The Transmodern Digital Enlightenment

DIY Epistemologies, AI–IoT Infrastructures, and Epistemic Justice in the Reconfiguration of Agency

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Abstract. Under transmodern conditions—marked by convergent life sciences and computational paradigms, ubiquitous connectivity, and accelerating AI–IoT infrastructures—the classical Enlightenment architecture of knowledge (institution-centred authority, relatively stable publics, and slower epistemic rhythms) is displaced by infrastructure-mediated conditions of perception, production, and justification. The paper develops a quadrangular conceptual framework—poiesis–technē / aisthēsis–epistēmē—to show how contemporary digital systems externalize and govern aisthēsis (through distributed sensing and datafication), accelerate poiesis (through generative synthesis and automation), and reconfigure epistēmē by reshaping practical norms of evidence, credibility, and closure. Against both technoutopian and fatalistic readings, the argument treats the emancipatory content of Digital Enlightenment as conditional: it depends on whether DIY epistemologies and autodidactic learning ecologies become civic infrastructures of participation, contestability, and repair, rather than being absorbed into platform spectacle or epistemic dependency. The normative core is an infrastructural expansion of epistemic justice, where harms and asymmetries increasingly track unequal access to interpretability, auditing, and intervention rights in AI–IoT environments. The conclusion articulates a transmodern pedagogical program in which digital and AI literacy function as justice-relevant capabilities for autonomy and collective empowerment under hybrid agency.

Keywords: Digital Enlightenment; transmodernity; poiesis and technē; aisthēsis and epistēmē; DIY epistemologies; autodidactic learning ecologies; AI literacy; Internet of Things; epistemic justice; hybrid agency; infrastructural power; sociotechnical imaginaries.

1. Introduction

It has been argued that we are living in a transmodern era. “Transmodernity” can be treated as a critical socio-historical category—an interpretive device for grasping the unstable and paradoxical character of the present *Zeitgeist* (Dussel 2012; Alcoff 2012). Transmodern times configure an historical interregnum in which antagonistic logics coexist—local and global, tradition and innovation, identity and difference—generating an unprecedented hermeneutics of simultaneity. Rather than a single regime of historicity, transmodernity involves desynchronized temporalities and heterogeneous

knowledges, with plural narratives and dissimilar technologies cohabiting in a rhizomatic social reality where modern linearity and teleology yield to multi-trajectory development and polycontextural meaning (Rosa 2013; Dussel 2012).

This condition is also normatively charged. In its decolonial inflection, transmodernity names not merely "after modernity," but a critical overcoming of Eurocentric modernity: an opening toward peripheral knowledges and historically subaltern voices, together with the demand for epistemic inclusion beyond colonial-capitalist grammars of truth and value (Dussel 2012; Bhambra 2014). Yet the same pluralization of epistemic landscapes carries confirmable risks: the erosion of shared criteria of truth can enable new forms of relativism, post-truth dynamics, and information manipulation in digitally mediated publics (Couldry and Mejias 2019; Zuboff 2019). Transmodernity, in short, is simultaneously a horizon of epistemic pluralization and a magma of meaning-crises, where struggles over interpretability and authority are increasingly infrastructural (Star and Ruhleder 1996; Pasquale 2015).

Within this transmodern interregnum, the world witnesses a powerful technoscientific convergence often described—at different levels of specificity—as a Fourth Industrial Revolution, marked by ubiquitous digitalization, intelligent automation, and pervasive connectivity that fuse physical, digital, and biological domains (Schwab 2016; van Dijck et al. 2018). In parallel, the contemporary research landscape is increasingly shaped by the expansion of life sciences and complexity sciences, cognitive science, genomics, AI, and convergent techno-scientific programs that challenge inherited boundaries between organism and artefact, subject and environment (Jasanoff 2015; Jumper et al. 2021). The philosophical problem, however, is not simply that new technologies exist or that knowledge production accelerates. It is that the conditions under which learning, creativity, and justification occur are being reconfigured by AI–IoT infrastructures—systems that increasingly operate as ambient, background conditions of perception, evaluation, and action rather than as discrete instruments (Atzori et al. 2010; Star and Ruhleder 1996).

Against this background, this paper introduces and defends a concept that is *not* assumed to be widely established in current scholarly usage: Digital Enlightenment. The term is proposed here as a conceptual tool for reconstructing a transmodern pedagogical and socio-epistemic project that differs structurally from the modern Enlightenment. The conceptual problem is therefore not whether digital technologies "help" human beings learn or create; it is whether transmodern infrastructures transform the very architecture of knowing and doing—and, if so, how that transformation reshapes agency, autonomy, and the distribution of epistemic power (Heidegger 1977; Stiegler 1998; Pasquale 2015; Crawford 2021).

A philosophy of technology approach is warranted because the contemporary digital milieu is not merely an ensemble of tools added to an otherwise stable epistemic subject. Classic analyses of technics emphasize that technological formations disclose worlds: they shape what can appear as relevant, what counts as evidence, and what forms of action become viable (Heidegger 1977; Stiegler 1998). What changes with AI–IoT infrastructures is that this world-disclosing function becomes increasingly infrastructural and ambient: sensing, prediction, recommendation, and automation oper-

ate as background conditions of perception and decision rather than discrete instruments. The Internet of Things extends measurement and actuation into everyday environments, producing an externalized *aisthēsis*—a distributed sensorium that governs visibility and legibility through datafication (Atzori et al. 2010; Couldry and Mejias 2019). Generative and predictive AI, in turn, acts simultaneously as a poietic accelerator and as an epistemic authority proxy: it speeds up the production of text, images, and plans while also presenting synthesized outputs that can be taken—rightly or wrongly—as substitutes for inquiry and judgment (Pasquale 2015; Bender et al. 2021; Crawford 2021).

The risk, therefore, is not that the concept is "popularized," but that it becomes philosophically underdetermined. If "Digital Enlightenment" is treated as a mere synonym for technological progress, it collapses into technophilic optimism; if it is treated as a euphemism for infrastructural domination, it collapses into fatalism. The aim of this paper is to avoid both by reconstructing "Digital Enlightenment" as a philosophically tractable transformation: a shift in the architecture of knowing and acting, where agency is redistributed across socio-technical assemblages and where the norms of autonomy require new forms of epistemic justice (Fricker 2007; Medina 2013).

1.1. Thesis and contribution: conceptual engineering with normative bite

This article advances a thesis about the transmodern Digital Enlightenment. The term "transmodern" is used here not as rhetorical ornament but as a marker of socio-technical discontinuity: a condition in which learning, creativity, and governance are mediated by digital infrastructures whose pace, scale, and ubiquity exceed the institutional rhythms characteristic of the modern Enlightenment (Rosa 2013; van Dijck et al. 2018). Within this condition, "Digital Enlightenment" names a shift from institution-centered *epistēmē* to infrastructure-mediated assemblages in which *poiesis* (creative production) and *aisthēsis* (attention and experience) become conditions of knowing, and agency is redistributed across DIY practices and AI–IoT systems. The emancipatory content of this shift is conditional: it is realized only insofar as it is coupled to epistemic justice through robust forms of digital and AI literacy (Fricker 2007; Eshet-Alkalai 2004; Long and Magerko 2020).

The conceptual core of the argument is a quadrangular framework: *poiesis–technē / aisthēsis–epistēmē*. Classical and modern reflections already indicate that making and knowing, sensing and judging, are not cleanly separable in practice (Aristotle 1999; Dewey 1934). In contemporary digital environments, this entanglement becomes infrastructural: *technē*—now embodied in platforms, protocols, models, sensors, and datasets—actively reshapes *aisthēsis* by governing what is perceived and measured, while *poiesis* is accelerated by computational synthesis and automation. The consequence is not merely that people can produce more; it is that the relation between production and justification changes, because outputs circulate with the authority of "smart" systems and because contexts of interpretation are increasingly pre-structured by opaque pipelines (Star and Ruhleder 1996; Pasquale 2015; Bender et al. 2021; Crawford 2021). A further implication follows from the politics of the sensible: what can be perceived,

shared, and validated is distributed unevenly, and that distribution becomes a site of technological power (Rancière 2004; Fricker 2007; Zuboff 2019).

Against the temptation to treat DIY culture as a peripheral "hobbyist" phenomenon, this paper argues that DIY epistemologies and autodidactic ecologies are central to the transmodern Digital Enlightenment. They function as civic epistemic infrastructures: learning-by-making, documentation practices, repair cultures, and collaborative experimentation constitute a mode of autonomy grounded in participation rather than passive consumption (Illich 1971; Papert 1980; Ratto 2011). This "maker turn" is not automatically emancipatory either; it can be absorbed into consumerist spectacle or into individualized self-optimization. Its philosophical significance lies in its capacity to convert technical engagement into epistemic agency—especially when coupled to critical making, which foregrounds the normative and political dimensions of material practices (Ratto 2011; von Hippel 2005). On this view, empowerment is neither merely individual nor merely collective; it is infrastructural and pedagogical: it depends on the availability of learning ecologies that enable subjects to interrogate, adapt, and sometimes redesign the technological conditions that shape their lives (Freire 1970; Illich 1971; von Hippel 2005).

The paper's normative contribution is to reframe epistemic justice for AI–IoT societies. In classical formulations, epistemic injustice concerns wrongs in credibility and interpretive resources—testimonial and hermeneutical harms (Fricker 2007). In transmodern digital contexts, these harms are increasingly mediated by infrastructures that determine whose speech is amplified, whose experiences become data, and whose interests are encoded in systems of classification, ranking, and recommendation (Pasquale 2015; Zuboff 2019; Crawford 2021). Epistemic justice must therefore be extended to include asymmetries in access to intervention: who can audit systems, understand their assumptions, contest their outputs, and reshape the contexts in which they operate (Medina 2013; Jasanoff 2015). Digital literacy and AI literacy, in this framework, are not optional "skills" but justice-relevant capabilities: they define whether subjects remain dependent users of black-box authority or become participants in the reconfiguration of socio-technical agency (Eshet-Alkalai 2004; Long and Magerko 2020).

Two objections motivate the structure of the argument. First, a technoutopian objection holds that Digital Enlightenment is simply the democratization of knowledge through access and computation. The reply is that access without interpretive capacity and intervention rights yields new forms of dependency and new patterns of epistemic inequality under infrastructural power (Pasquale 2015; Fricker 2007; Couldry and Mejias 2019). Second, a deflationary objection holds that AI and IoT merely automate; they do not reconfigure agency. The reply is that even if one refrains from attributing "agency" to artefacts in a strong sense, infrastructures can redistribute the space of possible action and the norms of evidence, thereby reshaping human agency at scale (Heidegger 1977; Stiegler 1998; Star and Ruhleder 1996; Atzori et al. 2010).

1.2. Roadmap

Section 2 contrasts the modern Enlightenment with the transmodern condition, arguing that the digital turn shifts epistemic authority from institutions to infrastructures and reconstitutes the subject of knowledge as an assemblage (Dussel 2012; van Dijck et al. 2018). Section 3 develops the conceptual quadrangle *poiesis–technē / aisthēsis–epistēmē*, showing how it clarifies the contemporary entanglement of creativity, attention, and justification (Aristotle 1999; Dewey 1934; Rancière 2004; Rosa 2013). Section 4 reconstructs DIY epistemologies and autodidactic ecologies as civic infrastructures of learning-by-making, distinguishing emancipatory participation from individualized "maker" spectacle (Illich 1971; Freire 1970; Papert 1980; Ratto 2011; von Hippel 2005). Section 5 analyzes AI–IoT infrastructures as mediators that redistribute interpretive capacity and restructure environments, introducing a test-indexed vocabulary for discussing bio–artificial continuity without metaphysical escalation (Atzori et al. 2010; Pasquale 2015; Bender et al. 2021; Crawford 2021). Section 6 then reframes epistemic justice under infrastructural power and argues that digital and AI literacy must be treated as justice-relevant capabilities (Fricker 2007; Medina 2013; Eshet-Alkalai 2004; Long and Magerko 2020). Section 7 synthesizes these claims into a transmodern program of Digital Enlightenment oriented toward autonomy and collective empowerment, before Section 8 concludes with implications for future research in philosophy of technology and allied fields (Jasanoff 2015; Couldry and Mejias 2019; Zuboff 2019).

2. From Modern to Transmodern Digital Enlightenment

2.1. Modern Enlightenment: *epistēmē*, institutions, public reason, and the disciplining of *technē*

The modern Enlightenment is often condensed into a moral-political imperative—*sapere aude*—and a corresponding epistemic ideal: the public use of reason as a regulative horizon for knowledge, critique, and civic maturity. In that configuration, autonomy is primarily construed as a capacity for judgment under publicly shareable reasons, and the legitimacy of knowledge is secured—at least in principle—by institutional forms that stabilize epistemic authority: academies, universities, scientific societies, and the emerging public sphere. This does not mean that the modern Enlightenment is reducible to a simple story of progress, nor that it achieved its own universalist promise. It means that its dominant grammar of emancipation was institution-centered: the subject of knowledge was imagined as a rational agent whose freedom is exercised through argument, critique, and the institutional mediation of expertise.

The internal tension of this model becomes visible once one attends to the modern settlement between *technē* and *epistēmē*. Modernity simultaneously amplifies technical power and morally disciplines it: the "right" use of *technē* is subordinated to the ends validated by rational critique and institutional authority. The separation is functional: *technē* becomes a means, while *epistēmē* defines the standards of legitimacy. Yet that separation also generates a structural vulnerability. When the conditions of publicity, access, and education are unequally distributed, the modern project risks reproducing a stratified epistemic order in which autonomy becomes the privilege of those who are already institutionally positioned to participate in "public reason." Decolonial critiques

sharpen the point: the universalism of modernity historically operated through exclusionary narratives and epistemic hierarchies, with "reason" often functioning as a gatekeeping device that policed the boundaries of legitimate knowledge (Dussel 2012).

From the standpoint of this paper, what matters is not to adjudicate the modern Enlightenment as a whole, but to isolate its operative epistemic architecture: (i) an institutional regime that certifies knowledge; (ii) a normative ideal of autonomy grounded in public justification; and (iii) a relatively stable differentiation between making and knowing, between the technical and the epistemic. The question, then, is what happens when that architecture is displaced by infrastructures that pre-structure perception, inference, and action at scale.

2.2. The transmodern condition: simultaneity, plural epistemologies, and infrastructural power

Transmodernity can be read as an interregnum in which heterogeneous temporalities and antagonistic logics coexist—without converging into a single linear narrative of historical development. On this view, the present is less a "stage" beyond modernity than a polycontextural field: local and global reorder each other; traditions persist, mutate, and return; and multiple epistemic registers—scientific-technical, popular, indigenous, situated—cohabit and contest the authority to define what counts as real, valuable, and actionable (Dussel 2012). The decolonial inflection is not ancillary here: transmodernity is, in Dussel's sense, also a normative invitation to rethink modernity's self-description by incorporating voices and knowledges historically positioned as peripheral.

At the same time, transmodern pluralization is inseparable from a socio-technical transformation: the emergence of platform-mediated sociality and pervasive data infrastructures that organize interaction, visibility, and value extraction. The "platform society" thesis captures the extent to which platforms no longer merely host social life but increasingly structure it—reconfiguring public values through connective infrastructures that are simultaneously economic, political, and epistemic (van Dijck et al. 2018). In parallel, the "data colonialism" diagnosis frames contemporary datafication as a new mode of appropriation—an infrastructural logic through which human life is rendered as extractable data under asymmetrical power relations (Couldry and Mejias 2019).

This is the key hinge for the article's thesis: transmodernity is not merely "more diversity of perspectives." It is also an environment in which the conditions of interpretability—what can be perceived, expressed, validated, and acted upon—are increasingly governed by socio-technical infrastructures. Plural epistemologies thus coexist with intensified struggles over sense-making, because the infrastructures that mediate visibility and credibility are not neutral channels; they are architectures of selection, amplification, and occlusion. The resulting landscape is simultaneously enabling (new spaces of learning, collaboration, and creativity) and hazardous (new regimes of opacity, manipulation, and epistemic dependency). This ambivalence is precisely what motivates the need for a concept of Digital Enlightenment that is neither triumphalist nor fatalistic.

2.3. The shift: the subject of knowledge as an assemblage under AI–IoT infrastructures

If modern Enlightenment presupposed an epistemic subject stabilized by institutions and public reason, transmodernity increasingly produces an epistemic subject stabilized (and destabilized) by infrastructures. Infrastructure studies make the point with methodological clarity: infrastructures are typically invisible in use, become visible upon breakdown, and shape what is possible by embedding standards, classifications, and access conditions into the background of practice (Star and Ruhleder 1996). The subject of knowledge, under such conditions, is not simply an individual reasoner "using" tools. It is an assemblage whose perceptual, interpretive, and practical capacities are redistributed across devices, platforms, protocols, and environments.

This is where the AI–IoT nexus matters philosophically. The Internet of Things extends sensing and actuation into everyday environments, generating a distributed, externalized sensorium that modulates what becomes legible and actionable through continuous data streams (Atzori et al. 2010). Infrastructural sensing is not merely "more information"; it is a redefinition of what counts as a relevant feature of the world. When AI systems are layered onto these environments—predicting, classifying, recommending, and generating outputs—the result is a new coupling between *aisthēsis* and *epistēmē*: perception is operationalized through measurement, and judgment is increasingly mediated by algorithmic proxies. This coupling can support autonomy when subjects and communities can interrogate, contest, and reconfigure it. It undermines autonomy when it consolidates epistemic authority into opaque pipelines that users cannot understand or meaningfully influence.

The transmodern Digital Enlightenment, as proposed in this paper, begins precisely at this junction. It names a shift in which *technē* becomes infrastructural, *poiesis* is accelerated by computational systems, and *aisthēsis* is reorganized through ambient sensing—thereby transforming the conditions under which *epistēmē* is produced and legitimized. To describe this shift adequately, we need a conceptual framework that does not treat creativity and attention as mere "soft" cultural variables, but as philosophically central dimensions of technological mediation. That is the task of the next section: to articulate a quadrangular map—*poiesis–technē / aisthēsis–epistēmē*—capable of tracking how agency, learning, and justification are being reconfigured in transmodern infrastructures.

3. A Conceptual Quadrangle: *Poiesis–Technē / Aisthēsis–Epistēmē*

3.1. Minimal definitions and why they matter

To conceptualize the transmodern Digital Enlightenment without drifting into either technological triumphalism or moral panic, we require a vocabulary that can track how learning, creativity, and justification are co-structured by socio-technical conditions. This section proposes a minimal quadrangle—*poiesis–technē / aisthēsis–epistēmē*—as

a conceptual map for describing how agency is reconfigured under AI–IoT infrastructures.

Poiesis denotes productive bringing-forth: the capacity to generate forms, artifacts, expressions, and solutions. It is not limited to "art" in a narrow sense, but names a generative dimension of practice—making something appear in the world that did not previously exist. *Technē* denotes situated know-how: a practical, craft-like intelligence that stabilizes procedures, materials, and methods. Although *poiesis* and *technē* are analytically distinguishable, they are rarely separable in practice. Producing something typically requires know-how; and know-how is often developed, tested, and refined through production (Aristotle 1999).

On the complementary axis, *aisthēsis* denotes the sensible-affective dimension of experience—perception, attention, salience, and the embodied conditions under which the world becomes present to an agent. *Epistēmē* denotes knowledge in the strong sense: the norm-governed dimension of justification, warrant, and intelligibility. Here again, separation is a theoretical convenience. Even in classical accounts, knowledge is not merely a formal relation between propositions; it depends on the cultivation of attention, the stabilization of perceptual practices, and the transformation of experience into communicable forms. Dewey's pragmatist reconstruction is particularly helpful: knowing is not an abstract gaze from nowhere but a mode of inquiry rooted in experience and oriented to reconstruction—an activity that depends on perceptual engagement and practical experimentation (Dewey 1934).

The point of these minimal definitions is methodological. Contemporary debates often discuss AI, platforms, or maker cultures in terms of "impacts" on society, as if technology were an external variable acting on an otherwise stable epistemic subject. The quadrangle is designed to resist that framing. It enables us to treat creativity (*poiesis*), technical infrastructures (*technē*), attention and experience (*aisthēsis*), and justification (*epistēmē*) as an interdependent field. Digital Enlightenment, on this view, is a transformation in that field: the conditions of production, perception, and justification are being reorganized simultaneously.

3.2. The quadrangle as a map of technological mediation

The central claim of this section is that the quadrangle clarifies what is distinctive about transmodern infrastructures: they do not merely supply new tools for existing epistemic practices; they reshape the background conditions that govern the relations among *poiesis*, *technē*, *aisthēsis*, and *epistēmē*. In the modern Enlightenment architecture sketched above, *technē* is often treated as a means subordinated to ends validated by public reason. In transmodern settings, *technē* increasingly takes the form of infrastructures—platforms, protocols, data pipelines, sensors, and models—that silently structure what can be perceived, what can be produced, and what counts as an acceptable warrant.
Heidegger's analysis remains relevant, not because it dictates a single verdict on modern technology, but because it highlights the world-disclosing character of technics: technologies are not neutral instruments but modes of revealing that determine what can appear as real and actionable (Heidegger 1977). Stiegler radicalizes this point by treating technics as a constitutive condition of human temporality and memory: technical systems organize retention and anticipation, thereby shaping the temporal horizon

within which experience, learning, and invention become possible (Stiegler 1998). Together, these lines of thought support a robust philosophical conclusion: when *technē* becomes infrastructural, it becomes a condition of possibility for both *aisthēsis* and *epistēmē*.

This is precisely what AI–IoT infrastructures intensify. IoT expands the scope of what is sensed and measured, reorganizing *aisthēsis* by translating aspects of experience into continuous data streams. AI systems then act on that stream by classifying, predicting, recommending, and increasingly generating outputs, thereby mediating both the production of new artifacts (*poiesis*) and the apparent authority of synthesized "knowledge" (*epistēmē*). The quadrangle provides a way to describe the resulting entanglements without prematurely anthropomorphizing machines or reducing agency to computation. The question is not whether AI "has" agency in a strong sense. The question is how infrastructural *technē* reorganizes *aisthēsis* (what becomes salient), accelerates *poiesis* (what can be produced with minimal friction), and thereby modifies *epistēmē* (how warrants are formed and trusted).

Importantly, this reorganization also has a political form. When infrastructures govern what appears as relevant, they govern the distribution of the sensible: what is made visible, what is amplified, what is normalized, and what is excluded from shared intelligibility. The quadrangle thus has a diagnostic function. It allows us to identify where power operates: not only through explicit coercion or persuasion, but through the background shaping of attention, visibility, and epistemic default settings (Heidegger 1977; Stiegler 1998). In later sections, this will provide the bridge to epistemic justice: if infrastructures shape the conditions of interpretability, then justice cannot be reduced to formal access to information; it must also address the distribution of capacities to understand and intervene in those conditions.

3.3. Time, creativity, and attention as epistemic conditions

The transmodern Digital Enlightenment is often experienced, phenomenologically and socially, as acceleration. This matters because acceleration is not merely a psychological complaint; it is a structural transformation in the temporal organization of learning, creativity, and justification. Rosa's theory of social acceleration is useful here: modernity already involved dynamics of speed-up, but contemporary conditions intensify them across technological change, social change, and the pace of life, producing a chronic pressure for responsiveness that reshapes the conditions of agency (Rosa 2013). In the present context, AI-assisted production and IoT-mediated environments extend this pressure into the micro-temporality of everyday cognition: prompts, notifications, recommendations, and automated outputs compress the time from intention to production, and from perception to response.

The quadrangle helps us specify what is at stake. When *poiesis* is accelerated by AI, the bottleneck shifts: production becomes easy, while the cultivation of criteria for judgment—*epistēmē*—becomes comparatively more demanding. When *aisthēsis* is reorganized by infrastructural selection mechanisms, attention is not simply "distracted"; it is governed by competing salience regimes that can fragment experience and weaken the conditions for sustained inquiry. In this setting, time is not merely a resource; it becomes an epistemic condition. Without temporal room for exploration, error, revi-

sion, and reflective comparison, the norms of justification are pressured toward superficial plausibility and rapid closure—especially when outputs arrive pre-packaged with an aura of computational authority.

Conversely, the transmodern condition also makes possible new pedagogical and creative ecologies. The same acceleration that threatens reflection can enable rapid iteration, collaborative prototyping, and distributed learning. The philosophical issue is therefore not whether acceleration is "good" or "bad," but how the temporal structure of practices affects the relations among *poiesis*, *technē*, *aisthēsis*, and *epistēmē*. Digital Enlightenment, as reconstructed here, requires that creative acceleration be paired with capacities for attentive discipline and justificatory robustness—capacities that are not simply individual virtues, but infrastructurally supported conditions of autonomy.

This sets up the argument of the next section. If the Digital Enlightenment is to be more than an infrastructural redistribution of production and perception, it must include forms of learning that reconnect *poiesis* and *technē* with reflective *epistēmē* and cultivated *aisthēsis*. That reconnection is not primarily achieved by institutional proclamation, but by practices and ecologies—DIY epistemologies and autodidactic infrastructures—that enable subjects and communities to learn by making, to document and repair, and to render infrastructures intelligible enough to be contested and redesigned.

4. DIY Epistemologies and Autodidactic Ecologies

4.1. DIY as epistemic practice: learning-by-making, documentation, repair

If Section 3 established that transmodern infrastructures reorganize the relations among *poiesis*, *technē*, *aisthēsis*, and *epistēmē*, DIY epistemologies can be specified as a practical counter-movement within that reorganization: a set of practices that reconnect production, perception, and justification through hands-on inquiry. The central claim is that DIY is not primarily a lifestyle aesthetic or a consumer identity; it is an *epistemic mode* whose core operations are (i) learning-by-making, (ii) documentation as warrant, and (iii) repair as epistemic resistance.

Learning-by-making provides a concrete pathway from *aisthēsis* to *epistēmē*: one learns what a system "is" by experimenting with how it behaves under manipulation, error, and iteration. This tradition is legible in the educational lineage that treats knowledge as something constructed through engagement rather than transmitted as finished representation (Papert 1980). Illich's critique of institutionalized schooling, in turn, helps to clarify why DIY epistemologies are politically consequential: they expose how monopolies over credentialed expertise can produce dependency, and they propose convivial infrastructures that enable agency through accessible tools, peer learning, and shared competence (Illich 1971).

The second operation—documentation—transforms DIY from mere tinkering into public, revisable, and therefore epistemically accountable practice. In transmodern settings, documentation (protocols, bills of materials, code repositories, build logs) functions as a quasi-methodological analogue to "materials and methods": it is what makes claims inspectable and repeatable. Contemporary open hardware scholarship has emphasized precisely this point: open designs and transparent build practices can improve reproducibility, lower costs, and widen participation in research and innovation. In this

sense, DIY epistemologies do not oppose scientific norms; they *re-localize* them within communities of practice by making the evidential chain visible and modifiable.

Repair is the third, often underestimated, operation. Repair is not only an economic or ecological act; it is also an epistemic one: to repair is to render intelligible the functional articulation of an artefact and to contest the engineered opacity that blocks understanding. Recent research on the "right to repair" frames repair as a practice where autonomy is exercised against product lock-in, informational asymmetries, and the privatization of diagnostic knowledge. Within the conceptual quadrangle, repair is a moment where *technē* is reclaimed (how the thing works), *poiesis* is reactivated (the artefact is re-made), *aisthēsis* is re-trained (attention to breakdown and function), and *epistēmē* is strengthened (knowledge is gained through reversible intervention rather than passive consumption). This is why the DIY ethos is not reducible to "making"; it is, more precisely, a practice of re-opening—of devices, infrastructures, and learning processes.

4.2. Autodidacticism as infrastructure, not a trait

DIY epistemologies presuppose something that is too often psychologized: autodidacticism. In transmodern conditions, autodidacticism should not be treated as a personal virtue ("self-motivation") but as an ecology: a set of infrastructural, social, and normative supports that make self-directed learning feasible and scalable. The relevant unit of analysis is therefore not the solitary learner but the *learning environment*—platforms, repositories, communities, tools, and norms.

Freire's account of education as praxis—reflection and action oriented toward transformation—remains foundational because it frames literacy as an emancipatory capacity rather than a narrow skill-set (Freire 1970). In the transmodern Digital Enlightenment, the analogous move is to treat technical and digital learning as a capability for participation: the ability to interrogate, modify, and collectively negotiate the conditions of one's own technosocial life. Von Hippel's work on user innovation helps specify the structural basis of this capability: users and communities innovate because they possess local knowledge, because tools and information circulate, and because innovation becomes distributed across networks rather than centralized in firms (von Hippel 2005). Gershenfeld's "fab lab" paradigm adds the infrastructural intuition: access to modular tools and shared fabrication resources changes what kinds of people can design, prototype, and learn-by-building (Gershenfeld 2005).

What is transmodern about autodidactic ecologies is that they increasingly run through platforms and data infrastructures that simultaneously enable and constrain learning. Analyses of platform society stress that platforms have become systemic mediators of sociality and public values, shaping the visibility and circulation of knowledge practices (van Dijck et al. 2018). Complementarily, the data colonialism framework highlights that the same infrastructures can appropriate human activity as extractable data, instituting asymmetries in who benefits from participation and who controls the conditions of intelligibility (Couldry and Mejias 2019). This ambivalence matters for autodidacticism: the ecology that enables self-learning (tutorial platforms, code repositories, open forums) can also reintroduce dependency via algorithmic visibility, credential inflation, surveillance, and proprietary capture of communal labor.

The philosophical upshot is that autodidactic ecologies are governance objects. They can be designed to support autonomy (open standards, legible documentation, community ownership, repairability), or they can be tuned to maximize retention, monetization, and behavioral predictability. Hence, in the transmodern Digital Enlightenment, "self-learning" is best understood as infrastructure-mediated autonomy—a capacity that is fragile unless coupled to the norms and institutions (formal or informal) that protect interpretability, contestability, and access to intervention.

4.3. Critical making and artisanal epistemology: praxis, not hype

DIY epistemologies become philosophically distinctive when they are interpreted through critical making: making as a method for concept formation and socio-technical critique, rather than as a celebration of novelty. Ratto's formulation is decisive because it treats material engagement as a bridge between conceptual analysis and lived technological experience, thereby converting "making" into a mode of inquiry in social life (Ratto 2011). Dewey's pragmatist view reinforces the epistemic logic: inquiry is experimental, iterative, and situated; the validity of concepts is tested through their consequences in practice (Dewey 1934). Together, these frameworks justify the article's claim that DIY can function as a transmodern enlightenment practice: it reconnects knowledge to manipulability, interpretation to experience, and critique to prototyping.

This is where the notion of artisanal epistemology acquires precision. "Artisanal" here does not mean pre-modern romanticism; it denotes a discipline of attention and craftsmanship in the production of warranted claims: transparency of materials and methods, repairability, reusability, and the public legibility of how results are achieved. Recent work on open hardware in science explicitly links these virtues to reproducibility and to democratizing access under structural inequalities. From the standpoint of epistemic justice, artisanal epistemology is also a distributional stance: it refuses the default assumption that intelligibility belongs to experts alone. It expands the space of who can *understand enough to contest*—a point aligned with the core diagnosis of epistemic injustice as a wrong in credibility and interpretive resources (Fricker 2007).

Crucially, critical making also functions as a filter against "maker hype." It distinguishes emancipatory DIY from three common degradations: (i) consumerist spectacle (making as branded identity), (ii) self-optimization (making as individual productivity theater), and (iii) instrumental STEMism (making as skill production detached from civic meaning). Under the quadrangle proposed in Section 3, these degradations can be described as imbalances: *poiesis* accelerates while *epistēmē* weakens; *technē* becomes proprietary while *aisthēsis* is redirected toward platform salience rather than inquiry. By contrast, critical making and artisanal epistemology aim at rebalancing: they cultivate *aisthēsis* (attentional discipline), reclaim *technē* (legibility and repair), activate *poiesis* (creative production), and strengthen *epistēmē* (documentation as warrant, public revisability).

If DIY epistemologies and autodidactic ecologies are the pedagogical-civic motor of the transmodern Digital Enlightenment, then AI–IoT infrastructures are the ambient environment within which this motor must operate. The task of Section 5 is therefore

to specify how AI–IoT systems redistribute interpretive capacity and restructure environments—clarifying when such infrastructures amplify autonomy and when they consolidate epistemic dependency.

5. AI–IoT Infrastructures and the Reconfiguration of Agency

5.1. IoT as distributed *aisthēsis* and environmental governance

In the transmodern condition, the Internet of Things (IoT) is best understood less as a discrete "technology sector" than as a socio-technical strategy for externalizing *aisthēsis*: it installs a distributed sensorium (sensing, identification, actuation) across everyday environments, turning spaces into continuous sites of measurement, prediction, and intervention. The classical IoT architecture—heterogeneous devices, networked communication layers, and data-driven services—already implies an epistemic transformation: the environment becomes legible in machine-readable variables, and the practical world is reorganized around what can be sensed, logged, and acted upon (Atzori et al. 2010).

This shift is not merely additive ("more data"). It redefines what can count as a salient feature of the world by translating lived situations into standardized signals. In infrastructural terms, IoT systems operate as background conditions: they become most visible when they fail, when they clash with local practice, or when access and interpretability break down—precisely the features that mark infrastructure as an ecology rather than a tool (Star and Ruhleder 1996). The normative stakes follow directly: when *aisthēsis* is partially delegated to networked sensing and automated classification, the governance of environments shifts toward those who control sensor placement, data schemas, interoperability standards, and downstream analytics.

Recent work underscores how quickly this becomes a security-and-privacy problem with epistemic consequences. Privacy and security vulnerabilities in IoT are not marginal technicalities; they determine who can safely inhabit datafied environments, who bears the risks of exposure, and who can trust the perceptual "picture" produced by sensor infrastructures (Sun 2025). In short, IoT is a material politics of perception: it reorganizes environmental intelligibility, and it does so under asymmetric control.

5.2. AI as a poietic accelerator and epistemic authority proxy

If IoT externalizes *aisthēsis*, contemporary AI—especially predictive and generative systems—functions as a dual reconfiguration of *poiesis* and *epistēmē*. On the one hand, AI becomes a poietic accelerator: it compresses the time and skill thresholds for producing texts, images, plans, and code. On the other hand, it increasingly functions as an epistemic authority proxy: it outputs synthesized responses in formats that mimic the rhetorical surface of justified knowledge, inviting users (and institutions) to treat outputs as epistemic closures rather than as prompts for further inquiry.

This is where the risk of "authority by synthesis" becomes structurally important. Pasquale's analysis of black-box regimes remains a strong anchor for understanding why opacity is not a mere inconvenience: when core classificatory and decision-making mechanisms are proprietary or inscrutable, the locus of accountability shifts away from those affected by the system and toward those who own or control the pipeline

(Pasquale 2015). In generative AI, the same logic is intensified by scale and by the public plausibility of fluent outputs. Bender et al. articulate this as a family of epistemic and social risks: large language models can produce compelling text without grounding, while reproducing biases and masking labor, data provenance, and environmental costs (Bender et al. 2021).

The key point is not simply that AI systems can be wrong. It is that they can reshape norms of justification by changing what counts as a "reasonable" epistemic move in practice: asking, accepting, forwarding, citing. This is precisely why risk-governance frameworks matter as philosophical objects rather than merely regulatory artifacts. NIST's AI risk frameworks for generative systems treat trustworthiness as a multidimensional problem (validity, reliability, transparency, accountability, harmful bias management, etc.), making explicit that "AI performance" is inseparable from context-sensitive risk and governance (NIST 2024). The transmodern issue, then, is not whether AI can support inquiry, but under what conditions it amplifies epistemic agency rather than substituting for it.

5.3. Bio–Artificial Continuity Without Metaphysics

Bio–artificial continuity can be defended in this article without endorsing a strong ontological claim (e.g., that living and artificial systems share an identical "kind" of agency). The continuity thesis can instead be framed as functional and infrastructural continuity: continuity in how capacities for sensing, interpretation, and action are distributed, stabilized, and evaluated across human–technical assemblages. The guiding idea is test-indexed: we specify continuity by the criteria under which a coupled system counts as reliable, interpretable, and governable in practice.

From an infrastructural perspective, continuity is most visible where socio-technical systems become "background conditions" for knowledge and action. In such settings, what matters is not whether the artifact "really" knows, but whether the assemblage yields stable, revisable, and accountable epistemic performance. Star and Ruhleder's ecology of infrastructure offers a precise lens: infrastructures embed standards, shape access, and become visible through breakdown and misfit; these are exactly the points where continuity becomes empirically and normatively tractable (Star and Ruhleder 1996).

On this framing, bio–artificial continuity is assessed through governance-relevant properties: traceability of inputs and outputs, robustness under shifting contexts, transparency appropriate to use, mechanisms for contestation and redress, and the distribution of competence required for safe operation. NIST's generative AI risk profile is useful here because it treats AI systems as context-sensitive risk objects whose trustworthiness depends on documented design choices, evaluation regimes, and organizational controls (NIST 2024).

Thus, continuity is not a metaphysical escalation; it is a continuity of coupled sense-making constraints. The thesis becomes: in transmodern AI–IoT environments, agency is increasingly hybrid in the specific sense that epistemic and practical capacities are produced by assemblages whose reliability, interpretability, and justice-relevance must be evaluated at the level of the coupling—not solely at the level of individual humans or isolated artifacts.

5.4. Interim synthesis: what “hybrid agency” means here

The preceding analysis allows a constrained definition that remains philosophically robust without anthropomorphizing machines. Hybrid agency, in this article, names the condition in which (i) *aisthēsis* is partially externalized into pervasive sensing and datafication, (ii) *poiesis* is accelerated through automated synthesis and recommendation, and (iii) *epistēmē* is reorganized because justificatory practices are increasingly mediated by infrastructural defaults (visibility regimes, ranking, provenance opacity, and delegated “answers”). The concept is hybrid not because artifacts become persons, but because the space of possible action and the norms of evidence are co-produced by assemblages whose architecture is typically invisible in use and politically consequential in breakdown (Star and Ruhleder 1996).

This hybridization has a predictable power signature. When the mediating pipeline is opaque, the authority to define what is salient, credible, or actionable concentrates in the hands of those who own and tune the infrastructure—an epistemic politics that tracks Pasquale’s diagnosis of black-box governance (Pasquale 2015). For that reason, the transmodern Digital Enlightenment cannot be framed as access-to-tools alone. It must include capabilities for understanding and intervention, and—crucially—an institutional recognition that such capabilities are not optional. A salient indicator is that the EU AI regulatory framework explicitly includes obligations to promote AI literacy, and the European Commission has clarified the timing of application for the relevant literacy provision (European Commission 2025).

Section 6 will therefore formalize the normative consequence: epistemic justice must be extended to infrastructural conditions. In AI–IoT societies, justice-relevant harms increasingly arise not only from interpersonal credibility deficits, but from unequal access to interpretability, contestability, and redesign—precisely the capacities required to prevent hybrid agency from collapsing into hybrid dependency.

6. Epistemic Justice, Digital/AI Literacy, and the Capability for Intervention

6.1. From epistemic injustice to infrastructural injustice

Classical accounts of epistemic injustice focus on wrongs that occur in the space of reasons and social recognition: a speaker is not believed when she should be (testimonial injustice), or collective interpretive resources are structurally insufficient for making sense of certain experiences (hermeneutical injustice) (Fricker 2007). Medina extends this picture by emphasizing the social ecology of knowing: epistemic harms are sustained by patterns of ignorance, credibility economies, and institutionalized “blind spots” that distribute interpretive power unevenly (Medina 2013). These frameworks remain indispensable. Yet the transmodern AI–IoT milieu forces a conceptual extension: epistemic injustice is increasingly *infrastructural*.

Infrastructural epistemic injustice arises when the material and computational architectures that mediate visibility, classification, and communication systematically distort who is legible, whose claims are amplified, and which experiences become intelligible in the first place. In the platform- and datafied environment, the question “who

is believed?" is no longer fully answerable at the interpersonal level, because credibility is mediated by ranking systems, recommender logics, frictionless forwarding, and automated "summaries" that pre-structure what counts as salient and plausible. In this setting, harms are not exhausted by interpersonal prejudice or interpretive gaps; they are produced by socio-technical arrangements that set default conditions of attention and intelligibility.

Pasquale's diagnosis of black-box governance remains a pivotal anchor because it shows how opacity is not merely epistemically inconvenient but politically constitutive: when the decision pipeline is proprietary or inscrutable, the locus of accountability shifts, and affected agents lack meaningful access to the reasons that structure their practical world (Pasquale 2015). This is precisely the point at which epistemic injustice becomes infrastructural. What is unequally distributed is not only credibility in conversation; it is *access to the conditions of justification*: the ability to inspect, contest, and alter the classificatory and evidential apparatus that governs one's inclusion in the shared world.

Contemporary AI systems are not "mere tools," but institutional technologies whose training data, labor conditions, and design priorities embed value-laden choices about whose realities are represented and whose harms are counted (Crawford 2021). The normative conclusion follows: in transmodern settings, epistemic justice must address the distribution of interpretability and contestability at the infrastructural level, because that is where epistemic power is increasingly exercised.

6.2. Literacy as justice-relevant capability, not a "skill"

If epistemic injustice can be infrastructural, then "literacy" cannot be treated as a neutral bundle of marketable competencies. It must be reconstructed as a justice-relevant capability: a set of learned powers that determine whether subjects remain dependent users of infrastructural authority or become participants in the governance of the conditions under which they know and act. This is the conceptual hinge between the descriptive analyses of Sections 2–5 and the normative program of a transmodern Digital Enlightenment.

Digital literacy includes cognitive and critical dimensions: the ability to interpret, evaluate, and navigate information environments, and to understand how media forms shape meaning and judgment (Eshet-Alkalai 2004). In the present argument, this point must be sharpened: the relevant literacy is not only interpretive but intervention-oriented. In AI–IoT environments, the decisive question is whether subjects and communities can understand enough of the pipeline to challenge it when it misfits their practices, harms their interests, or encodes unjust assumptions.

AI literacy is not merely familiarity with AI applications; it includes concepts that enable critique and responsible use (e.g., data, training, bias, evaluation, limits of outputs, and contextual appropriateness) (Long and Magerko 2020). Yet in the transmodern condition, even this is not sufficient unless literacy is aligned with institutional mechanisms that make such understanding actionable. A subject may know that an AI output is probabilistic, biased, or ungrounded; without pathways for contestation and redesign, that knowledge remains ethically inert.

This is why governance frameworks should be treated as part of the conceptual apparatus rather than external compliance artifacts. NIST's generative AI risk guidance

explicitly frames trustworthiness as contextual and multi-dimensional, requiring documentation, evaluation, monitoring, and accountability practices that extend beyond "user awareness" (NIST 2024). When imported into the present argument, the implication is clear: literacy must be coupled to *governable affordances*. Otherwise, literacy becomes a burden shifted onto individuals, while the infrastructures that generate dependency remain structurally unaltered.

The critical issue is not only whether users understand AI, but whether organizations and public institutions provide the conditions for meaningful oversight, contestation, and remedy. In a transmodern Digital Enlightenment, literacy is therefore a capability with civic weight: it is a precondition for autonomy under hybrid agency, and thus a justice-relevant good.

6.3. Rights to explanation, contestation, and participation: minimal institutional implications

A transmodern reconstruction of epistemic justice requires a minimal institutional package that operationalizes "capability for intervention." The aim is not to offer a legal treatise, but to specify the normative implications that follow once epistemic power is acknowledged to be infrastructural. The package can be formulated in three tightly connected requirements: (i) explainability and documentation proportional to risk, (ii) contestability and redress mechanisms, and (iii) participation rights in the design and governance of socio-technical systems.

First, explanation here should be understood pragmatically: not as a metaphysical demand for full transparency, but as access to reasons and documentation sufficient for accountability in context. NIST's risk approach supports this: robust governance requires traceability, evaluation regimes, and documented controls that make systems auditable and correctable (NIST 2024). Second, contestability requires that affected persons can challenge decisions, classifications, and outputs, and that institutions provide pathways for correction and remedy. Without contestation, explanation becomes performative; it informs without empowering. Third, participation rights follow from the nature of the harm: if infrastructures pre-structure intelligibility, then justice requires that those most affected by misfit and harm have a voice in the shaping of standards, datasets, evaluation criteria, and deployment contexts. Otherwise, the transmodern condition reproduces a paternalism of infrastructure: governance "for" people without governance "by" people.

This is where regulatory signals are philosophically relevant. The EU's AI regulatory framework explicitly includes requirements oriented toward AI literacy in deployment contexts, and the European Commission has clarified when key provisions entered into application (European Commission 2025). The normative significance is that literacy is being treated, at least in principle, as a responsibility not only of individuals but of organizations and institutions: an acknowledgment that autonomy under AI mediation is partly a matter of structured competence and institutional support.

AI is an extractive and institutional technology, and therefore the just distribution of epistemic power cannot be addressed solely through consumer choice or individual caution (Crawford 2021). The minimal institutional implications can thus be stated with conceptual clarity: an epistemically just AI–IoT society is one in which explanation is actionable, contestation is feasible, and participation is structurally enabled. These are

not optional ethical add-ons; they are the transmodern equivalents of Enlightenment conditions for the public use of reason—reconfigured for infrastructural mediation.

7. A Transmodern Program of Digital Enlightenment

7.1. Defining the transmodern Digital Enlightenment: from access to intervention

A transmodern Digital Enlightenment can now be defined with conceptual precision. It is not an era-description reducible to "more information" or "more powerful tools," nor a mere cultural mood attached to connectivity. It is a normative-epistemic configuration in which the conditions of knowing and acting are mediated by infrastructures that recompose *poiesis*, *technē*, *aisthēsis*, and *epistēmē*—and in which autonomy depends on whether individuals and communities possess the capability for intervention. This capability designates the practical power to understand, contest, and reshape the socio-technical conditions that structure perception, production, and justification, rather than merely consuming their outputs (Fricker 2007; Freire 1970; van Dijck et al. 2018).

On this definition, "access" is an insufficient benchmark. Access can coexist with dependency when interpretive resources are scarce, when systems are opaque, and when users are positioned as terminal points in a pipeline rather than as participants in its governance. By contrast, intervention names a deeper form of emancipation: the power to transform the very conditions under which claims become credible, experiences become intelligible, and actions become possible. Transmodern Digital Enlightenment, therefore, is best understood as a shift from institution-centered public reason to infrastructure-mediated epistemic agency—where the distribution of intervention capacity becomes the decisive metric of freedom.

7.2. A governance-and-pedagogy bundle: the minimal "program"

If the concept is defined by intervention capacity, the corresponding program must be neither utopian nor purely technocratic. A minimal transmodern program can be articulated as a governance-and-pedagogy bundle with four mutually reinforcing components.

First, literacy as capability: digital and AI literacy must be institutionalized as justice-relevant capabilities, enabling comprehension of infrastructural mediation, probabilistic outputs, data provenance issues, and the limits of automated synthesis. Treated as capability, literacy is oriented to action: it enables auditing practices, responsible use, refusal when appropriate, and collective demands for accountability (Freire 1970; NIST 2024).

Second, documentation and traceability: infrastructural power can be rendered contestable only if systems are accompanied by documentation proportional to risk—covering design intents, data sources, evaluation regimes, known failure modes, and governance controls. Traceability is not a fetish of transparency; it is a condition for accountability and repair in complex socio-technical environments (NIST 2024; Pasquale 2015).

Third, contestability and redress: interpretability without contestation is ethically inert. The program therefore requires channels through which affected persons can challenge classifications and outputs, obtain explanations adequate to context, trigger

review procedures, and secure remedies. Contestability converts epistemic critique into institutional force, preventing hybrid agency from degrading into hybrid dependency (Pasquale 2015; Fricker 2007).

Fourth, convivial infrastructures and repairability: where possible, infrastructures should be oriented toward user and community agency—through open standards, interoperable systems, repairable devices, and shared learning ecologies that support learning-by-making and the reappropriation of *technē*. This is not a romantic return to artisanal life; it is a strategic commitment to infrastructures that do not structurally monopolize competence and interpretation (Illich 1971; van Dijck et al. 2018).

The four components form a single program because each is fragile without the others. Literacy without documentation becomes guesswork; documentation without contestation becomes ritual; contestation without repairability becomes frustration; repairability without literacy becomes exclusion. The core principle is therefore compositional: autonomy is achieved through the co-design of competences, institutional pathways, and infrastructural affordances.

7.3. Time, attention, and creative autonomy under acceleration

A transmodern program cannot remain at the level of governance and rights; it must also address the temporal and attentional conditions that determine whether intervention capacity can be exercised at all. Under accelerated socio-technical rhythms, production is increasingly frictionless, while judgment becomes increasingly expensive. When *poiesis* is accelerated by automated synthesis, the bottleneck shifts to *epistēmē*: the labor of verification, contextualization, and justification expands relative to the labor of generating outputs. Without an explicit attention-and-time policy at the level of practices and institutions, epistemic agency becomes vulnerable to premature closure and "authority by synthesis."

The problem is structural, not merely psychological. Acceleration compresses the temporal space needed for inquiry: exploration, error, revision, and deliberation become costly under constant demands for responsiveness (Rosa 2013). Infrastructural mediation further intensifies this by organizing memory, anticipation, and communicative tempo through technical systems that externalize cognitive functions and normalize rapid turnover of attention (Stiegler 1998). In such conditions, the cultivation of *aisthēsis*—the disciplined management of salience, focus, and experiential continuity—becomes an epistemic prerequisite rather than a private lifestyle choice.

A transmodern program therefore requires a principle of temporal sovereignty: institutions and communities must protect time for inquiry and justification, not only time for production. This includes norms of "verification before circulation," practices of slow interpretation in high-stakes contexts, and the design of educational and professional environments where reflective intervals are protected rather than penalized. These measures also counter a distinct epistemic risk associated with generative systems: fluent outputs can simulate understanding, encouraging epistemic overconfidence while masking uncertainty and error (Bender et al. 2021). The programmatic conclusion is precise: creative autonomy under AI acceleration requires time structures that restore the balance between production and justification, and attentional ecologies that re-enable sustained inquiry.

7.4. Limits and risks: avoiding technoutopianism and DIY romanticism

The program above must be defended against two symmetrical distortions. The first is a technoutopian reading that treats infrastructural diffusion as inherently emancipatory. The second is a romantic DIY reading that treats "making" as intrinsically liberatory. Both fail to account for structural asymmetries of power, resources, and visibility.

The technoutopian distortion ignores that AI–IoT infrastructures are frequently built within extractive political economies: they rely on large-scale data appropriation, uneven labor relations, and asymmetric control over the means of computation and classification (Crawford 2021). Even when access appears universal, dependency can deepen if interpretability, contestation, and redesign remain centralized. The risk is a new paternalism: subjects are "served" by smart systems while being deprived of meaningful voice over the conditions of service.

The DIY-romantic distortion ignores that DIY ecologies can be captured by platform logics, credential markets, and consumerist spectacle, reproducing inequalities rather than dissolving them. Autodidactic opportunity is materially conditioned: time, equipment, safe spaces, and social support are unevenly distributed, and learning platforms can amplify visibility asymmetries rather than correct them (van Dijck et al. 2018). Moreover, participation itself can become a vector of extraction when communal knowledge production is mined for data and value under asymmetrical ownership and governance arrangements (Couldry and Mejias 2019). The program must therefore include safeguards: anti-capture norms, community governance where feasible, and public infrastructures that reduce dependency on extractive intermediaries.

These risks do not refute the Digital Enlightenment project; they specify its conditions of possibility. Transmodern emancipation is conditional: it is realized only when infrastructures and learning ecologies are designed to distribute intervention capacity rather than to monetize dependency.

7.5. Implications for future research

This synthesis yields several implications for future research in philosophy of technology and allied fields. First, the concept of agency should be further operationalized at the level of coupling: research should develop evaluation vocabularies that track how *aisthēsis*, *poiesis*, and *epistēmē* are reconfigured by infrastructures, without collapsing into either anthropomorphism or purely instrumental accounts (Stiegler 1998; NIST 2024). Second, epistemic justice research should deepen its infrastructural turn by integrating analyses of governance, standards, and documentation regimes with the classical focus on credibility and interpretive resources (Fricker 2007; Pasquale 2015). Third, the political economy of learning ecologies requires systematic attention: how autodidactic infrastructures are financed, governed, and captured is not peripheral but constitutive of whether "Digital Enlightenment" describes emancipation or a refined dependency (Couldry and Mejias 2019; van Dijck et al. 2018).

8. Conclusion

This article has reconstructed the transmodern Digital Enlightenment as a philosophically tractable transformation in the conditions of knowing and acting. The central thesis is that "Digital Enlightenment" should not be indexed to access, diffusion, or computational power as such, but to the distribution of a justice-relevant capability for intervention under AI–IoT mediation. In transmodern environments, perception is reorganized by distributed sensing and datafication, production is accelerated by automated synthesis, and justification is re-situated within infrastructural defaults that shape salience, credibility, and evidential authority. The concept of Digital Enlightenment becomes coherent, and normatively discriminating, only when framed as the redistribution of intervention capacity across these reorganized relations of *poiesis–technē* and *aisthēsis–epistēmē* (Fricker 2007; Pasquale 2015; NIST 2024).

Three contributions follow from this reconstruction. First, a conceptual contribution: the quadrangular framework clarifies why contemporary debates about AI, platforms, and "smart" environments cannot be settled by the language of tools alone. The decisive transformations occur at the level of the coupling between production, perception, and justification, where infrastructural mediation becomes the condition of possibility for what can count as evidence, what can appear as relevant, and what can be acted upon as reasonable. Second, a sociohistorical contribution: the modern Enlightenment's institution-centered architecture of authority is displaced in transmodernity by infrastructure-mediated epistemic agency, where norms of autonomy and emancipation must be reformulated for ambient computation and ubiquitous sensing (Atzori et al. 2010; van Dijck et al. 2018). Third, a normative contribution: epistemic justice requires an infrastructural turn. In AI–IoT societies, justice-relevant harms arise not only from interpersonal credibility deficits, but from unequal access to interpretability, contestability, and redesign—conditions that increasingly define who can participate in the production and governance of shared intelligibility (Fricker 2007; Medina 2013; Crawford 2021).

The programmatic result is deliberately minimal and non-utopian. Digital and AI literacy are treated as capabilities oriented to intervention rather than as market skills; documentation and traceability are treated as accountability conditions rather than transparency ideals; contestability and redress are treated as institutional requirements rather than discretionary ethics; and conviviality, repairability, and open learning ecologies are treated as strategic infrastructures for autonomy rather than as nostalgia for artisanal life (Illich 1971; Long and Magerko 2020; NIST 2024). This bundle also integrates the article's controlled account of bio–artificial continuity: continuity is specified in a test-indexed vocabulary of coupling constraints and governable properties, avoiding metaphysical escalation while preserving the conceptual resources needed to analyze hybrid agency under AI–IoT mediation (Star and Ruhleder 1996; NIST 2024).

Several limitations delimit the scope and strengthen the interpretive discipline of the argument. First, the paper is conceptual and normative rather than empirical: it does not claim to measure intervention capacity or to provide causal estimates of AI–IoT effects on autonomy. Its purpose is to engineer a coherent conceptual framework that can guide empirical research and institutional design. Second, transmodernity is treated as a socio-technical condition rather than a homogeneous historical stage; the distribution of infrastructures, literacies, and governance regimes is geographically and politically uneven, and the argument must therefore be read as identifying a structural tendency rather than a universal description (Couldry and Mejias 2019; van Dijck et al.

2018). Third, the proposed program remains "minimal" by design: it specifies enabling conditions—documentation, contestability, literacy-as-capability, repairability—without attempting to exhaust the policy space or to adjudicate the full spectrum of regulatory models. That restraint is principled: over-specification would risk collapsing philosophical reconstruction into contingent institutional preferences.

Three research trajectories follow directly from the framework advanced here. First, intervention capacity should be operationalized and assessed across domains: education, health, labor, and smart-city environments are plausible testbeds for developing indicators of interpretability, contestability, and redesign access under AI–IoT mediation, aligned with risk-governance vocabularies and evaluation practices (NIST 2024; Atzori et al. 2010). Second, comparative studies of autodidactic ecologies and DIY epistemologies should examine how learning-by-making, documentation norms, and repair practices scale or fail under platform mediation, and how capture dynamics reshape the boundary between empowerment and dependency (Illich 1971; Ratto 2011; van Dijck et al. 2018). Third, epistemic justice research should deepen its infrastructural orientation by integrating analyses of credibility economies with the political economy of data, computation, and classification: the question is not only who is believed, but who can make systems answerable, who can contest the pipeline, and who can participate in the governance of shared intelligibility (Fricker 2007; Pasquale 2015; Crawford 2021).

If the argument of this article holds, the transmodern Digital Enlightenment is neither a slogan nor a fate. It is a conditional project: a redistribution of intervention capacity under hybrid agency, sustained by pedagogical infrastructures, institutional pathways of contestation, and governance regimes that prevent AI–IoT mediation from becoming a refined form of epistemic dependency. The philosophical task is therefore practical in the strongest sense: to clarify the conditions under which infrastructure becomes a medium of autonomy rather than a mechanism of capture (Freire 1970; Couldry and Mejias 2019; NIST 2024).

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