Eco-Digital Posthumanism:
Eco-Digital Co-Responsible Agency, Genealogy, and Research Agenda

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Abstract

Eco-Digital Posthumanism is a sociological-philosophical theory that redefines subject formation and civic responsibility at the intersection of ecological systems and digital infrastructures. While posthumanist thought has powerfully decentred the human subject, and critical data studies have examined the material conditions of digital architectures, their co-constitution remains undertheorized. This article addresses that gap. It does so through three theoretical moves. Drawing on Barad's intra-action (Barad, 2007), it rejects the presumption that entities precede relations. Haraway's notion of sympoiesis (Haraway, 2016) situates subjectivity within multispecies processes of co-becoming, resisting the reduction of ecology to measurable footprint. Braidotti's relational ethics (Braidotti, 2013) reframes the posthuman subject as embodied, embedded, and fundamentally non-autonomous. Their approaches diverge in emphasis yet converge in destabilizing the fiction of the self-standing individual. From this convergence, the theory derives its central construct: eco-digital co-responsible agency, namely the proposition that if agency is distributed across humans, non-humans, and digital infrastructures, responsibility cannot be individualized but must be shared ecologically and technologically. This onto-epistemological claim, following Barad's inseparability of ethics and ontology (Barad, 2007), grounds the theory's normative implications rather than reducing them to design prescriptions.

At the centre of the theory lies an unresolved tension. Ecological re-embedding (grounded in place, embodied attentiveness and material co-presence) confronts the dis-embedding logic of algorithmic platforms, curated self-performance, and data colonialism (Couldry & Mejias, 2019). The theory does not seek to dissolve this contradiction. It treats it as analytically generative. Its implications extend to education, AI ethics, media studies, and civic ecology, demanding a reconfiguration of institutional and technological arrangements that currently amplify algorithmic mass individualism.

1. Introduction

Eco-Digital Posthumanism emerges at the intersection of two converging theoretical trajectories: the posthuman turn in philosophy and cultural studies and the ecological urgency of the Anthropocene as it becomes inseparable from the pervasiveness of digital infrastructures. Neither trajectory alone is sufficient. Posthumanist philosophy has powerfully decentred the human subject and theorized relational ontologies; ecological thought has foregrounded material entanglements between bodies, environments, and nonhuman processes. What remains undertheorized is the systematic co-constitution of these two dimensions and the implications of that co-constitution for subjectivity, agency, and responsibility.

The ontological foundation of this theory is relational. Entities as human, nonhuman and technological, do not precede their relations but are constituted through them. Karen Barad's concept of intra-action establishes this with precision: phenomena are "*the ontological inseparability of agentially intra-acting components*," such that what we call "subjects" and "objects" are not pre-given but emerge through specific material-discursive practices (Barad, 2007, p. 139). It should be understood as an ontological claim and not as a metaphor for interdependence: there are no independently existing entities that subsequently enter into relations. Braidotti deepens this within a neo-Spinozist monism, framing the posthuman knowing subject through "*radical immanence, relational ontology, and affirmative ethics*" (Braidotti, 2019, p. 3), a move that maintains theoretical complexity without collapsing relationality into undifferentiated flat networks. The posthuman condition, as Braidotti argues, "*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*" (Braidotti, 2013, p. 1). This displaces not only the Cartesian *cogito* but also the liberal subject as rights-holder, citizen, and property-owner, the normative anchor of most digital ethics discourse. Yet the very radicality of this ontology poses a problem: if no entity pre-exists its relations, the attribution of responsibility risks dissolution into systemic indeterminacy, facing a difficulty that eco-digital co-responsible agency is precisely designed to address. Digital technologies reconfigure this ontological landscape in ways that ecological posthumanism alone cannot address. Infrastructures of computation, sensing, and datafication do not merely mediate reality but actively shape ecological and epistemological conditions. Parikka's media materialism demonstrates that digital infrastructures are geological agents, "*sedimented in the minerals and energies that sustain them*" (Parikka, 2015, p. 35); Gabrys shows how sensing technologies "*materialize environments and configure possibilities for participation*" (Gabrys, 2016, p. 8). The digital is ecological through its material footprint (rare earths, energy consumption, e-waste, infrastructural asymmetries) as well as through the ways it reshapes social imaginaries, relational practices, and the very conditions under which agency becomes possible or is foreclosed. Couldry and Mejias extend this analysis into the

political: data colonialism describes how personal and collective life is appropriated through digital infrastructures in ways that structurally mirror colonial extraction (Couldry & Mejias, 2019). Van Dijck, Poell, and de Waal (2018) demonstrate how algorithmic platforms do not merely reflect but actively redesign public values and relational spaces through infrastructural power.

López's notion of ecomedia literacy provides a socio-pedagogical articulation of these claims: the critical capacity to interpret the ecological "footprint" and cultural "mindprint" embedded in media infrastructures (López, 2020). This socio-pedagogical contribution grounds the theory in practice without reducing it to instrumentalism.

The prevailing normative response to these conditions has been formulated within what is broadly termed *digital humanism*: a project that, from the Vienna Manifesto on Digital Humanism (2019) to the UNESCO Recommendation on the Ethics of AI (2021), articulates the governance of digital transformation around human dignity, agency, and oversight. Floridi's philosophy of the onlife condition gestures toward a more relational account, recognizing the dissolution of boundaries between online and offline environments and situating the subject as an "inforg" within an infosphere (Floridi, 2011, p. 9). These are consequential theoretical and normative contributions. Yet even where they are philosophically sophisticated, they tend to retain the human subject as the ultimate locus of responsibility, rendering accountability imputably and individually human. This is a structural limit, not a contingent one: when agency is distributed across humans, nonhumans, and digital infrastructures, responsibility cannot be individualized without distortion. Eco-Digital Posthumanism does not position itself against these frameworks but asks different questions, that an anthropocentrically anchored normative architecture is not designed to answer.

In adopting an onto-epistemological stance in Barad's sense, we treat knowing and being as inseparable operations — every act of inquiry is itself an intervention in the phenomena it describes. This positions Eco-Digital Posthumanism neither as constructivist nor as naïve realist, but as a framework in which ontological claims carry immediate ethical implications — and in which ethics cannot be retrofitted onto a prior ontology. It is from this position that the following definition is developed.

2. Definition and Distributed Agency

Eco-Digital Posthumanism is defined as a sociological-philosophical theory that reconceptualizes subjectivity, agency, and responsibility at the intersection of ecological and digital entanglements. It asserts that subjectivity is no longer a private interiority; it emerges, instead, through the messy collision of environmental processes and the rigid logic of algorithmic infrastructures. In Weberian terms, this theory functions as an ideal-type: an analytically accentuated construct "*formed by the one-sided accentuation of one or more points of view*", rather than a descriptive claim about empirical

totalities, therefore designed to clarify structural tendencies within contemporary eco-digital formations (Weber, 1904/1949, p. 90). It does not claim that empirical reality conforms neatly to its articulation; it isolates and renders intelligible patterns that emerge when ecological and digital processes are grasped as a single relational field rather than as separate domains.

The ontological premise follows Karen Barad's account of intra-action (Barad, 2007). Entities do not precede relations; they emerge through specific material-discursive practices. Agency, accordingly, cannot be treated as a property that individuals possess — it is not an attribute but a doing, a dynamism of relational enactment through which phenomena materialize. What we conventionally designate as "subjects" and "objects" are not pre-given ontological units but effects of intra-active configurations. This ontological inseparability displaces the liberal-humanist subject understood as autonomous, self-grounding, and prior to the field of action.

Rosi Braidotti extends this displacement within a neo-Spinozist monism (Braidotti, 2013). The posthuman subject is "not a self-standing entity, but an embodied and embedded subject that is always already in relation" (Braidotti, 2013, p. 49). Relationality here is not a moral appeal to interdependence; it is an ontological condition. The displacement concerns not only the Cartesian cogito but also the juridical and political figure of the liberal rights-bearing individual — a figure that continues to anchor much of contemporary digital ethics discourse.

Ecological posthumanism extends this ontological displacement into environmental humanities. Oppermann's posthuman ecocriticism reads "the co-evolution of organisms and inorganic matter in their hybrid configurations" (Oppermann, 2016, p. 21), while Iovino and Oppermann's material ecocriticism establishes that matter itself "is storied" and "carries meanings, traces, and agencies" (Iovino & Oppermann, 2014, p. 5). Alaimo's trans-corporeality further articulates bodies as sites of continuous interchange with material flows (Alaimo, 2010, p. 2). Together, these frameworks establish that ecological entanglement is not contextual background but a constitutive dimension of subjectivity.

The digital dimension intensifies this relational field without dissolving it into technological determinism. Parikka's media materialism demonstrates that digital infrastructures are grounded in geological extraction and energy regimes, materially sedimented in rare earth minerals, energy consumption, and e-waste flows (Parikka, 2015, p. 35). Gabrys shows that sensing technologies do not merely register environments but actively materialize them by configuring what counts as data, participation, and environmental visibility (Gabrys, 2016, p. 8). Van Dijck, Poell, and de Waal analyze how platform infrastructures reorganize public values and institutional norms through infrastructural power (van Dijck, Poell & de Waal, 2018). These accounts establish a common analytical point:

digital systems are not neutral mediators but active participants in shaping the relational conditions under which subjectivity and agency are enacted.

At the political-economic level, Couldry and Mejias introduce the concept of data colonialism to describe how contemporary digital infrastructures appropriate human life in structurally extractive ways — not merely as analogy to historical colonialism but as systematic pattern of value capture through data extraction that reorganizes power relations at scale (Couldry & Mejias, 2019). If agency operates within infrastructures that are materially grounded, institutionally stabilized, and politically asymmetrical, then it cannot be conceptualized as purely human initiative acting upon passive tools.

Where Barad clarifies ontological inseparability, Giddens's structuration theory adds the temporal dimension this ontology requires (Giddens, 1984). Structures are both the medium and the outcome of social practices: recursively reproduced across time through situated action, neither external constraints independent of actors nor reducible to individual intention. Digital infrastructures exemplify this recursive structuration — platforms, protocols, and data architectures sediment patterns of interaction, stabilize asymmetries, and condition future possibilities of action. Agency can thus be analytically distinguished, without being ontologically separated. Its registers span across intra-active processes (Barad, 2007), recursively reproduced institutional structures (Giddens, 1984), infrastructural mediations (van Dijck et al., 2018; Gabrys, 2016; Parikka, 2015), and extractive political economies (Couldry & Mejias, 2019). They operate as distinguishable analytical registers within a single relational configuration. López's notion of ecomedia literacy offers the socio-pedagogical articulation of this configuration: by foregrounding the ecological footprint and cultural mindprint embedded in media infrastructures, it renders visible the entanglement of environmental materiality and mediated subject formation (López, 2020). This does not reduce the theory to curriculum design; it demonstrates that distributed agency has practical consequences for how media environments are interpreted, inhabited, and contested. The implication is structural. If subjectivity is co-constituted across human actors, nonhuman organisms, ecological materialities, and digital infrastructures, then responsibility cannot be coherently individualized without remainder. Liberal models of imputable accountability presume a pre-existing subject who stands outside the field of relational production. Under relational ontology, this presumption becomes analytically unstable. Distributed agency is the ontological premise of this theory; eco-digital co-responsible agency is its normative articulation, developed in the following section.ù

3. Theoretical Formula Eco-Digital Co-Responsible Agency:

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

This section established distributed agency as the ontological premise of Eco-Digital Posthumanism. If entities emerge through intra-active processes rather than pre-existing as autonomous units (Barad, 2007), and if digital infrastructures recursively stabilize relational asymmetries across time (Giddens, 1984; van Dijck, Poell & de Waal, 2018), then action cannot be attributed to a sovereign subject operating upon an external world. Agency is enacted across relational configurations that are simultaneously ecological, infrastructural, and political-economic. The problem shifts from the necessity of responsibility to its conceptual coherence under relational ontology.

Donna Haraway's notion of sympoiesis extends this argument into a dimension that Barad's intra-action does not explicitly develop (Haraway, 2016). Where intra-action accounts for the ontological inseparability of entities through material-discursive practices, sympoiesis "*makes-with*" places agency within multispecies processes of co-becoming: the ongoing entanglement of living organisms, environments, and evolutionary trajectories that precede and exceed any single act of relational constitution. Co-becoming is not an accidental feature of social life but its structural condition across species boundaries. The human does not disappear as a moral agent within this account; rather, human agency is re-situated within assemblages of ecological and technological co-production that include nonhuman organisms as active participants, not merely as background conditions. Responsibility, under such conditions, cannot be conceived as the property of an isolated subject. It emerges within relational fields where effects are generated through entangled agencies that are simultaneously ontological, multispecies, infrastructural, and political-economic. Eco-digital co-responsible agency names precisely this condition. The concept should not be interpreted as a dilution of responsibility into abstract collectivity nor does it imply that accountability becomes impossible to assign. It differs from policy frameworks that invoke "shared responsibility" which presuppose already constituted agents cooperating within a stable normative framework. Co-responsibility, in the sense developed here, refers to responsibility that arises from co-constitution itself. Liberal models of imputable accountability rely on a subject imagined as prior to relational entanglement; a subject who enters the field of action already formed, separable, and identifiable as the bearer of responsibility. Under relational ontology, this presupposition becomes analytically unstable: the subject who is held responsible is itself an effect of the relational configurations through which action is generated.

Human actors remain central to ethical consideration although it reframes ethical attribution. Human actors remain loci of decision, interpretation, and intervention, but these capacities operate within

layered configurations of intra-active processes, institutional recursivity, infrastructural mediation, and extractive political economy. Responsibility therefore cannot be restricted to individual intention; it must also account for the material and infrastructural conditions that enable, constrain, and shape what counts as action in the first place. Eco-digital co-responsible agency does not replace accountability; it redistributes its conceptual grounding from the pre-relational subject to the relational field from which subjects emerge.

The analytical consequence is structural rather than merely moral. Ethical evaluation shifts from isolated actions to relational configurations. Inquiry must account for how ecological materialities, algorithmic architectures, platform governance and extractive economic logics converge in producing specific outcomes and for how those configurations differentially distribute capacities for action and exposure to harm. Co-responsibility thus designates not a moral exhortation but an ontologically grounded reorientation: the recognition that in eco-digital formations, responsibility is irreducibly relational, technologically mediated, and ecologically situated. Distributed agency is the ontological premise of this theory. What we propose as eco-digital co-responsible agency is its normative articulation, the conceptual form that responsibility must take when the conditions of action are constituted through entanglements that no single subject produces or controls.

4. Genealogical Foundations

Eco-Digital Posthumanism does not emerge as an isolated theoretical invention but as a recomposition of several intellectual lineages whose convergence makes its central construct intelligible. Instead of cataloguing adjacent fields, it identifies a selective articulation of traditions without which the theory of eco-digital co-responsible agency could not be formulated. Each lineage contributes a dimension that the others do not supply; their intersection, rather than their sum, defines the theory's conditions of possibility.

The first and most decisive lineage is relational ontology and posthuman philosophy. It provides the conceptual core from which the rest of the framework departs. Karen Barad's agential realism establishes the ontological inseparability of entities through intra-action, displacing the metaphysics of pre-constituted subjects and objects (Barad, 2007). Donna Haraway's sympoiesis extends this relational framework into multispecies co-becoming, situating agency within processes of making-with that exceed human intentionality and encompass living organisms across species boundaries (Haraway, 2016). Rosi Braidotti's posthuman philosophy reframes subjectivity as embodied, embedded, and non-self-standing, destabilizing the liberal humanist figure of the autonomous rights-bearing individual (Braidotti, 2013). Cary Wolfe (2010) further consolidates this displacement by situating posthumanism within systems theory and the deconstruction of species hierarchy. Without

this ontological lineage, distributed agency and its normative articulation as co-responsibility would lack foundation. Eco-Digital Posthumanism inherits from it the claim that relations are constitutive rather than secondary — that subjects do not precede entanglements but emerge through them.

A second lineage derives from ecological posthumanism and environmental humanities. Material ecocriticism (Iovino & Oppermann, 2014; Oppermann, 2016) and trans-corporeality (Alaimo, 2010) foreground the agency of matter, environments, and bodily interpenetration with ecological flows. These frameworks refuse to treat ecology as context or backdrop; they position material ecologies as active participants in world-making processes. This strand grounds the ecological dimension of the theory, ensuring that eco-digital entanglement is not metaphorical but materially situated. The "eco" in Eco-Digital Posthumanism is not reducible to environmental impact metrics; it designates the constitutive involvement of ecological processes (material, multispecies, and environmental) in subject formation, agency, and responsibility.

A third lineage emerges from critical digital studies, media materialism, and political economy of digital infrastructures. Jussi Parikka's geology of media reveals the extractive material substrate of digital systems, sedimented in rare earth minerals, energy regimes, and e-waste (Parikka, 2015). Jennifer Gabrys demonstrates how sensing technologies and computation do not merely register environments but actively materialize them by configuring what counts as data, participation, and ecological visibility (Gabrys, 2016). José van Dijck, Thomas Poell, and Martijn de Waal analyse how platform infrastructures reorganize public values and institutional norms through infrastructural power (van Dijck, Poell & de Waal, 2018). Nick Couldry and Ulises Mejias extend this analysis through data colonialism, identifying systematic patterns of extraction through which digital infrastructures appropriate human and social life in ways structurally analogous to colonial regimes (Couldry & Mejias, 2019). Shoshana Zuboff further specifies the behavioural and predictive logics of surveillance capitalism, through which human experience is rendered a raw material for economic control and behavioural modification (Zuboff, 2019). Bernard Stiegler contributes a distinct and necessary dimension: where Couldry and Mejias foreground structural extraction and Zuboff foregrounds behavioural capture, Stiegler (2017) identifies how digital infrastructures co-constitute the very capacities for attention, memory, and care through which moral agency operates. Responsibility, in this account, cannot be conceived independently of the technological pharmaka that simultaneously enable and erode relational and ethical capacities. From this lineage, Eco-Digital Posthumanism derives the infrastructural, extractive, and cognitive dimensions of distributed agency — the recognition that digital systems are not neutral mediators but active participants in the asymmetrical production of relational conditions.

The fourth lineage provides the temporal and institutional dimension necessary to account for how relational configurations persist, stabilize, and transform across time. Anthony Giddens's structuration theory conceptualizes structures as both the medium and outcome of social practices, recursively reproduced through situated action (Giddens, 1984). This framework enables the theory to account for the sedimentation of eco-digital formations beyond singular events of intra-action to explain why infrastructural asymmetries endure and how they become naturalized as conditions of possibility. Enrique Dussel's transmodern philosophy extends this institutional dimension geopolitically. His ethics of planetary co-responsibility grounded in the recognition of dialogical exteriorities and plural ecologies of knowledge that Western modernity has systematically marginalized, ensures that the theory's account of co-responsibility does not remain implicitly Euroatlantic in its normative horizon (Dussel, 2002). Co-responsibility, as formulated in Eco-Digital Posthumanism, must account not only for ontological entanglement and infrastructural asymmetry but for the geopolitical differentials that determine whose agency is distributed, whose responsibility is recognized, and whose knowledge counts as legitimate within eco-digital formations.

Taken in relation to one another, these lineages do not constitute parallel influences but intersecting conditions of possibility. Relational ontology provides the metaphysical displacement of the autonomous subject; ecological materialism embeds this displacement within multispecies entanglement; critical digital studies reveal infrastructural mediation, extractive asymmetry, and cognitive conditioning; sociological structuration and transmodern ethics account for temporal reproduction and geopolitical differentiation. Eco-Digital Posthumanism emerges at their intersection as a recomposition oriented toward the conceptual articulation of agency and responsibility adequate to the conditions of the digital Anthropocene.

5. Theoretical Implications and Operational Translation

If Eco-Digital Posthumanism reconceptualizes agency as distributed and responsibility as co-constituted across ecological and digital entanglements, its implications extend beyond conceptual clarification. They concern the institutional domains within which agency is organized, stabilized, and reproduced. The theory reframes how responsibility must be understood in fields where ecological processes and digital infrastructures converge, without prescribing specific policy models.

In educational theory, Eco-Digital Posthumanism reorients the understanding of subject formation. If subjectivity emerges through ecological and infrastructural entanglements rather than through autonomous interiority, education cannot be conceived solely as the cultivation of individual competencies. It becomes a site where relational capacities are shaped within material, technological, and multispecies conditions. This perspective resonates with traditions of ecological literacy (Orr,

1992) and complexity thinking (Morin, 2008) but extends them by foregrounding digital infrastructures as constitutive components of contemporary ecological life. Educational responsibility, under this framework, does not concern only ethical intention or civic virtue; it concerns the capacity to recognize and critically interpret the infrastructural and environmental conditions through which agency is enacted. This also entails recognizing plural epistemologies and marginalized ecological knowledges, whose exclusion has historically shaped both technological infrastructures and environmental governance. Within this theoretical horizon, the EcoAI framework can be understood as one operational translation of Eco-Digital Posthumanism in the educational domain. Rather than presenting AI as a neutral tool, EcoAI treats algorithmic systems as participants in ecological and civic assemblages, emphasizing critical AI literacy not as technical skill acquisition but as the capacity to situate AI within its material footprint, extractive supply chains, and socio-political consequences.

In media studies, Eco-Digital Posthumanism shifts analytical focus from representation to infrastructure. Media are not merely channels of communication; they are ecological forces embedded in geological extraction, energy regimes, and algorithmic governance (Parikka, 2015; Gabrys, 2016). Platform systems reorganize relational spaces and public values (van Dijck, Poell & de Waal, 2018), thereby shaping the conditions under which agency is expressed and recognized. From this perspective, media literacy expands into ecomedia literacy (López, 2020): the capacity to interpret media infrastructures as ecological and political formations. The emphasis is not on moralizing digital behaviour but on analysing how infrastructural arrangements distribute visibility, agency, and vulnerability across ecological and social fields.

Eco-Digital Posthumanism also reframes debates in AI ethics. If agency is enacted across layered configurations of human actors, data infrastructures, ecological materialities, and economic logics, then ethical evaluation cannot be restricted to individual decision-making or abstract principles. Responsibility must account for the infrastructural conditions that generate algorithmic outcomes. This perspective aligns with analyses that expose the material and extractive dimensions of AI systems (Crawford & Joler, 2018). Rather than dissolving accountability into systemic opacity, it relocates ethical inquiry from isolated agents to relational configurations: from what an actor intended to how distributed agency was structured, stabilized, and rendered asymmetrical within specific eco-digital formations.

Finally, Eco-Digital Posthumanism extends civic ecology into the digital Anthropocene. Community-based environmental practices (Krasny & Tidball, 2012) increasingly unfold within algorithmically mediated environments where data infrastructures, sensor networks, and platform imaginaries shape collective action. Citizenship can no longer be conceptualized solely in terms of human deliberation;

it must be understood as eco-digital co-agency within infrastructural systems that condition participation. Stewardship, under a posthuman framework, extends beyond human community management to multispecies co-flourishing within eco-digital assemblages, a recognition that civic responsibility is constitutively entangled with nonhuman organisms, ecological processes, and the technological architectures that mediate their interaction.

Eco-Digital Posthumanism therefore operates at both the ontological and institutional level. Its contribution lies in rearticulating the conceptual conditions rather than designing specific governance frameworks under which education, media systems, AI governance, and civic ecology must be understood. A further theoretical task - beyond the scope of this definitional note - concerns the specification of criteria through which co-responsibility may be analytically distributed across particular eco-digital formations. Such specification requires case-based and empirical elaboration that takes the present framework as its conceptual starting point. Where responsibility has traditionally been localized in autonomous subjects, the theory insists on examining the relational configurations through which subjects, infrastructures, and ecologies co-produce worlds.

6. Attribution and Research Context

The term Eco-Digital Posthumanism, as articulated in this article, designates a specific theoretical configuration and is introduced here as a conceptual contribution by Gianfranco Rubino. This article serves as the initial point of reference for the concept and its internal architecture.

The concept is developed within a broader research trajectory that includes work on EcoAI Framework Literacy and Digital Citizenship. In this context, Eco-Digital Posthumanism functions as the theoretical foundation from which subsequent operational and pedagogical elaborations, including the EcoAI Framework, are derived. Scholarly engagement with the concept is expected to reference its initial formulation in this work, in accordance with standard academic practice.

Keywords

eco-digital posthumanism; eco-digital co-responsible agency; relational ontology; intra-action; multispecies entanglement; distributed agency; data colonialism; platform infrastructures; ecomedia literacy; sociological structuration; posthuman subjectivity

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