becoming the primary application of the theory of Moralising Technology.

The first lies in its overly narrow conception of technology, which is treated primarily as discrete artefacts rather than as complex systems with macro, structural, and ecological dimensions. As Romele points out, “technology is always more than the sum of its material parts and immediate mediations”.²⁶ Yet in the Anthropocene, technology has been endowed with an all-encompassing and all-penetrating profile, and in fact exhibits an increasingly

25 Peter-Paul Verbeek, “Obstetric Ultrasound and the Technological Mediation of Morality: A Postphenomenological Analysis,” *Human Studies* 31, no. 1 (2008): 17–18.

26 Alberto Romele, “The Transcendental of Technology Is Said in Many Ways,” *Foundations of Science* 27, no. 3 (2022): 976.

“disruptive”, if not outright “destructive” one.²⁷ By ignoring “overarching essence” and “macro, structural background conditions,”²⁸ postphenomenology risks reverting to naïve progressivism and instrumental optimism.²⁹ Mitcham warns that “whenever big thinking is rejected in favour of addressing manageable problems, it implicitly rests on a comfortable affirmation of the status quo...[.] under such circumstances, is it not necessary at least on occasion to think big again?”³⁰ Further, Stiegler, building on Heidegger, asserts that we must now recognise that technological “enframing” encompasses the whole Earth.³¹ Postphenomenology, insofar as it has “a methodical focus on specific technologies, cannot take full consideration of the planetary situation because it overlooks its ontological dimension.” As a result, it unconsciously accepts the presupposition of enframing and “indifferently and a priori encounters things (both windmill and turbine) as standing-reserve.”³² Recent trends in phenomenology of technology thus contend that focusing exclusively on artefacts cannot adequately address our epoch’s technological challenges.

A second major limitation is the reduction of ethics to design, as if every ethical issue could be resolved by appropriate artifact engineering. In this paradigm, “ethics, after all, is about the question how to act—and technologies appear to give ‘material’ answers to this question,”³³ and thus all values must be, or can be, mediated by technology. This leads easily to the belief that every social and ethical challenge is, in principle, designable—and that “an effective way to manage and direct technology” can always be found. As a result, technical design becomes the chief area for ethical inquiry, focusing on reflecting in advance about possible problems via attempts to “bridge the gap between the context of design and the context of use.”³⁴ Yet, as Wang Xiaowei notes, a focus on the immediate behavioural adjustment of individuals by specific artefacts cannot foster stable habits or

27 Pieter Lemmens and Yoni Van Den Eede, “Rethinking Technology in the Anthropocene: Guest Editors’ Introduction,” *Foundations of Science* 27, no. 1 (2022): 97.

28 Jochem Zwier, Vincent Blok, and Pieter Lemmens, “Phenomenology and the Empirical Turn: A Phenomenological Analysis of Postphenomenology,” *Philosophy & Technology* 29, no. 4 (2016): 331.

29 Yoni Van Den Eede, Gert Goeminne, and Marc Van den Bossche, “The Art of Living with Technology: Turning Over Philosophy of Technology’s Empirical Turn,” *Foundations of Science* 22, no. 2 (2017): 241.

30 Carl Mitcham, “What Is Living and What Is Dead in Classic European Philosophy of Technology?,” in *The Oxford Handbook of Philosophy of Technology*, ed. Shannon Vallor (Oxford: Oxford University Press, 2022), 31.

31 Pieter Lemmens, “Thinking Technology Big Again: Reconsidering the Question of the Transcendental and ‘Technology with a Capital T’ in the Light of the Anthropocene,” *Foundations of Science* 27, no. 1 (2022): 174.

32 Jochem Zwier and Vincent Blok, “Saving Earth: Encountering Heidegger’s Philosophy of Technology in the Anthropocene,” *Techné: Research in Philosophy and Technology* 21, no. 2/3 (2017): 232.

33 Peter-Paul Verbeek, “Materializing Morality: Design Ethics and Technological Mediation,” *Science, Technology, & Human Values* 31, no. 3 (2006): 369.

34 Peter-Paul Verbeek, “Materializing Morality: Design Ethics and Technological Mediation,” 380.

genuine character formation.³⁵ If morality is realised through nothing more than artefact-based regulation, then once the material mechanism is absent, the agent's conduct may revert or shift entirely, resulting in a loss of individuality and deeper moral agency. Furthermore, this approach underestimates the ways persistent ethical commitments and stable values themselves shape and redirect technology, and largely ignores the problem of technological multistability. At worst, this risks turning the philosophy of technology into a superficial and uncritical field, parasitic on industrial development.³⁶ Such a conception, as has already been shown in critiques of normative ethics, is far removed from the engaged concerns of social or political philosophy.

In sum, the value of the materialisation theory is its ability to revive the integration of technology and morality without reverting to animism or naive naturalism. Yet its narrow focus on artefacts and short-term design unduly limits the scope of technology ethics research. This renders human conduct and ethical critique overly technologized and homogenised, while promoting an uncritical, optimistic acceptance of technological progress. To expand the field of technology ethics, it is necessary to move beyond artefact-level mediation toward questions of moral innovation, character formation, and the ontological bases of moral life. In this sense, the limitations and critiques of materialisation theory open promising new directions for future research in technology ethics.

3. Toward a Three-Dimensional Framework for Technology Ethics Research

Based on the critique of normative ethics and the repositioning of technology ethics, a comprehensive framework for technology ethics should encompass the three dimensions emphasised by the theory of moralising technology: ethical norms, the moral foundation of these norms, and the forms of life that serve as the foundational basis for both. The theory of Moralising Technology is confined to the first of these dimensions—ethical norms. Critiques of this theory point out the core content of the latter two dimensions in technology ethics research: (1) at the ontic level, research should move beyond focusing on single, specific technologies and immediate ethical actions, and recognise the specific purposes underlying technology as well as the totality of human activities. Specifically, it should explore how stable technological environments shape the acquisition of virtues at the individual level; this will shed light on how individuals transcend homogenised technological mediation and reveal the regulatory role of morality in relation to technology; (2) at the ontological level, research should recognise the mutual constitution between

35 Wang Xiaowei, "Do Things Have Intentionality: A Critique of Material Engagement Theory," *Studies in Dialectics of Nature* 39, no. 1 (2023): 78.

36 Dominic Smith, "Rewriting the Constitution: A Critique of 'Postphenomenology,'" *Philosophy and Technology* 28, no. 4 (2015): 547.

the forms of life of a cultural whole and its understanding of technology. Taking this as a basis, it should seek a new theoretical foundation for the missing moral dimension of modern technology in the Anthropocene—an era where Heidegger’s “Gestell” (enframing) has become materialised.

Accordingly, a three-dimensional model emerges for technology ethics. The first dimension is the reconciliation of the technology–ethics divide at the level of action, explaining how specific technologies mediate instant ethical behaviours. The second dimension constitutes the purpose of the first—namely, the distinctive cultivation of moral dispositions and character at the individual level, revealing how technical environments promote virtue acquisition and how virtue in turn guides technology. The third dimension serves as the meaning-source and ultimate purpose for the other two, disclosing the ontological intertwinement of technology and ethics and responding to the root problem of the missing moral dimension of modern technology. Together, these three dimensions comprise a comprehensive model for both the theory and practice of technology ethics. The remainder of this section elaborates the latter two dimensions.

3.1 The Second Dimension of Technology Ethics Research: Virtue Acquisition

The second dimension of technology ethics research critically addresses the narrow interpretation of technology ethics offered by the theory of moralising technology. Its primary aim is to explain how concrete technological environments modulate the process of individual virtue acquisition, thereby emphasising how morality itself regulates technology. This dimension thus advocates for designing specific technological environments to foster the cultivation of personal virtues. According to the revised positioning of technology ethics, the second dimension expands the scope of research at the ontic level.

While a single, discrete technology can be effective in regulating people’s immediate ethical behaviours, it is insufficient for shaping enduring personal virtues. For example, a speed bump on a road can reliably regulate a driver’s speed at a given moment, but cannot ensure that drivers slow down in places where there is no speed bump but caution is needed. The education of realising individuation, which here refers to the cultivation of personal virtues, is a way to transcend the homogenization brought about by technological mediation. Such personalised cultivation relies on environments in which a multiplicity of technological mediations work in concert. Thus, we must transcend the single-technology, artefact-centric perspective of design and address how technological environments composed of multiple mediations promote the formation of virtue, enabling individuation to counteract technological standardisation and homogenization. Against the backdrop of moralising technology, this approach draws upon Hubert Dreyfus’s skill acquisition model.

The skill acquisition model, echoing Aristotle's view of everyday ethics, maintains that virtue is acquired through engagement with particular situations and practical experience.³⁷ As Dreyfus points out, "On analogy with chess and driving, it would seem that the budding ethical expert would learn at least some of the ethics of his or her community by following strict rules, would then go on to apply contextualised maxims, and, in the highest stage, would leave rules and principles behind and develop more and more refined spontaneous ethical responses."³⁸ From the perspective of moralising technology, the acquisition of virtue is inseparable from the technical mediation of human-environment relations. Combined with the skill acquisition model, these mediations manifest as multiple affordances inviting agents to undertake certain behaviours, to which actors at different skill stages respond with different degrees of sophistication. Notably, affordances are not merely objective features of the present environment but are jointly constituted by the subject and their environment. For instance, in the case of yielding to pedestrians: environmental factors such as the presence of traffic lights, speed bumps, cameras, or pedestrians, along with subjective factors such as a driver's habits, driving skill, and ethical/legal awareness, jointly shape the affordances available in each situation. Who we become is thus the product of the interplay between ourselves and our surroundings. In what follows, this process is analysed through concrete stages of virtue acquisition.

According to agents' responsiveness to affordances, virtue acquisition can be divided into three levels:

First Level: Novice and Advanced Beginner Stages.

At this stage, agents are maximally detached from their environments. Their behaviours are not characterised by perception and response to affordances, but rather by adherence to explicit rules or relatively ambiguous guidelines, with little concern for the possible consequences of their actions. For instance, a novice doctor communicating with a patient for the first time may rigidly adhere to the ethical rule against lying, even if this results in emotional harm to the patient. As the doctor becomes an advanced beginner, they may come to recognise more abstract guidelines such as "do not lie, unless telling the truth will hurt the patient emotionally." However, precisely determining what constitutes emotional harm to the patient is often inexpressible in linguistic terms. Guidelines, being more abstract than rules, rely on fuzzy experience that defies precise articulation. As the critique of normative ethics demonstrates, such abstract guidelines cannot fully explicate the application of concrete rules.

37 Hubert Dreyfus and Stuart Dreyfus, "Towards a Phenomenology of Ethical Expertise," *Human Studies* 14, no. 4 (1991): 237–240.

38 Hubert Dreyfus and Stuart Dreyfus, "The Ethical Implications of the Five-Stage Skill-Acquisition Model," *Bulletin of Science, Technology & Society* 24, no. 3 (2004): 254.

Second Level: Competence and Proficiency Stages.

At this stage, agents become emotionally involved in specific situations, constructing recognisable affordances through the joint mediation of their individual backgrounds and various technological interventions in the environment. Different agents will perceive different sets of affordances. When faced with the myriad affordances present in a situation, a less experienced agent must deliberate carefully about which affordances to respond to. Upon achieving proficiency, agents can directly perceive appropriate affordances, though they may still need to think rationally about how best to act. Agents at this stage bear responsibility for the possible consequences of their actions, taking pride or blame as the outcomes unfold.

For example, a competent doctor contemplating whether to disclose the whole truth to a patient must integrate their own skills, education, and character, as well as considerations about the patient's condition and personality and the hospital's practical constraints. Such an agent faces various possible responses—direct disclosure, gentle hints, concealment, or communicating with a patient's family. At this stage, simply following rules or guidelines is inadequate, and the agent must reflect seriously on which affordance to act upon and accept the attendant consequences. A proficient doctor can quickly identify the right affordance (such as concealing the diagnosis) but still must deliberate about the best way to act on it.

According to the model of skill acquisition, those who act solely according to rules or guidelines are permanently confined to the competent stage—a fate that befalls most people. This means agents acting only by ethical norms will never truly achieve virtue. This can be further explained: from the agent's perspective, norm-based action focuses only on external compliance, not on consequences, perhaps yielding lighter responsibility but excluding the emotional engagement and experience necessary for virtue acquisition. From the environmental perspective, when most agents in a setting act in the same way, the environment itself reinforces this behaviour as the salient affordance, deeply influencing the choices of each individual.

Third Level: Expert Stage.

At this stage, all necessary rational deliberation has already been internalised and transformed into experience. The agent can act appropriately in a direct and intuitive fashion in response to various affordances present in the environment. For example, a virtuous master doctor instinctively knows how to communicate with different patients in different situations. Each expert's actions are concretely embedded in specific circumstances, and may differ from case to case. Thus, the actions of a moral expert are neither a product of conscious rule-following nor of mere technical mediation, but are

instead animated by virtues deeply internalised as part of the agent's very personhood. Experts are thus capable of acting with their own style, transcending the immediate context. Each moral expert develops a unique personal style; there is no single code that prescribes the "correct" behaviour in every case. What we call ethical norms are in fact the codification of expert action driven by inner virtue, and conflicts between different ethical norms ultimately originate in differences among expert styles. Importantly, from the vantage point of technological mediation, virtue acquisition remains an open-ended process, since new technological environments always produce new affordances, prompting experts to reinforce or transcend their established virtues.

The skill acquisition model thus supports a "situated ethics," whereby agents begin by following social norms, then progressively immerse themselves in their environments, accumulating experience through the mediation of technology, until they can finally respond intuitively to various affordances. The process of virtue acquisition thus embodies a return from normative ethics to virtue ethics, i.e., a trajectory from rule-following to technological mediation to the cultivation of internal virtue. For example, in the realm of traffic: normative ethics explores how to make drivers obey rules like "yield to pedestrians" or "stop at red, go at green"; the theory of moralising technology studies how a specific artefact (e.g., a speed bump) regulates a specific act (slowing down in front of pedestrians); whereas virtue acquisition theory analyses how the persistent modulation by a well-designed technological environment can cultivate a stable habit of yielding as a virtue. Accordingly, the purpose of the materialisation of morality is—in line with the repositioning of technology ethics—to enhance personal virtue and promote moral renewal at the societal level. If the theory of moralising technology is limited to single, immediate technical interventions, then the virtue acquisition model complements it by introducing complex, diachronic adjustments through context and environment—for instance, considering from a techno-ethical perspective how Chinese ritual objects ("liqi [礼器]") contribute to the cultivation of the Confucian "junzi (君子)" personality. The cultivation of virtue requires thoughtful design of environments and depends on the sustained mediation of technology. Importantly, virtue is itself independent of technology, and functions to regulate subsequent technological choices. The very process of virtue acquisition is an individualised process whose particularity transcends the abstraction of external norms and the homogenization of technical design. Nevertheless, the individuation achievements of moral experts remain subject to collective public norms, representing the highest shared understanding of morality in their culture. This dynamic reflects the relationship between the individualised "I" and the pre-individual "we": the "I" becomes part of the "we", and the "we" makes the "I" possible. In summary, the acquisition of virtue is both a transcendence of the "I" constrained by technologically homogenised behaviour and a return to the "we" that exists in coexistence yet embodies heterogeneity. In other words, morality serves as both the foundation and the end of ethical norms, and is itself grounded in more fundamental forms of life.

A plausible critique of the skill-acquisition model of virtue can be drawn from the ethical criticisms directed against “nudging.” This critique may be formulated as follows: if the virtue acquisition model—particularly in its initial stage—appears to rely on externally determined factors to modulate human experience, then how should the relationship between freedom and control be understood? In response, I propose the following three points.

First, the first dimension of technology ethics as understood in this paper already seeks to overcome the dualism between technology and ethics, as well as that between subject and environment, by acknowledging that agents and their environments co-constitute one another through technological mediation. This is a key contribution of postphenomenology. The second dimension, the model of virtue acquisition, further critiques the immediacy of mediation emphasized in postphenomenological theory and instead highlights the diachronic co-constitution of moral virtue and the technological environment. By contrast, nudging continues to presuppose a human-environment dualism, regarding technological design as an external instrument of behavioural control—a view that this study fundamentally rejects. In this sense, technological mediation in virtue acquisition is generative and educational, aiming to foster moral reflection and personal growth rather than achieving external behavioural regulation.

Second, the first stage of the model, which proposes that agents act according to established rules, does not imply a lack of moral autonomy. First, established rules are not created *ex nihilo*—they are formalisations of virtuous actions, much as Socrates sought to articulate the rational structure underlying expert skills. Second, every agent is always already a member of some society, possessing certain forms of moral awareness necessary for the process of learning virtue. Accordingly, when technological design fails to align with a community’s shared moral consensus, individuals will immediately experience a sense of dissonance. The logic of nudging presupposes a morally deficient actor—one lacking both rationality and social grounding—which seldom corresponds to real human agents. By contrast, the external rules involved in virtue acquisition have an educative function: they serve as a transitional stage through which the individual moves toward self-regulation and moral reflection.

Finally, freedom and control should not be conceived as mutually exclusive. As social beings, humans are neither entirely rational nor completely passive. Even before consciously acquiring a virtue, individuals inhabit a shared moral order and practice that both constrain and enable the exercise of freedom. The relationship between freedom and control thus manifests as a dynamic equilibrium continuously adjusted and regenerated within socio-technical environments. Moral growth unfolds precisely within this productive tension.

Nevertheless, the phenomenon of “unconscious control” in real technological contexts should not be overlooked. Revisiting Coeckelbergh’s critique of nudging is instructive in this regard. He criticises nudging for presupposing a conception of the human being as an irrational and independent individual who must therefore be guided and controlled by external environments—whether such control is overt or subtle. This critique exposes the implicit environmental control and the neglect of freedom embedded in nudging practices.³⁹ The design of technological environments is indeed necessary, since the acquisition of virtue arises from the reciprocal shaping between agents and their surroundings. Yet, the acquisition of virtue is, at its core, an educational process through which agents and their environments co-constitute stable moral dispositions. He exposes the environmental control and the neglect of freedom implicit in nudging practices, reminding us to reflect on the moral soundness of the norms we follow and the ethical adequacy of our technological environments. The design of such environments is necessary because the acquisition of virtue arises from the reciprocal constitution between agents and their surroundings. As Coeckelbergh’s argument suggests, this process depends not only on individual effort but also on the collective ethical co-creation of the social community.

The virtue acquisition dimension thus remedies the neglect of morality by both normative ethics and the theory of moralising technology, revealing the role of morality in regulating technology. At the individual level, the intertwining and co-constitution of technology and morality becomes manifest. The acquisition of personal virtue is a necessary guarantee for individuals to resist the overwhelming influence of technology in the modern age, and it further underscores the role of stable collective understanding in regulating technological development. A shared moral understanding within a given culture directs its choices and interpretations of technology, while the emergence of new situations through rapid technological change often compels some experts to articulate novel moral understandings, thus catalysing the evolution of societal ethics as a whole. This, in turn, points us to the third dimension of technology ethics research.

3.2 The Third Dimension of Technology Ethics Research: Technological–Moral Plurality

The model of virtue acquisition serves as a conceptual bridge: it not only integrates the postphenomenological notion of technological mediation as a necessary means for cultivating virtue, but also ultimately reveals that the cultivation of individual virtue always unfolds within a broader socio-cultural and moral context, conditioned by the most fundamental techno-moral mediation at the ontological level. In essence, the acquisition of virtue represents both a transcendence of the “I” constrained by technologically

39 Mark Coeckelbergh, *Green Leviathan, or the Poetics of Political Liberty: Navigating Freedom in the Age of Climate Change and Artificial Intelligence* (London: Routledge, 2021), 51–52.

homogenised behaviour and a return to the heterogeneous “we” that exists in coexistence. Therefore, the dimension of virtue acquisition already implicitly anticipates the techno-moral mediation at the ontological level. Technological mediation at the ontological level manifests itself as a form of techno-moral plurality, which identifies the task of technology ethics as reconstructing the techno-moral understandings of different cultures.

The acquisition of personal virtue is modulated by concrete technological means, while transformation in cultural morality relies on technological mediation at the cultural level. Once the discussion shifts to the ontological dimension, issues such as subject freedom and environmental control that arise in the context of “nudging” are directly dissolved under the technological mediation that situates both within the same ontological horizon. By placing both sides within a shared existential and moral perspective, the cosmotechnical mode of thinking transforms control into participation, making design itself a moral practice of co-creation rather than domination. However, this introduces a new question of agency—namely, how moral differences emerge among different cultures—which depends on the distinct social, cultural, and metaphysical conditions inherent to each cultural context. Here, “technology” should not be narrowly understood as technical artefacts, but should also encompass technological practice, creation, and understanding. Zhao Tingyang observes that all meaning in human existence originates from creation, which itself is a kind of technological mediation, for humans can only realise their creative capacity through engagement with concrete things. Through technological creation, humans transform meaningless “things” into meaningful “events,” thus giving rise to significance. From a universal perspective, humans invented tools and language, opening up the bifurcation of time and the possibility for all meaning, order, and history to emerge; from a concrete perspective, since the creation of culture, each distinct civilisation has established its own ways of thinking, normative systems, and moralities, choosing different forms of possible life. Human understanding is always a product of technological mediation. In this way, different groups through original acts of creation have formed distinct existential orders, which in turn have come to structure and dominate their creators, ultimately evolving into different cultural understandings.⁴⁰ Thus, naturalism, modern technology, and normative ethics are in reality all distinctive creations specific to Western culture. This critique exposes the unconscious affirmation of “enframing” by both normative ethics and the theory of materialisation, for enframing is a particular, not a universal, condition. Accordingly, the so-called “universal” model of technology inspired by modernity is merely an illusion brought about by the dominance of enframing. In reality, different ways of understanding technology and morality exist in each culture, each arising from that culture’s original technological creations.

40 Zhao Tingyang, *One or All Problems* (Beijing: SDX Joint Publishing Company, 2023), 69.

Each specific form of moral and technological understanding is intertwined, rooted in its foundational form of life. To highlight the inseparability of a culture's technological understanding from its cosmology, Yuk Hui introduces the concept of "cosmotechnics," which he defines as the "the unification between the cosmic order and the moral order through technical activities."⁴¹ Cosmotechnics professes both the "technicity" of the cosmic (understood as the world) and the "cosmicity" of technics.⁴² Cosmology, in this sense, refers to a certain regional nature rooted in a culture's everyday forms of life and corresponding to its moral order. For example, naturalism as the paradigmatic cosmological understanding in the West excludes all non-material entities related to morality or aesthetics, leading to a modern technological paradigm that seeks efficiency and control and to a norm-based ethics that neglects internal virtue. The absence of a moral dimension in its cosmological understanding thus drives contemporary technological rationality to become a universal standard in all domains. Modern technological enframing is thus simultaneously a mode of understanding of both technology and morality. This demonstrates that a culture's conception of technology (as modern technology) and of morality (as normative ethics) are unified through ontological technological mediation (enframing). However, beyond naturalism, there exist other cosmological understandings in other cultures, each corresponding to different understandings of technology and morality—for instance, the Chinese cosmotechnical tradition is characterised by the "Tian Ren He Yi," articulating a moral order that stresses the symbiosis of human beings and all things through the technological understanding of "qi" or implements. At the ontological level, cosmotechnics reveals both technological and corresponding moral diversity. Reconstructing cosmotechnics is tantamount to emphasising a new technological-moral understanding—that is, "in order to reintroduce a form of life and to reactivate a locality."⁴³

The global spread of modern technology has resulted in the synchronization and dominance of enframing logic worldwide. If we accept the philosophical critique that enframing has become the "principle of all principles," then it follows that the forms of morality thus framed are incapable of genuine ethical critique of technological development. Moralizing technology as well as normative ethics both fail to deeply explore ontological technological mediation, remaining fixated on the behavioural level, and are thus justly critiqued for their unwitting endorsement of enframing. The reconstruction of virtue acquisition models already points to forms of life as the ultimate foundation for the relationship between technology and morality. Mark Coeckelbergh, drawing on Wittgenstein, argues

41 Yuk Hui, *The Question Concerning Technology in China*, 20.

42 Pieter Lemmens, "Other Turnings: Yuk Hui's Pluralist Cosmotechnics in between Heidegger's Ontological and Stiegler's Organological Understanding of Technology," in *Cosmotechnics*, eds. Yuk Hui and Pieter Lemmens (Routledge, 2021), 10.

43 Yuk Hui, *The Question Concerning Technology in China*, 31.

that “technologies are embedded in, and shaped by, forms of life”⁴⁴ and the reverse is equally true. In sum, the first two dimensions of technology ethics research—namely, the specific level of critique—must be grounded in deeper ontological reflection. Only by clarifying and responding to the ontological dimension of technological mediation can we genuinely escape the unconscious constraints of enframing in concrete techno-ethical practice. Ontological technological mediation manifests as technological diversity: using diverse ways of technology to offset the universalising logic of enframing and diverse ways of morality to counteract the erasure of the moral dimension in modern technology, thus addressing the crisis of globalised, monocultural thought in the Anthropocene.

However, why is the cosmotechnical dimension indispensable? The cosmotechnical dimension is indispensable for establishing the ontological foundation that dynamically connects the first two dimensions of technological ethics. First, if our inquiry remains confined to the ontic level of beings, problems such as subjective freedom and environmental control—typified by the debate around “nudging”—cannot be fully resolved. Once the discussion turns to the ontological level, these oppositions are dissolved, since both subject and object are understood as co-constituted within the same ontological horizon of technological mediation. In other words, the genuine overcoming of dualism requires a return to the ontological dimension.

Second, the ontological dimension of techno-moral mediation introduces a form of technological-moral diversity, which opens up the plurality of moral understandings. This cosmotechnical plurality provides a reflective space for rethinking the globalisation of enframing in the Anthropocene, offering alternative modes of thought beyond the homogenising logic of modern technology. By contrast, focusing solely on the ontic level—as post-phenomenology has been criticised for—risks losing this broader ethical horizon and remaining trapped in local technical practices without questioning their ontological presuppositions.

Finally, for concrete moral agents, moral practice necessarily involves three intertwined dimensions: moral action, inner virtue, and existential-moral background. Neglecting the latter two has led normative ethics toward dogmatism, while ignoring the third—the ontological background—inevitably reintroduces the subject-object dualism. The tripartite model proposed here shows that only on the basis of the ontological dimension can the other two dimensions arise and acquire meaning. Therefore, these three dimensions should not be regarded as a linear hierarchy of explanation, but as a co-constitutive moral structure within which human beings are always already embedded. It is through the cosmotechnical perspective that this triadic moral structure is integrated, revealing the

44 Mark Coeckelbergh and Michael Funk, “Wittgenstein as a Philosopher of Technology: Tool Use, Forms of Life, Technique, and a Transcendental Argument,” *Human Studies* 41, no. 2 (2018): 186.

intrinsic unity between moral practice, virtue cultivation, and the ontological conditions of human existence.

Therefore, this dimension of technological–moral plurality supplements the lack of ontological depth in the first two dimensions. Its purpose is to reconstruct the technological–moral diversity of different cultures, serving as both the root of significance and the ultimate purpose of the other two dimensions. The meaning of this “root” is that only by foregrounding the ontological co-constitution of technology and morality, and by making this the explicit basis for research, can the previous two dimensions of technology ethics acquire genuine critical force. Its ultimate purpose lies in the fact that the globalisation of modern technology has brought about the Anthropocene, wherein all philosophical problems are inextricably linked to technological ones. Thus, the core question for philosophy today is how to envision and realise alternative modes of thinking and knowing in the face of global technological enframing—a challenge that no concrete research in technology ethics can afford to ignore.

4. Conclusion

A comprehensive framework for technology ethics must integrate three dimensions: ethical norms, the moral foundation, and the more fundamental forms of life. The strand of technology ethics guided by normative ethics accepts the modernist dichotomy between technology and ethics, resulting in ethical norms that either lag behind technological developments or are constrained by technical rationality. Such norms often possess an abstract quality divorced from concrete contexts, which undermines their effectiveness in critically addressing technological issues. The “moralising technology” dimension in technology ethics overcomes the technology–ethics divide by highlighting the moral quality of technology and the material character of morality. However, it confines technology ethics to the immediate behavioural regulation afforded by specific technologies, carrying the risk of technologizing and homogenising human conduct.

The dimension of virtue acquisition instead stresses how technological environments—comprised of multiple technologies—shape the cultivation of personal virtues. This dimension overcomes the abstraction of ethical norms and the homogenization of technical design, manifesting the highest shared moral understanding of the civilisation in question, and highlights, at the individual level, the mutual regulation between technology and morality. The dimension of technological–moral plurality, for its part, brings attention to the ontological mediation of technology that the materialisation of morality overlooks. It provides the fundamental source of meaning for the preceding two empirical dimensions and, by reconstructing techno-moral understandings across various cultures, attempts to

address the contemporary challenge of overcoming the global hegemony of enframing thinking.

Taken together, the three dimensions of technology ethics emphasise the intertwined and co-constitutive nature of technology and morality on the levels of concrete action, stable personal cultivation, and, most fundamentally, cultural life itself. This integrative framework bridges applied technology ethics with theoretical philosophy of technology, yielding an approach that is both theoretical, critical, and practical. Accordingly, technology ethics research should not narrowly focus on a single dimension, but must recognise their interrelation: the first dimension comprises the primary focus of technology ethics, but should be oriented toward the cultivation of virtue in the second dimension, while the third dimension serves as the existential grounding and ultimate purpose of the first two. Thus, this multidimensional approach not only provides a profound theoretical foundation for research in technology ethics but also offers concrete methodologies and practical relevance for broader work in the philosophy of technology.

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