Eco-digital Posthumanism: Definition, Genealogy, and Research Agenda within the EcoAI Framework

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Abstract

The concept of **Eco-Digital Posthumanism** stands as a theoretical horizon within the **EcoAI (Rubino, 2025) Framework**, envisioning a posthumanist orientation through which humanity, non-human entities, and technological infrastructures co-constitute shared worlds.

Grounded in a **relational ontology**, this perspective refuses ontological separations between 'human', 'environment', and 'technology'; instead, it frames them as intra-acting, constitutive elements in dynamic assemblages. Drawing on Karen Barad's notion of *intra-action* (Barad, 2007), Donna Haraway's concept of *sympoiesis* (Haraway, 2016), and Rosi Braidotti's **affirmative ethics of relationality** (Braidotti, 2013), Eco-Digital Posthumanism offers a robust ontological and ethical basis for reconsidering human-technology-environment relations as fundamentally entangled.

The related EcoAI framework proposes that emergent **eco-technologies** — including sensing infrastructures, AI-driven environmental monitoring, and digitally mediated communal platforms — are not mere tools, but active mediators that shape both material reality and collective subjectivity. In this light, humans are reconceived as **eco-technological intra-agents**: their agency is neither purely individual nor detached but arises in dyadic and poly-nodal entanglements with environments and technologies. The ethical imperative intrinsic to this view is to design infrastructures and learning ecologies that foster mutual care, multispecies attentiveness, and distributed co-agency.

A vital tension animates the formation of the Eco-Digital Humanism theory: on one side, the **ecological system** demands renewed forms of relationality between humans, environments, places, and presences. This demand emphasizes physical co-presence, material engagement, and practices that re-embed subjectivities in place-based knowledge, embodied awareness, and ecological responsiveness. Here, educational media play a key role: Antonio López defines **ecomedia literacy** as the critical capacity to comprehend and engage with the reciprocal ecological "footprint" and cultural "mindprint" of media systems (López 2020). This socio-pedagogical pillar grounds the theory in media-ecological practice. It calls for pedagogies and practices that re-embed subjectivities in place-based knowledges, somatic awareness, and ecological attunement.

On the other hand, stands the rise of an **immaterial relational geographies**: social media, algorithmic platforms, influential digital narratives, ephemeral trend dynamics, and hyper-mediated connectivity craft relational spaces that lean toward an **individualistic massification** which often replace embodied interaction with curated digital self-expression and mediated connectivity with risks of disembedding relationality. These forces often substitute co-present engagement — with its embodied gestures, proxemics, and spontaneous nonverbal communication — with curated digital self-expression and algorithm-driven interaction. The communication shifts from embodied co-construction to performative self-branding, from tangible immediacy to mediated simulacra. José van Dijck and colleagues analyse how these platforms shape public life and values through infrastructural power (van Dijck, Poell & de Waal 2018). Moreover, scholars like Couldry and Mejias warn of **data colonialism**, where personal data are appropriated in ways akin to digital exploitation (Couldry & Mejias 2019). These critical sociological perspectives highlight how algorithmic systems can erode embodied co-presence and place-based relationality. This tension must be at the heart of Eco-Digital Humanism: it calls for technologies, pedagogies, and AI systems that restore and augment embodied, place-rooted relational ethics, rather than further eroding them.

Eco-Digital Posthumanism therefore envisions a middle path: **techno-ecological designs** and curricular frameworks that honour the ecological imperative for reciprocity, material co-presence, and affective attunement, while resisting the flattening of relationality that results from algorithmic mass individualism. In this, Eco-Digital Posthumanism embeds both philosophical depth and sociological grounding (López, van Dijck, Couldry & Mejias), extending **ecological posthumanism** (as developed by Oppermann, 2016;) and **material ecocriticism** (Iovino & Oppermann, 2014), by providing a mediation-centred, operational lens for guiding education, ethical design, and the governance of AI-mediated environments.

In sum, **Eco-Digital Humanism** posits that humans, non-humans, and technological systems co-create worlds; that ecological instances of sustainability necessitate relational, place-embedded forms of being and that the rising immaterial relational geographies without proper literacy threaten to separate us from those embodied ecologies. The theory thus demands a reconfiguration — through EcoAI Framework — of pedagogy, policy, and design, so that the digital infrastructures serve ecological relationality rather than displace it.

1. Introduction

The emergence of *Eco-Digital Posthumanism* responds to two converging trajectories in contemporary theory: the posthuman turn in philosophy and cultural studies, and the ecological urgency of the Anthropocene intertwined with the pervasiveness of digital technologies. Relational

ontology postulates that relations are ontologically prior to independent entities. Wesley J. Wildman defines it as the philosophical framework where "*relations between entities are ontologically more fundamental than the entities themselves*," reversing the typical substantialist logic in which entities pre-exist relations (Wildman 2006, 1).

In posthumanist philosophy, this perspective is deepened by Karen Barad's concept of intra-action, where entities are not pre-existing but come into being through their entanglements: "intra-actions are understood as social-natural or material-discursive relations of ontological inseparability and mutual constitution" (Mauthner 2021, 2). Rather than collapsing relationality into flat or undifferentiated networks, Braidotti's relational ontology maintains complexity and specificity; instead, she frames it within a **neo-Spinozist monism**, in which "radical immanence, relational ontology, and affirmative ethics" shape the posthuman knowing subject (Braidotti 2018, 3). Enrique Dussel's transmodern philosophy extends postcolonial critique into an ethics of planetary co-responsibility, calling for a dialogical 'exteriority' that resists universalizing paradigms and instead affirms genuinely plural ecologies of knowledge. As Dussel writes, "*Transmodernity is the project of co-responsibility among all the "others" of the world, whose voices are exterior to Western modernity yet indispensable to its transformation*" (Dussel 2002,18).

Together, these philosophical premises provide the metaphysical foundation of *Eco-Digital Posthumanism*, which asserts that subjectivity, agency, and responsibility co-emerge within relational assemblages of humans, non-humans, materials, and infrastructures. Furthermore, the posthuman condition, as articulated by Braidotti (2013), "*introduces a qualitative shift in our thinking about what exactly is the basic unit of common reference for our species, our polity and our relationship to the other inhabitants of this planet*".

The *posthuman condition* is thus not merely a rhetorical turn but a redefinition of subjectivity beyond the anthropocentric model of "*the Cartesian subject of the cogito, the Kantian 'community of reasonable beings', or the subject as citizen, rights-holder, property-owner*" (Braidotti 2013) displaces the centrality of the human subject, emphasizing relationality, materiality, and the non-separability of humans and non-humans. Simultaneously, ecological posthumanism (Oppermann, 2017; Iovino & Oppermann, 2014) further brings to light the entanglement of subjectivities with material ecologies and environmental processes. Digital technologies complicate this landscape: infrastructures of computation, sensing, and datafication do not merely mediate reality but actively shape ecological and epistemological conditions as "posthuman operators" reshaping epistemologies and social imaginaries (Gabrys, 2016; Parikka, 2015; Hui, 2020). The digital is ecological not only in its material footprint-rare earths, energy consumption, e-waste-but also in the ways it configures social imaginaries and practices of agency. To bridge the philosophical and the sociological, we turn

to contributions from digital and ecological sociology. Antonio López's notion of **ecomedia literacy** defines a pedagogical capacity to critically interpret the ecological "footprint" and cultural "mindprint" of media infrastructures (López 2020). Meanwhile, José van Dijck, Poell, and de Waal (2018) analyse how algorithmic platforms redesign public values, participation, and relational spaces under a "platform society." Critical scholars, including Couldry and Mejias, alarm us about **data colonialism**, where personal data is appropriated in extractive, exploitative ways akin to colonial systems (Couldry & Mejias 2019).

The concept of Ecodigital Posthumanism captures this convergence: a recognition that ecological accountability must be rethought within digital environments, where agency is distributed among human and non-human actors, algorithms, and infrastructures. The theory therefore affirms the continuity of nature–culture–technology, echoing Braidotti's call for a "non-dualistic understanding of nature–culture interaction" (Braidotti 2013, p. 3), while situating this continuum within the algorithmic infrastructures of the Anthropocene. By articulating Ecodigital Posthumanism, this work aims to carve out a distinct field of inquiry that moves beyond the limits of digital humanism. While digital humanism often reiterates anthropocentric frameworks or paradigms of rights and responsibilities, Ecodigital Posthumanism situates human subjectivity within more-than-human ecologies, foregrounding interdependence, vulnerability, and co-agency. It thus provides a framework to reimagine education, civic participation, and ethics in a world where digital infrastructures are inseparable from ecological futures.

2. Definition

Eco-Digital Posthumanism is defined as a sociological and philosophical theory that explores the interconnections between ecological posthumanism and digital ecologies, reconceptualizing subjectivity, agency, and responsibility at the intersection of ecological and digital entanglements. It asserts that subjectivity, agency, and civic responsibility are co-constituted by environmental processes and algorithmic infrastructures. Like Weber's ideal type, this theory functions as an analytical construct that allows us to rethink education, ethics, and politics under digital-ecological conditions. (Weber 1968 [1921], 4). Following Braidotti, posthuman subjectivity emerges from the recognition that "*the human is not a self-standing entity, but an embodied and embedded subject that is always already in relation*" (Braidotti 2013). This relational ontology displaces the humanist subject of autonomy and re-centres interdependence across species, materials, and infrastructures.

Ecological posthumanism extends this displacement within environmental humanities: As Oppermann explains, "*posthuman ecocriticism is a diffractive mode of reading the co-evolution of organisms and inorganic matter in their hybrid configurations*" (Oppermann 2016, p. 21) while Iovino and Oppermann (2014) develop this into *material ecocriticism*, where matter itself "is storied"

and "carries meanings, traces, and agencies" (p. 5). Alaimo similarly stresses the "trans-corporeality" of bodies, understood as "*the interconnections of human corporeality with the material flows of substances and discourses*" (Alaimo 2010, p. 2).

The digital dimension amplifies this interdependence: Parikka emphasizes that "*media are geological agents, sedimented in the minerals and energies that sustain them*" (Parikka 2015, p. 35), while Gabrys argues that sensing technologies and computation "*materialize environments and configure participatory possibilities*" (Gabrys 2016, p. 8). In Floridi's philosophy of information, the subject is already situated in an "informational ontology," where "*we are inforgs, mutually connected informational organisms in an infosphere*" (Floridi 2011, p. 9). Incorporating **eco-media sociology** from Antonio López that introduces **ecomedia literacy** as the capacity to critically interpret the ecological "footprint" and cultural "mindprint" embedded in media infrastructures (López 2020), this socio-pedagogical lens grounds Ecodigital Posthumanism in practices that interweave media, ecology, and critical awareness. The **Structuration theory** (Giddens 1984) complements this by framing agency as recursively emergent through human-structure relations: actors both shape and are shaped by structural conditions—highlighting the dynamic interplay between digital infrastructures and ecological realities. By bringing these strands together, **Eco-Digital Posthumanism** affirms that subjectivity and responsibility are co-constituted by environmental processes and algorithmic infrastructures. It is simultaneously both ecological and digital, both material and computational. As Zapf reminds us, literature and culture can serve as "*cultural-ecological forces of connectivity and creativity*" (Zapf 2016, p. 54), while Abram insists on the sensorial grounding of knowledge: "our bodies have formed themselves in delicate reciprocity with the manifold textures, sounds, and shapes of an animate earth" (Abram 1996, p. ix). This broader genealogy justifies defining Ecodigital Posthumanism as a framework that situates the posthuman subject in the ecologies of both nature and code.

3. Theoretical Formula:

"If agency is distributed across humans, non-humans, and digital infrastructures, then responsibility must also be shared ecologically and technologically"

Ecodigital Posthumanism posits that subjectivity, agency, and ethical responsibility are not properties of individual human actors but emerge from entangled relational assemblages across ecological, technological, and material layers. This formula can be articulated in foundational components:

Relational Subjectivity from Rosi Braidotti redefines the posthuman subject as "*not a self-standing entity, but an embodied and embedded subject that is always already in relation*" (Braidotti 2013, 49). Subjectivity is thus understood as co-constitutive, embedded in ecologies, technologies, and multispecies networks. Another foundational concept is Distributed Agency (Intra-active). Karen Barad's concept of *intra-action* gives substance to this relational ontology: "entities do not exist as separate individuals before they relate—they are formed through their connections" (Barad 2007,) In Barad's words, "the world is composed of entangled agencies, which take on specific forms only when certain boundaries or agential cuts are made" (Barad 2007, 46). Thus, agency is not pre-given but emerges in the "differentiating-entangling" that constitutes phenomena (Barad 2007, 20).

Also, Jennifer Gabrys Material-Digital Co-constitution, emphasizing how sensing technologies and computation "materialize environments and configure possibilities for participation" (Gabrys 2016, 8). Likewise, Jussi Parikka conceptualizes media as geological agents: "media are geological agents, sedimented in the minerals and energies that sustain them" (Parikka 2015, 35). Agency thus extends to algorithmic and infrastructural flows that actively shape ecologies and imaginaries and their convergence. At last, in this relational framework, ethics and ontology are inseparable. As Barad stresses, agential realism blurs the boundary between knowing and being—onto-epistemology—making every act of knowing inherently ethical (Barad 2007). Responsibility is thus ecologically and technologically shared, not individualized. To enrich the theoretical foundation, there are also sociological frameworks that extend the model: For Ecomediality and Pedagogy, Antonio López idea of ecomedia literacy — the critical capacity to interpret the ecological *"footprint"* and cultural *"mindprint"* of media infrastructures (López 2020) - sustains the operationalization of Eco-Digital Posthumanism by embedding critical media practices within ecologically attuned, digitally mediated learning ecologies. Another major component relates to Platform Society and Infrastructure Power**:** José van Dijck and colleagues reveal how algorithmic platforms restructure public values and civic participation, embedding infrastructural power into daily life (van Dijck, Poell & de Waal 2018). It also helps operationalize Eco-Digital Posthumanism by highlighting the material conditions and power dynamics of digital infrastructures that must be critically redesigned to support distributed co-agency and ecological relationality rather than perpetuate centralized control and disembedding.

The Data Colonialism and the Commodification of Life theory, by Nick Couldry and Ulises A. Mejias, theorize about data colonialism and how personal data is expropriated for capital in ways that mirror colonial extraction (Couldry & Mejias 2019). It contributes foreground the imperative within Eco-Digital Posthumanism to reclaim data practices as relational and co-responsible, designing digital infrastructures that protect personal and ecological agency rather than extract and commodify it. Shoshana Zuboff warns of a new economic logic: *surveillance capitalism*, where human experience becomes a commodity, ultimately undermining autonomy (Zuboff 2019). This critique underscores

Eco-Digital Posthumanism's call to design digital-ecological infrastructures that resist commodifying relational ecologies and instead uphold collective autonomy and ecological co-responsibility. Among the sociological theory at support, the Structural Dynamics of Agency idea, theorized in Anthony Giddens's structuration theory (1984) conceptualizes agency as co-constitutive with social structures—highlighting the duality where digital infrastructures and ecological contexts shape and are shaped by human action. This perspective reinforces Eco-Digital Posthumanism's emphasis on designing socio-technical arrangements that both enable and are responsive to ecological practices, ensuring that agency remains distributed across human and non-human nodes in a continuously evolving web of relations. An obliged explanation must be given about Agency in the context of *Eco-digital Posthumanism.* In this declination it does not refer to an individual property or autonomous free will, but to the capacity to produce effects within relational and distributed assemblages. It emerges where humans, non-humans, technologies, and ecologies intra-act, shaping outcomes that cannot be attributed to a single intentional subject. Responsibility, therefore, must be rethought as ecological and technological co-responsibility. As beforementioned, different strands of theory contribute to this expanded notion: from the **Classical humanist agency**, that focus on intentional and voluntary action of an autonomous human subject, to **Posthuman agency** (Braidotti 2013; Barad 2007; Haraway 2016) that refines it as relational, situated, and distributed across multi-species and material entanglements. In the core of the definition of agency for this theory **Ecological agency** (Oppermann 2017; Alaimo 2010; Iovino & Oppermann 2014) cannot be ignored: ecosystems, environments, and bodies act as forces that shape human and non-human conditions and connects to **Digital agency** (Gabrys 2016; Parikka 2015; Hui 2020) where infrastructures, algorithms, sensors, and platforms act by configuring knowledge, perception, and behaviour. Furthermore, Actor–Network Theory, Bruno Latour (2005) insists that "*agency is not the province of humans alone but is distributed across networks of human and non-human actants*" (Latour 2005, p. 71). His concept of the **"actant"** dissolves the subject–object divide, showing how stability and change emerge through collective assemblages. Kathleen Hayles's work on extended cognition (2012) likewise situates mind and agency in **socio-technical systems**, arguing that cognition is enacted across human–machine couplings: "cognitive processes are distributed in hybrid ecologies of people, artifacts, and environments" (Hayles 2012, p. 48). Finally, Bernard Stiegler (2017) reframes responsibility as **technological co-responsibility**, insisting that "we are always already caught up in the technologies that shape our attention, memory, and capacity for care" (Stiegler 2017, p. 12). For Stiegler, ethical agency must account for how digital infrastructures co-constitute our relational capacities and moral horizons. By weaving together Latour's actor–network agency, Hayles's extended cognition, and Stiegler's technological responsibility, Eco-Digital Posthumanism articulates a new theory of **ecological and technological co-responsibility**: humans, non-humans, materials,

and infrastructures co-produce worlds and share in the ethical imperative to sustain relational, multispecies entanglements. Therefore, the **Eco-Digital posthuman agency** represent the convergence of ecological and digital dimensions, where subjectivity and responsibility are co-constituted by human actors, material ecologies, and computational infrastructures.

Further Dimensions of Agency and Cognition

While the core formulation of *Eco-Digital Posthumanism* identifies subjectivity, agency, and responsibility as emergent from relational entanglements of humans, non-humans, and infrastructures, this model requires further specification to account for the complexity of posthuman conditions. To strengthen its theoretical coherence, we draw on complementary frameworks that articulate plural ontologies (Ferrando), distributed networks of agency (Latour), and extended cognition beyond the human brain (Hayles). These dimensions provide additional layers that expand the theoretical formula and situate Ecodigital Posthumanism within a broader constellation of posthumanist thought: Francesca Ferrando defines "philosophical posthumanism" as an approach that is simultaneously "*post-humanism, post-anthropocentrism, and post-dualism*," encapsulating the deconstruction of rigid binaries and the affirmation of plural, relational subjectivities (Ferrando 2021, 22). The *Distributed Agency via Actor–Network Theory (ANT)* is a theoretical and methodological framework that emerged from Science and Technology Studies (STS), particularly through the work of Bruno Latour, Michel Callon, and John Law. It posits agency as emerging from the network, rather than residing in individuals so that agency is seen as emerging from the network itself rather than being located solely in humans". The idea that agency emerges from networks rather than solely from humans aligns with Latour's argument: *"agency is not limited to human beings, but objects should also be counted as agents"* (Latour 2005). His contribution reinforces the ANT perspective that agency is distributed across human and non-human actants embedded in relational assemblages.

N. Katherine Hayles expands cognition beyond the individual brain with the Extended and Distributed Cognition, arguing that "*cognition involves more than the neocortex, but also the body and its extended external systems*". This aligns with the posthuman shift towards embodied, systemic thinking. Jennifer Gabrys and the idea of the *Material-Digital Co-constitution* emphasizes that digital infrastructures "*materialize environments and configure possibilities for participation*" (Gabrys 2016, 8), while Parikka argues that media themselves are "geological agents" embedded in material substrate (Parikka 2015, 35). In the *Eco-Digital Subjectivity and Responsibility* field, the convergence supports a perspective of agency and responsibility that is ecologically and technologically shared, rather than individual. In Ferrando's terms, the posthuman condition becomes an inclusive and ethically grounded worldview shaped by pluralities and interdependencies (Ferrando 2021, 22).

4. Genealogical Foundations

The eco-digital posthumanism recognizes as genealogical foundation: the Posthumanism (Braidotti, 2013; Wolfe, 2010) for decentring of the human, relational subjectivity, critique of anthropocentrism; the Transmodern Philosophy (Dussel 2002), Enrique Dussel's transmodern project, that extends postcolonial critique into an ethics of planetary co-responsibility, foregrounding dialogical 'exteriorities' and plural ecologies of knowledge; The Ecological Posthumanism (Oppermann, 2017; Iovino & Oppermann, 2014; Alaimo, 2010) wich focus on material ecologies, environmental humanities, posthuman ecocriticism; the Critical Digital Studies (Parikka, 2015; Gabrys, 2016; Hui, 2020) that focuses on media materialism, technological ecologies, environmental footprint of digital infrastructures. The Relational Theories (Barad, 2007; Haraway, 2016) for the idea of intra-action, situated knowledges, more-than-human agency; the Digital and Ecological Sociology (Couldry & Mejias 2019; van Dijck, Poell & de Waal 2018; Zuboff 2019; López 2020) for platform society, data colonialism, surveillance capitalism, and ecomedia literacy as frameworks situating digital infrastructures within ecological and social systems; the Risk and Environmental Sociology (Beck 1992; Urry 2011) for global risk society, climate change, and socio-ecological mobilities as contexts where technological infrastructures and ecological crises intersect.

5. Scope of Application

Eco-Digital Posthumanism applies to education, media studies, AI ethics, and civic ecology. Within the EcoAI framework, it grounds curricula that cultivate systemic thinking, critical digital awareness, and civic responsibility. In line with Morin's "pensée complexe" (Morin, 2008), education is reframed as preparation for navigating entangled ecological-technological realities. Building on Dussel's transmodern ethics of planetary co-responsibility, curricula should foreground dialogical engagement with marginalized knowledges, ensuring that students learn not only complexity thinking but also co-responsibility among diverse global 'others' (Dussel 2002). EcoAI embodies this by fostering ecotechnological citizens (EcoAI Framework, 2025), who recognize that AI is not merely a tool but an active participant in ecological and civic systems. This resonates with David Orr's call for ecological literacy as a foundation of democratic citizenship (Orr, 1992).

The field of media studies gains new insights from Ecodigital Posthumanism's emphasis on ecomediality (López, 2014). Media are not neutral intermediaries but ecological forces that structure imaginaries, practices, and political ecologies. Parikka's notion of geology of media (2015) demonstrates that infrastructures are embedded in material and planetary processes, while Gabrys (2016) shows how sensing technologies configure modes of ecological participation. Together, these frameworks support an "ecomedia literacy" that reads media as agents of ecological transformation.

Eco-Digital Posthumanism also enriches debates on AI ethics by framing responsibility as distributed across human and non-human actors, infrastructures, and algorithms. This aligns with Barad's agential realism (2007), where ethics and ontology are inseparable. Within EcoAI, this is operationalized as critical AI literacy—teaching students to evaluate the ecological footprint, biases, and justice implications of AI. As Crawford & Joler (2018, Anatomy of an AI System) illustrate, AI is deeply entangled with exploitative extractivism and ecological externalities. EcoAI thus positions ethics not as an abstract principle but as a practice of ecological and technological accountability.

Finally, Eco-Digital Posthumanism informs civic ecology by conceptualizing citizenship as eco-digital co-agency. This aligns with the work of Krasny & Tidball (2012), who define civic ecology as community-based practices that foster resilience through environmental stewardship. In the digital Anthropocene, civic ecology must account for algorithmic infrastructures, social media imaginaries, and AI-enabled monitoring systems. EcoAI advances this by offering pedagogies where students use AI simulations, sensors, and multimodal storytelling to cultivate civic action rooted in ecological justice.

6. Attribution

This definitional note establishes the term **Eco-Digital Posthumanism** (and/or **Ecodigital posthumanism**) as authored and introduced by Gianfranco Rubino, within the broader research program on **EcoAI Framework Literacy and Digital Citizenship**. The concept is here formally established and registered with a DOI, ensuring academic citability and providing a stable reference point for future theoretical development

Keywords

Core Concept: Ecodigital Posthumanism; Eco-digital Posthumanism.
Framework & Application: EcoAI; EcoAI framework; education; digital citizenship; AI ethics.
Theoretical Anchors: ecoliteracy; ecomedia literacy; ecological humanities; posthuman subjectivity; sociology; actor-network theory.
Critical Debates: critical digital studies; platform society; data colonialism; ecological responsibility.

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