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The impossible, necessary outside of nature: a Luhmannian intervention into post-humanist ecology

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ABSTRACT

In the wake of climate change, social theory has been subject to a surge of new materialist and posthuman approaches that reconfigure ontology and politics beyond the modern nature/culture binary which the Anthropocene has rendered untenable. But their (re-)turn to ontological speculation brackets the socio-epistemic situatedness and productivity of the way we think nature and its relationship to society. This paper reads Niklas Luhmann's systems theory as a posthuman perspective that can address the epistemological blind spot of materialist-ecological thought. Luhmann's ecology aligns with the former on the posthuman framing of shaping power, the productivity of an environmental outside that remains unknown, and the call for political modesty which follows. On the other hand, Luhmann's theory poses a critical challenge to materialist-ecological thought: the society/environment binary is here constitutively necessary, and its mapping onto a nature/culture binary functionally advantageous for subjects and social systems because it offers opportunities for complexity-reduction.

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Climate change and the end of society's environmental outside

As climate scientists are sounding alarm bells over the drastic ecological changes caused by an industrialized humanity, and human societies across the globe face their often-catastrophic effects, social theorists and social scientists are grappling with how to conceptualize the environment that is making itself increasingly felt. Much of the scholarship generated in response to mounting environmental concerns is united by the recognition that established frameworks of modern-liberal and discursive-poststructuralist thought are insufficient to think the relationship between human societies and their environment. What is needed, scholars argue, is a rethinking of subjectivity, shaping power and, most fundamentally, ontology itself, to recognize how societies have, all along, been made and changed by the ecological relations between humans and nonhumans (Bennett, 2012; Chandler, 2019; Coole, 2010; Latour, 2017). New materialist, speculative-realist and posthuman thinking identifies the binary distinction between human societies populated by acting subjects and their nonhuman environments to be researched, controlled and exploited for the purpose of human advancement as modernity's foundational error and the root cause of climate change. To rectify it, the new posthuman scholarship reconceptualises nonhuman nature

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as creative in its own right, and actively entangled in the many pursuits that us moderns simplistically attributed to human ingenuity alone.

The new materialist-ecological quest for an ecology fit for understanding, and guiding action in, the Anthropocene means that questions of epistemic conditioning are bracketed in favour of ontological innovation. This paper argues that Niklas Luhmann's sociological systems theory can advance contemporary materialist-ecological scholarship at this juncture. Luhmann's distinct contribution, as developed in the following, lies in the fact that he offers a mode of posthuman thinking to which the exploration of epistemic situatedness is central. Luhmann's world of relational systems that reproduce themselves via contingent distinctions from their environment is thoroughly posthuman. But beyond existing materialist-ecological approaches, Luhmann's ontogenetic perspective highlights that becoming posthuman cannot be treated as simply a better way of understanding being. Ontological expressions are here explored as contingent on the meaning relations of subjects and social systems that must make sense of their environmental outsides to reproduce their own relations, but which the new anthropocenic awareness has robbed of the guiding idea of an inert nonhuman environment.

In Luhmann, every particular environment conceptualized on the inside of a system plays a functionally necessary role in the reproduction of its relations insofar as it externalizes complexity. Against this background, ecological relationality and nonhuman agency can be understood as the products of an evolutionary adaption of society's knowledge relations. Post-human ecologies respond to climate change insofar as they move beyond the modern idea of a passive, distant nature that has become untenable. At the same time, they offer orientation for subjects and social systems to reproduce themselves against an environment of incalculable, disruptive complexity. They do so by making sense of the former as a nonhuman agency that cannot, in itself, be understood or adequately controlled. The paper begins with a brief overview of the main contributions of materialist-ecological theory in the first section. This forms the backdrop for assembling an alternative posthumanism from Luhmann's theory in the remainder of the paper. The second section offers a brief introduction to Luhmann's social systems theory and outlines how the former aligns with key materialist-ecological arguments. In the third and final section of the paper, I unpack how Luhmann's thought, read as a posthumanism of its own kind, offers a theoretical perspective to investigate nonhuman shaping power together with the epistemic situatedness of its ontological propositions, which is currently bracketed in materialist-ecological thinking.

Materialist-ecological reconfigurations: a posthuman ontology and politics

The first part of the paper offers a brief overview of the main ontological and political contributions that new materialism, speculative realism and posthumanism make to contemporary social theory, and to the social sciences more generally. To describe this extensive, rich and diverse body of scholarship, this paper will, in the following, make use of the label materialist-ecological theory. The author is conscious of the fact that the below overview involves both simplifications and the smoothing-over of, at times, substantial differences. Bracketed here is, for instance, the theoretical tension between the substance-focused 'immaterialism' (Harman, 2016, p. 15) of the speculative realist Object-Oriented Ontology and the new materialist focus on relational complexity (Lemke, 2017). Without marginalizing those theoretical, and indeed partially ontological, rifts, it is argued that the paradigms painted in broad strokes below nevertheless accurately capture common grounds of the diverse new materialist-ecological scholarship (see also Bergthaller, 2014; Cudworth & Hobden, 2015; Devellennes & Dillet, 2018; Bergthaller & Horn, 2020). Maybe more importantly,

I suggest that the analytical ends here justify the means of engaging with materialist-ecological scholarship via a summarizing overview. Both the diagnosis of a missing regard for the conditioning power of epistemic relations and the promise that Luhmann offers for remedying this lacuna with his 'epistemologically sensitive' posthumanism does not only apply to, and can advance, the work of one particular thinker but rather posthuman social theory as a whole. For this reason, it is the corpus of this scholarship in its entirety that forms the backdrop and addressee of the arguments developed in the following.

The first central, shared achievement of the new materialist-ecological scholarship is, I suggest, that it pushes contemporary social science research to reflect on, and move beyond, its anthropocentric, either rationalist or cultural-epistemological, concept of shaping power. Materialist-ecological approaches mobilize diverse theoretical resources from re-imagined modern philosophy to natural scientific research and non-Western thought to draw out 'the curious ability of inanimate things to animate, to act, to produce effects dramatic and subtle' (Bennett, 2010, p. 41). Materialist-ecological thinking dislocates shaping power from the figure of the rational human subject, which, it is argued, has at least latently lived on in poststructuralist scholarship because the former regards only the meaning systems and social relations produced by humans as productive (Bennett, 2010, p. 107; Bryant, 2011a; Mol, 1999). On the contrary, materialist-ecological theory views even creative thought as rooted in the constitutive materiality of brain cells and neuronal networks (Barad, 2007, p. 140; Bennett, 2012, p. 45). This posthuman turn not only expands the domain of agents that populate human societies but reconfigures agency itself. Agency is here no longer a capacity of human (or nonhuman) actors but 'an ongoing flow' (Barad, 2007, p. 140; see also: p. 214) or potentiality of materialization. This potentiality it manifestly real but exceeds any particular actuality it brings forth and thus cannot be known as such. Only its actualization is subject to perspectivist observation (Harman, 2002, pp. 45–47).

Materialist-ecological thinking dislocates social continuity and change from the anthropocentric focus on human reason, the meaning systems it creates and the social structures it holds up. Here, these human driving forces hold no creative privilege over technological artifacts, viruses or indeed an ecosystem that intertwines humans, animals, plants and geological matter (Chandler, 2013; Viveiros de Castro, 1998). Where modern thought theorized subjective and socio-cultural shaping power against the distant, constitutive outside of a withdrawn nature, materialist-ecological thinking reveals that nonhuman '"others" are never very far from "us"; "they"' and "we" are co-constituted and entangled' and their creative intra-actions that 'cut "things" together and apart … are not enacted from the outside' (Barad, 2007, p. 179) of human societies.

The second contribution of the new materialist-ecological scholarship is that it offers a set of analytical tools to map and conceptualize the political effects of nonhuman agency. Using the example of the COVID-19 pandemic, while modern-liberal and post-structuralist approaches can only engage with the normative appropriateness and political performativity of social responses to the crisis (Agamben, 2020; Delanty, 2020), materialist-ecological theory offers an analytical lens that provides insight to how the virus itself, masks and vaccines have altered societies as powerful actors in their own right (Bratton, 2021; Valdés, 2021). As Braun and Whatmore write in their introduction to *Political Matter*, materialist-ecological theory is united by the refusal to imagine nonhuman shaping power

> as something that encroaches on political life from the outside. From their varied perspectives, the life of the polis must never again be thought of merely as humans gathered together without their myriad attachments. The "stuff" of politics is there, from the beginning. (2010, p. xxxiii)

While materialist-ecological theory thus urges for a 'parliament of things' (Latour, 1993, p. 142) to be added to our understanding of both the issues and processes that demand governmental intervention and the workings of governance itself, it also radically limits its scope and aspirations (Barad, 2007, p. 187, 203). Nonhuman shaping power always exceeds the scientific laws and management plans humans produce to map and approximate it (Bennet, 2012; Harman, 2002), rendering knowledge-production in an entangled world local, incremental and contextual (Danowski & Viveiros de Castro, 2017, pp. 92–112; Latour, 2017, p. 136). Materialist-ecological thought calls for an epistemological and political position of human modesty, which stands in sharp contrast to the omnipotence of the rational subject of modern thought and science. At the receiving end of powerful material forces that cannot be controlled, but at best be mitigated in their effects, human communities must reinvent politics beyond the, as Latour calls them, 'pathetic resources' (2017, p. 108) of management and governance. Here, some scholars call for a shift towards a more adaptive, ad-hoc and resilient politics (Chandler, 2013, 2019; Latour, 2017).

Beyond nature/culture – in a different way: the environment of Luhmann's systems

While the posthuman turn has been largely welcomed within the social sciences, materialist-ecological scholarship has been met with a number of critical responses. Critics either diagnose a simplistic materialist essentialism underpinning its arguments (Lemke, 2017, 2018; Zerilli, 2015), call into question the novelty of its contribution (Ahmed, 2008; Devellennes & Dillet, 2018) or fear that the flat ontology of human-nonhuman entanglements provides no basis to capture and critique social inequalities and exclusions (Cudworth & Hobden, 2015; Lemke, 2018). This paper develops a different, sympathetic critical intervention into the existing body of materialist-ecological scholarship – one that targets what might be called its epistemological blind spot.

Materialist-ecological theorists purposefully position themselves against what they view as the post-structuralist obsession with 'various pseudo-problems of philosophy' (Bryant, 2011a, p. 262) related to our access to reality in order to return the gaze of social theory to manifest 'matters of concern' (2004, p. 248), importantly those related to climate change. But as a consequence, materialist-ecological theory offers no insight into how the ontologies of active materiality and entangled human-nonhuman agency relate to the social contexts and meaning systems that condition any understanding of the environment (Bergthaller, 2014, p. 41). Materialist-ecological scholarship draws out the many ways in which the modernist environmental outside has become impossible to uphold in the face of a rapidly changing natural environment. But it leaves blank the socio-epistemic conditions and effects of our changing sensitivity towards the nonhuman world.

This paper reads Luhmann's sociological systems theory as offering both a critical intervention in and a productive contribution to materialist-ecological scholarship at precisely this juncture. Luhmann's thought, it is argued, offers a posthuman perspective of its own kind that on the one hand aligns with the central materialist-ecological claims drawn out above. But because ontology, for Luhmann, is always ontogenetically linked to the epistemic relations on the inside of a system, and their need for autopoietic continuation, his theory on the other hand also provides analytical tools to explore the social contitionedness and functionality of the present ecological reconfiguration of ontology. In Luhmann, the distinction between a systemic inside and its social outside is necessary for the existence of the former. While the nature/culture binary is merely one way to give meaning to this constitutive distinction, thought with Luhmann, increasing social attention to nonhuman shaping power continues rather than disrupts meaning systems that reproduce

themselves at the border to a nonhuman nature. The rising public attention on material-ecological issues is here situated in the specific mode of self-reproduction that drives social relations in contemporary societies. It will be argued that rising ecological concerns offer complex contemporary societies a way of managing high complexity under social conditions where the modern-liberal ideals of subjective rationality and absolute governmental agency can no longer hold force.

The following section will offer a brief introduction to Luhmann's systems theory that will ground my reading of the former as a particular brand of posthumanism. My reading of Luhmann's theory aligns with recent scholarship that explores its critical potential (Fischer-Lescano, 2012; Moeller, 2012; Wolff, 2021). But more specifically, it draws on a small subset of the former which engages Luhmann's work productively, albeit with a certain amount of creative re-reading that not all Luhmann scholars would endorse, in the context of recent materialist-ecological social theory (Bergthaller, 2014; Bryant, 2011b; Hörl, 2017; Philippopoulos-Mihalopoulos, 2011, 2013, 2014; Wolfe, 2010). Borrowing from Wolfe's discussion of Luhmann in *What is Posthumanism?*, the understanding of post-humanism that underpins such a reading of Luhmann is focused on 'the necessity for any discourse or critical procedure to take account of the constitutive (and constitutively paradoxical) nature of its own distinctions, forms, and procedures … in ways that may be distinguished from the reflection and introspection associated with the critical subject of humanism' (Wolfe, 2010, p. 122).

Luhmann's theory is thus certainly not posthuman in a way that involves sketching out the essential quality and operativity of nonhuman agency. However, as for materialist-ecological scholarship, the 'fundamental postulate of [Luhmann's] systems theory' is 'its replacement of the familiar ontological dichotomies of humanism (culture/nature and its cognates: mind/body, spirit/matter, reason/feeling, and so on)' (Wolfe, 2010, p. 220) – albeit that Luhmann replaces the former not with a relational ontology of human-nonhuman entanglements but with the functional distinction system/environment.

Unlike Talcott Parsons, Luhmann does not presume that systems are pre-given, ontic entities which structure a reality that can be accurately captured and fully explained by the social scientist (Luhmann, 1990, p. 254). Luhmann's social systems theory rather captures how subjects – as consciousness systems – and social systems, from politics to the economy or art, continuously produce themselves by drawing a contingent distinction from their environment, which Philippopoulos-Mihalopoulos describes as simultaneous 'worlding' and 'othering' (2013, p. 171). As showcased by the neurobiological research of Humberto Maturana and Francisco Varela, from which Luhmann draws the concept of autopoiesis, this mode of self-referential worlding or worldmaking can be found in the natural world, for example in the neuronal system of a frog, which reacts to its own excitability rather than directly to an external stimulus (Lettvin et al., 1959).

When Luhmann states at the beginning of his magnum opus, *Social Systems*, that systems are real – what he means is that they are real for the observer, the social scientist located on the inside of the social system, who has adopted systems theory as one such ordering framework to guide their second-order observation (Moeller, 2012, p. 78). If one is to ascribe an ontology to Luhmann's thought, where an always both produced and productive complexity unfolds a multiplicity of contingent systemic worlds, it is not an ontology of foundations, essences and ultimate origins.[1] On 'the cusp of a reality that remains unknowable' (Rasch, 2013, p. 56), Luhmann's theory performs a radical turn to the inside that collapses the distinction between the sources and the effects of creative production, and deliberately leaves unanswered questions that pertain to grounds beneath the system's self-grounding relations. Everything a system perceives is the immanent product of the relations that the system is comprised of – including Luhmann's systems theory. Luhmann's

thought performs a 'de-ontologisation of reality' (Luhmann, 2009b, p. 35; own translation). It merges the recognition that reality is real because we can make sense of it with the insight that it is only real to the knowing observer because they immanently produce existent self and the world inhabited in their systemic relations, in the absence of any possibility to access an external reality (Luhmann, 2009b, pp. 34–39).

For the autopoietic system, keeping its own relations constant is the dominant functional principle and operational aim. But importantly, this self-reproduction is closed-off from any external influence. Autopoietic systems produce all elements that they require to reproduce their relations, including those perceived as external influences, on the inside of the system (Luhmann, 1995, pp. 2–35). Autopoietic systems are spaces of reduced complexity that produce and reproduce themselves by perpetually drawing a distinction to a complex environment in sense, which can then be disregarded by system-internal processes. Systems therefore need an environment as the constitutive outside from which they differentiate themselves, but this environment is co-constituted with the systemic inside within the ongoing process of relational autopoiesis (Luhmann, 1989, pp. 11–14).

According to Luhmann, not only the consciousness systems of individuals but also different social systems continuously produce themselves, and the worlds they inhabit, in a way that is autopoietically closed off from their respective environments. Luhmann adopts a socio-historical perspective here. While society has not always been structured into autopoietic systems, functional differentiation followed horizontal segmentation and vertical stratification at the dawn of modernity to allow society to cope with the drastic increase of complexity. Social systems each perform a particular function for society but are functionally closed off from the rest of society. Importantly, this does not mean that systems are completely independent from each other and maintain no contact to other systems. Luhmann maintains that autopoietically closed systems are 'structurally coupled' in in multiple ways, but whatever is received from another system only comes into existence as perturbation on the inside of a system. Whatever a subject or social system perceives, understands or knows about the systems that are part of its environment is self-produced and only attributed to the systemic outside *a posteriori*, with no means of ensuring that such knowledge has any grounding in the real systemic environment (Luhmann, 2012, pp. 66–67). As a consequence, systems cannot adequately understand or predict how other systems act; each system can only process the outputs of other systems as self-produced, disruptive events (Luhmann, 2012, pp. 634–750). Politics, for instance, is required to deal with the fallout of economic crises – but it does not actually understand when and how these occur in the economic system.

Consciousness- and social systems reproduce themselves in relations of meaning expressed as communication. Importantly, particular meaning systems are here not the agents of communication, but, just like the world they inhabit, they are products of self-reproductive relations of communication. As Luhmann famously states, humans 'cannot communicate; only communication can communicate' (1995, p. 57). In the communicative production of the system's inside/outside boundary, the allocation of 'inside' and 'environment' – what is regarded as part of a consciousness system's identity or a social system's functional responsibility vs what is externalized through this distinction – is fundamentally contingent, and can be re-allocated in every new reproductive instance. The immanently creative inside/outside distinction merely but vitally 'presupposes the operationally functioning unity of what is differentiated' (Luhmann, 2012, p. 25) – of system and environment (Luhmann, 1989, pp. 6–7).

Luhmann's meaning systems are second-order machines – they are self-aware. Such systems observe their own existence and actions, and this observation is taken into consideration in the self- and worldmaking processes that reproduce them. Second-order machines therefore suffer

from a constant increase of internal entropy as they accumulate data from the observation of their own actions against the background of various alternatives. As a consequence, Luhmann (1990, p. 29, 1995, p. 83) argues that they develop ordering structures that facilitate continuous self- and worldmaking by banning the encroaching complexity to the outside of the system. The environment of the system thus serves both as a constitutive outside and as a destination for the externalization of complexity in every instance of autopoietic reproduction.

Reading Luhmann's ecology as posthuman theory

A first point of alignment between Luhmann and posthuman social theory is that shaping power is, in both, dislocated away from the human subject. Where materialist-ecological theory retraces agency to materiality, its inter-relations and its entanglements with humans and social structures, in Luhmann, it is neither subjects nor systems but instead systemic relations that produce both selves – subjects and social systems – and the worlds they inhabit. The substance or identity of a system is always secondary to a process of distinction which continuously differentiates the system from its environment. The substance that makes up autopoietic systems, regardless of whether these manifest as a subject's consciousness or the political, does not exist as an ontological essence. Rather, it is contingently produced through a system/environment distinction which is not controlled by human agency but from which both subjects and societies instead emerge as secondary, contingent and changeable (Bryant, 2011b, pp. 139–142). As observed by Bergthaller,

> the theory of autopoiesis is fundamentally consonant with the ontological premises of the new materialisms. It is monist in the sense that phenomena such as self-hood, intentionality, or agency are assumed to emanate from the same "stuff" that everything else is made of and […] does not consider cognition as the exclusive province of human beings, but as an emergent property pervading the whole biosphere. (2014, p. 47)

Luhmann's systems theory has been read in a way that understands the communicative relations of social- and consciousness systems as purely composed of meaning (Moeller, 2012). However, it is argued here that such a reading misses out the radical posthumanism of Luhmann's theory, which is explicitly developed to 'correct the widespread overestimation of the role of language' (Luhmann, 1995, p. 10). Meaning relations and their communicative expression are defined by their effect, the relational continuation of communication, and thereby of systemic existence, not by their ontological composition. Philippopoulos-Mihalopoulos (2011, 2013) shows, for the realms of law and art, how communication is never limited to linguistic signs but always involves material constituents like paper, bodies and spaces. Reading Luhmann against the backdrop of the new materialist-ecological scholarship (Hörl, 2017) productively pushes his theory beyond the latent, implicit primacy of linguistic meaning that haunts it at times (Philippopoulos-Mihalopoulos, 2014, pp. 400–401). Synthetic, epistemic-material relations of communication are the agents of self-making and world-making in Luhmann's posthuman theory of social systems. In their description, Luhmann defies modern anthropocentrism and instead subverts any meaningful distinction between thought, social structures and material-ecological relations. Consciousness and education, like neuronal networks or ecosystems, are composed of nothing but self-reproductive relations. Technological devices are as vital to constituting the human-nonhuman network of communication as human speech is. In the opening pages of *Ecological Communication*, Luhmann critically remarks, in a manner uncannily similar to many materialist-ecological thinkers, how social theory needs to discard its

'ethnocentrism' (1989, p. 5) if it is to develop an adequate understanding of the relationship between society and environment.

Both materialist-ecological social theory and Luhmann then finally identify the relationship between humans and their nonhuman environments as the central challenge faced by contemporary societies. For materialist-ecological theorists, the agency of objects and matter is ontologically founded and not a product of recent ecological changes. However, they emphasise that in the Anthropocene, nonhuman agents increasingly make themselves noticed to human communities (Coole, 2010; Latour, 2017). Luhmann's emphasis on the need to engage with ecological questions is developed with a focus on second-order observation: towards the end of the twentieth century, 'society feels itself affected in many different ways by the changes that it has produced in its own environment' (Luhmann, 1989, p. 1). In other words, threats from the environment of the social system are so particularly concerning because social observation produces them as such. This does not mean that Luhmann's position vis-à-vis climate change is one of scepticism or social relativism. All that is real is, for Luhmann, produced in communicative expression. On the contrary, the manifest reality of ecological changes is rather treated as a given in *Ecological Communication*, the implicit starting point from which Luhmann's arguments unfold. What Luhmann (1989, pp. 19–21, 1993, pp. 529–531) is interested in is under what conditions, and to which effect, contemporary societies are particularly sensitive to disruptions from their nonhuman environment.

Managing environmental complexity has, following Luhmann, become increasingly important for societies in the course of functional differentiation. Functionally closed-off social systems are highly specialized and thus effectively geared to the tasks they perform, but they are also highly vulnerable, as everything that is not directly related to their function can only be perceived as environmental disturbance or 'irritation' (Luhmann, 1989, p. 29). On the one hand, these environmental irritations provide the system with opportunities to reproduce its boundaries, and thereby its integrity. Functionally differentiated systems thus need to expose themselves to ecological disturbances in order to persist. For this reason, their relationship with their environment must be one of, as Luhmann calls it, *resonance* – a high sensitivity towards environmental issues. But on the other hand, invasive ecological complexity also threatens the autopoiesis of the system, which is thus always 'both supported and disturbed by its environment' (Luhmann, 1989, p. 13). Irritations, in Luhmann, describe a system's encounter with the 'world [as] an immeasurable potential for surprises', as 'virtual information' (Luhmann, 2012, p. 19), which it cannot comprehend as such, but must – and does – yet respond to. Systems accomplish this, following Luhmann, by giving 'selected irritations the sense of information' (ibid.), meaning that they come into being as concrete issues, events or processes on the inside of systemic meaning structures. Here, they can be perceived and communicatively expressed, allowing systemic meaning-relations to continue. However, the successful management of, in Luhmann's terms, irritating environmental complexity is always precarious, and hinged on a system's ability to transform the former into selected pieces of information that can be processed. The fact that social systems both require and are threatened by a constant engagement with environmental complexity, and must therefore develop ways to successfully manage it, is, for Luhmann, the core of the 'ecological question' (1989, p. 6) faced by contemporary societies.

The critical role that environmental irritations play as both threats to and creative resources for Luhmann's systems prompts the question whether the theoretical backdrop of materialist-ecological thinking does not render visible an environmental real of pure potentiality, akin to the creative materiality theorized by the former, as the driving force of systemic autopoiesis and adaption in Luhmann. Understood in this sense, the way in which we make sense of environmental irritations,

for instance whether modern societies aim to predict and control the effects of climate change using existing scientific and political means or whether they utilize them as an opportunity to fundamentally re-think their means of ecological engagement, is contingent. Not contingent but rooted in real, profound changes in the nonhuman environment of social systems is, understood in this sense, the increased frequency and severity of environmental disturbances that make themselves felt on the inside of the former. In other words, the materialist-ecological turn in meaning-making is responding to something real, even if we cannot accurately conceptualize the thing-in-itself it is responding to.

Erich Hörl, who reads Luhmann along these materialist-ecological lines, takes his open and historically situated understanding of communication as the starting point to explore how recent ecological changes and technological innovations have, from the outside of social systems and subjects, caused a shift in the orientation and content of meaning (2017, pp. 13–21). Here, the 'reconceptualization of modes of existence, faculties, and forms of life in terms of [ecological] relations' (Hörl, 2017, p. 7) constitutes the contingently expressed but necessary communicative adaption to the manifest reality of significant environmental changes that increasingly and disruptively impact on social systems. Against those critical voices that view Luhmann's society of systems as a deterministic dystopia without the possibility for change (Lange, 2005; Malowitz & Selk, 2015), reading Luhmann with a materialist-ecological bend radicalizes his assertion that autopoietic continuity is a continuity in form only that allows for fundamental changes in the content and make-up of the epistemic and social relations reproduced. As Luhmann puts it, a 'social system is not, like an organism, fixed in its type. A donkey cannot become a snake, even if such a development was necessary for survival (2009a, p. 18).

Luhmann's theory can thus accommodate the radical reconfiguration of not only ontology but social life that the new materialist-ecological theories envision. However, I argue that any assertion of the manifestly real quality of its ground is nevertheless fundamentally alien to Luhmann's thinking, and sets him apart from the former. In Luhmann, creation and observation are one and the same. When Luhmann writes that 'irritation from the environment into the system' is 'always a construct of the system itself, always self-irritation – albeit occasioned by environmental effects' (2012, pp. 66–67), whether these 'environmental effects' are rooted in a creative potentiality genuinely external to the system or dreamed-up by a system that generates the complexity that must disrupt it on its own inside is left open. Irritations cannot be retraced but only be attributed to causes. The attribution of 'ecological' as opposed to 'social' causes offers no more real, secure ground because, for Luhmann, whether environmental disturbances felt by a system have manifestly real causes on their outside can simply not be determined. The moment they come into being on the inside of the system, both human and nonhuman agency are already effects produced in meaning. As Elena Esposito puts it, for this reason 'the human or nonhuman nature of the elements (actors) makes no difference, because there is no reference to any external instance: neither the subject, nor society, neither nature nor God – everything is reconstructed a posteriori' (2017, p. 288).

Unlike materialist-ecological social theory, Luhmann does not ground his turn to ecology in the manifest reality of a shaping power exerted from an ecological-material 'encompassing system' (Luhmann, 1989, p. 6) that the rationalist observational mode of modern science and philosophy had hidden from view. However, in alignment with the former, his arguments presume the failure of what he refers to as the modern 'Cartesian or Baconian tradition' (Luhmann, 1993, p. 527) of science and philosophy. The new materialist-ecological theories have shown how the modern idea of an Earth populated and conquered by exclusively rational human subjects must be

significantly adapted or even discarded altogether when these human subjects find themselves at the receiving end of nonhuman shaping power. Luhmann, on his part, argues that a functionally differentiated scientific system can only fall short of its self-imposed expectations. In 'The Modernity of Science' (1994), Luhmann shows how providing secure knowledge and orientation for communicative sense-making/worldmaking, which is the functional responsibility of science, is exactly what a functionally differentiated scientific system cannot do. As it has no access to its environment, science cannot make diagnoses and prognoses about 'the real' with any certainty.

For Luhmann, as for materialist-ecological thought, science must therefore discard its modernist aspirations of 'instructing others about the world' (Luhmann & Behnke, 1994, p. 20). What follows is a 'crisis of modern science' rooted in the 'becoming visible of its simplifications' (ibid.), which reduces its capacity to provide guiding knowledge and certainty for society. The consequence that Luhmann draws out seems to describe contemporary societies remarkably aptly: trust in scientific evidence and progress declines, and the level of general social uncertainty increases (Luhmann, 1993, p. 528). While these social conditions, as the examples of anti-mask protests and vaccine sceptics in the case of the COVID-19 pandemic illustrate, certainly bring with them their own challenges, it is under these conditions that societies, following Luhmann, are more resonant towards environmental disturbances because these are no longer readily 'absorbed' by a positivist science.

Their posthuman perspective leads both Luhmann and materialist-ecological social theory to a position of modesty regarding the extent to which humans can meaningfully act on ecological challenges. For the latter, the pluralization of actors and life-worlds means that the nonhuman shaping power experienced by human societies can only be predicted and governed to a limited extent, necessitating a shift towards a an adaptive, resilient, and ecologically cooperative politics. Luhmann's starting point is here the insight that successful environmental intervention can only happen if the object of this intervention 'is sufficiently ordered, so that if we examine it, we can know exactly what it consists of. It is open to us and apparent by itself' (1993, p. 529). A functionally differentiated society, which is closed-off from its environment, and auto-logically responds to its own stimuli, has no way of achieving this insight, and has thus no way of acting on its environment *as it really is*. Consequently, ecological governance can no longer be 'an issue of a greater or lesser technological control over nature' (Luhmann, 1989, p. 14).

As for materialist-ecological theory, this does not mean that no action on environmental challenges is possible, but that the presumptions for, and expectations from this action must be adapted. Following Luhmann (1989, pp. 16–17, 2012, pp. 32–33), different social systems can react to their increased resonance towards environmental disturbances, but only within their respective functional logic. In *Ecological Communication*, Luhmann, chapter by chapter, examines the capacity of society's different functional systems to respond to ecological resonance – the economy, law, politics, education – and, one after the other, calls into question their ability to fundamentally alter the way human societies interact with their environments. The political system receives the most dedicated attention here. For Luhmann, the conditions of functional differentiation subvert the decisionist aspirations of modern politics. The functioning of politics, like that of science, is, following Luhmann, hinged on the responsibility of 'uncertainty absorption' (1993, p. 530), which is here performed through the provision of collectively binding decisions for society as a whole. Politics, in other words, is society's 'problem-solving' system. It must respond to the views and priorities of citizens, including the increasing public awareness for the ecological changes in the Anthropocene (Luhmann, 1989, p. 177).

However, like the scientific system, politics has no access to the environment it is tasked to effectively govern, it can merely adapt its internal functioning as a consequence of the ecological

communication it produces. As in the case of modern science, Luhmann (1993, pp. 530–531, pp. 538–539) prophesizes the effect of a decline of trust in the political system together with an unresolved, high level of uncertainty that impedes socially reproductive processes of meaning-making/worldmaking. Strikingly similar to what is argued by materialist-ecological theory, Luhmann suggests that a way forward can only lie in adapting the 'intellectual climate' (Luhmann, 1993, p. 537) and expectations of and within ecological politics so that 'uncertainty is recognised' (ibid.) and accounted for, which means discarding linear causality as the model for political planning and steering.[2]

Environmental outsides: contingent materiality and necessary complexity-reduction

Luhmann's thought however diverges from materialist-ecological posthumanism in one important respect: for the former, it is both possible to recover nature from its status as society's outside, and necessary to do so in the name not only of theoretical progress beyond the humanist reductionism of modern thought but also of our political responsibility to learn from anthropogenic climate change, and alter the way we think and act accordingly.[3] The only way forward is to bring the nonhuman outside, ontologically and politically, into our human societies. But viewed through the lens of Luhmann's posthumanism, such an ontological enfolding of nonhuman agency cannot change the fact that meaning systems reproduce themselves against an environmental outside. Inside/environment distinctions are constitutive of all systemic being (Luhmann, 2012, p. 25; Moeller, 2012, pp. 127–129; Philippopoulos-Mihalopoulos, 2014, p. 405).

Thought with Luhmann, neither materialist-ecological social theory nor the contemporary societies slowly awakening to the reality of climate change can escape the necessity to have an *an environment* – societies and the consciousness systems of subjects exist through the binary distinction from a co-produced outside that always selectively externalizes something, excludes something from the systemic inside to be known, taken into account and managed. The externality of the environment is here necessary – but importantly, its material-ecological framing is contingent. For Luhmann's individuals and social systems, the nonhuman environment is just one, or maybe rather part of one, of their environmental outsides. Social systems perceive each other only in the form of environmental complexity (Luhmann, 1995, pp. 108–113). To the political system, the logic of art is as foreign as the functioning of a fungus rhizome, and any qualitative difference between their environmental quality is the contingent product of its own relations. Subjects are outsides to each other, but also lie outside of society and its functionally differentiated systems. The nonhuman environment is common to all meaning-based systems, 'they all have in common that they relegate the totality of physical, psychical, nervous etc. conditions and events … into their environment' (Blühdorn, 1999, p. 189). But it is never simply *the* environment of a subject or a social system. However, the fact that the meaning relations of modern societies neatly map their inside/environment distinction onto a nature/culture binary must nevertheless be understood as the product of their relational functioning, where every conceptualization of the environment plays a functional role in ensuring autopoiesis.

Materialist-ecological theory has effectively brought to light how modern thought and modern societies have been reproducing themselves against an outside of nature that was, all along, their epistemic creation. But beyond this, Luhmann offers us the theoretical tools to explore the ontogenesis of our new materialist-ecological understanding of being, and the conditioning role that the epistemic relations which make up, and keep in motion, contemporary societies play here. I

argue that, understood with Luhmann, the ontological reconfigurations of materialist-ecological scholarship continue rather than disrupt meaning systems that reproduce themselves against the other of nature, or more precisely through the externalization of complexity to a nonhuman outside. Following Luhmann, the increasing sensitivity to nonhuman shaping power that marks contemporary societies (Luhmann, 1989, p. 13), and which contextualizes the rise of materialist-ecological scholarship, must thus not be understood as the end of nature's constitutive externality, but rather as a shift in the epistemic frameworks that perform the externalization of complexity to a nonhuman environment (Esposito, 2017; Wolfe, 2010, p. 210).

As shown above, Luhmann's social systems need the constitutive outside of environmental complexity to be constantly present in order to reproduce their relations, but are at the same time threatened by it, and thus need to manage it. They oscillate between openness to, and the need to exclude, an environment. The threat of disruptive complexity is particularly urgent for contemporary, highly complex social systems. They accommodate a number of specialized subsystems, a multiplicity of psychic systems and the interaction systems they form, and thus suffer from an entropic increase of internal complexity, which offers frequent opportunities for autopoietic reproduction, but which must at the same time be constantly externalized as 'environment' to not threaten the integrity of the system (Luhmann, 2012, pp. 326–350). With Luhmann, it can be argued that making sense of, and thereby externalizing, environmental disturbances as the product of an active, dynamic and threating nonhuman environment is a functional response to exactly these conditions on the part of contemporary meaning systems because it offers a structured way to manage this complexity.

The multiple effects of climate change, which impact manifestly on human societies, mean that a black-boxed nonhuman environment is no longer available to absorb externalized complexity. Attributing a nonhuman cause to a flood or bushfire no longer secures their meaning and ends the conversation, but rather sparks further investigation into the relationship to climate change and the political measures to mitigate the former. As Fréderic Neyrat, who discusses the externality of nature as functionally necessary for modern societies in a related fashion in his work on immunity, puts it: nature is no longer available as 'our hidden trash bin' (Neyrat, 2016, p. 250). Climate change, Neyrat argues, has rendered nature unavailable as a transcendental outside to which social threats can be externalized in a way that precludes any further investigation into causes, effects and possible mitigation. The permanent latent presence of ecological threats on the contrary, using Luhmann's terminology, adds to the informational complexity that societies and subjects must contend with in a world where 'environmental catastrophe is part of our daily reality' (Neyrat, 2016, pp. 247–248). For Neyrat, the consequence is an ambiguous but permanent insecurity felt by the Anthropocene's global subjects, which gives rise to immunitarian paranoias such as the conspiracy theories that rose to prominence during the COVID-19 pandemic.

With Luhmann, on the contrary, the focus on a material-ecological environment and its disturbances can be understood as a way to manage the environmental complexity of both human and nonhuman origin. Luhmann suggests that the materialist-ecological form given to environmental disturbances is contingent, and particularly well-suited for complexity-reduction. Different from the irritations that social systems may locate in subjects, or other areas of society, existing structures of meaning allow for classifying nonhuman shaping-power and its effects as ontologically secure. Their material reality conceals the foundational paradox of ecological environmental disturbances – the fact that they are co-constituted with, and relative to, the system experiencing them – which the dissolution of modern rationalism and decisionism has on the contrary made increasingly apparent for 'social' issues. In Luhmann's words, 'natural constraints are more "attractive" because they do

not seem contingent: Those constraints on a system's self-reference that appear as natural or necessary … conceal tautology or paradox in the performance of self-reference' (1989, p. 26).

From a Luhmannian perspective, contemporary, functionally differentiated societies benefit from selecting ecological challenges as the ones to resonate with. The possibilities for externalization they provide generate some of the orientation for the reproduction of meaning relations that modern science and modern politics no longer offer, even if this orientation merely locates and contours the threat experienced, and does not come in the form of definite knowledge or a pathway for governmental resolution. For the social system, and the consciousness systems inhabiting it, the recognition of environmental shaping power as real, but not fully understandable and governable, becomes a way of giving form to, and thereby excluding, complexity as environmental. Luhmann presciently references climate anxiety, which has become a prevalent social phenomenon (Taylor & Murray, 2020), to argue that it is, for the consciousness system experiencing it, a way of reducing uncertainty because it gives anxiety a form, cause and course of action to respond to it. It transforms 'the uncertainty of the situation into the certainty of anxiety' (Luhmann, 1989, p. 130; see also: 1993, p. 535) induced by an environmental shaping power that we cannot comprehend or control.

In addition to the wide-spread presence of such climate anxiety, public surveys reveal that the democratic publics across the globe rank climate change as a top priority for political action (Poushter & Huang, 2019). Understood with Luhmann, this focus on ecological environmental threats and their resolution illustrates the complexity-reducing function of society's natural outside as an epistemic frame. While the unprecedented scale and urgency of the climate catastrophe, which scientists and ecological activists draw attention to and which materialist-ecological theory conceptualizes, is uniquely threatening, it thereby also offers an ordering framework in the form of a hierarchy of threats that focuses attention for subjects and the social systems most immediately coupled to them, such as politics. As can be read in the Extinction Rebellion Manifesto *This is not a Drill*, the 'stakes are higher now than ever before. This time, we are literally fighting for our lives' (Burns & Reimann, 2019, p. 165).

Thought with Luhmann, materialist-ecological scholarship must be situated in society's functionally conditioned turn to an environment that reduces complexity no longer by identifying what can be disregarded, but now by selecting environmental disturbances for attention. For the scientific system, and here particularly the Humanities and Social Sciences, the posthuman turn and its particular conceptualization of material-ecological shaping power, can be understood as a way to perform its social function of providing orienting knowledge in the absence of the absolute certainty of, as Luhmann puts it, 'the Cartesian-Baconian confidence in more knowledge and, instead, allows us to maintain or even cultivate uncertainty in matters of both cognition and action' (1993, p. 536). By giving name and form to the political and epistemic limitations of complex contemporary societies, materialist-ecological theory offers a way to make sense of the former. Here, the ambiguous environment of unprocessable complexity becomes an environment with shaping power, legal and normative claims in its own right (Luhmann, 1993, p. 530; 1989, pp. 80–81, p. 129). Its nonhuman, pre-conceptual shaping power cannot be fully understood or controlled, but at least, following posthuman theory, *we can be certain of this impossibility*. As a consequence, the incomprehensibility of ecological forces no longer signals the failure of the epistemological tools available to science and philosophy. It rather becomes a theoretical achievement, and the ontological condition for a reconfigured, more appropriate understanding of shaping power.

Luhmann's thought poses a critical challenge to materialist-ecological social theory insofar as it identifies its ontological and political achievements to undo the modern nature/culture binary as

part of a wider reconfiguration of society's relationship to nature which, rather than dissolving its externality, renders it functionally effective for managing complexity in Anthropocene societies. Luhmann's theory ontogenetically ties the new environmental ecologies to the autopoiesis of modernity's knowledge relations and social structures, and thereby calls into question whether we can 'hope to simply replace [them], like a faulty engine, with a better ontology' (Bergthaller, 2014, p. 52). Where materialist-ecological theory envisions the dusk of modernity's ecology of rationalist human control and the transition towards a heightened social awareness of the complexity and relationality of being (Hörl & Schott, 2018), Luhmann's theory highlights the common social ground and functional equivalent of both. Spearheaded by academic discourses, both constitute means of dealing with environmental irritations. Politically and ethically, we might have good reasons to prefer the non-anthropocentric ecology offered by the new materialist-ecological theories.

But, thought with Luhmann, such preference is firstly always a case to be made because ontological evolution cannot readily be attributed to a better, more adequate understanding of reality. Secondly, and maybe more importantly, while the content of the new ecological ontologies radically breaks with modernity's idea of an inert nature clearly distinct from human societies and their creative actors, their functionally equivalent roles as selective expressions of environmental irritations that facilitate social autopoiesis mean that the new ecologies always also allow the ideas and social relations of modernity to continue. However, to be clear, their functional role as a means of continuing the externalization of complexity along different lines does not mean that the new materialist-ecological theories have no real transformative potential. In a world of social and consciousness systems made up of nothing but self-grounding, self-disrupting meaning relations, any changes to the content and orientation of meaning is impactful, and has the potential to radically transform the make-up of this world.

Again, for Luhmann, a donkey cannot become a snake – but a meaning system is not, like an organism, fixed in the content and quality of the relations it reproduces (2009a, p.18). This means that the posthuman turn, understood with Luhmann, can, at the same time, be both conditioned by the workings of systemic relations that seek continuity and play a significant role in changing not only academic discourse, but the meaning-relations within wider society, and via that, its organization. Luhmann himself even offers tentative ideas for how the scientific system can do so – by supplying societies with novel theoretical tools 'to do justice to the new problem situation' (1989, p. 142). For Luhmann, doing justice to complex, posthuman societies means acknowledging the contingency and openness of society's ontological attributions and political pathways, and embracing as a strength that it is 'in ecological communication that society places itself' (ibid.), and all of its presumptions, in question.

Conclusion

Materialist-ecological social theory has shown that the power that shapes societies across the globe is not exclusive to, and maybe not even primarily exercised by, humans. Undoing the binary distinction between human societies and their natural outside presumed to be inert, materialist-ecological scholarship reconfigures the ontology of modern thought to render visible how nonhuman agency has always operated, with political consequences, on the inside of human societies. This paper has started from the observation that the materialist-ecological return to ontological speculation brackets the functional role, operativity and productive effects of the nature/society distinction understood as an epistemic framework for meaning-making.

Against this background, the paper developed Luhmann's systems theory as a productive contribution to materialist-ecological scholarship because, as the paper has shown, its distinct brand of posthumanism collapses the distinction between ontology and epistemology and situates conceptions of being in the autopoiesis of meaning systems.

It was shown how Luhmann's theory on the one hand offers a way to accommodate the posthuman focus on environmental challenges, nonhuman shaping power and the need for epistemological and political modesty in the face of the former. But, shifting the level of analysis, where materialist-ecological theory reveals the *impossibility* of maintaining a sharp society/environment distinction in the face of climate change, Luhmann draws attention to its epistemic *necessity*, and to the *functional productivity* of retaining its contingent framing as the binary between culture and nature.

Understood with Luhmann's posthumanism, societies always need an environmental outside; the contemporary awareness for ecological changes is here not a sign of its dissolution, but plays a functional role for how subjects and social systems reproduce themselves at the border to their nonhuman environments. Focusing on unknowable and uncontrollable ecological forces reduces ambiguity and orients sense-making in complex contemporary societies where positivist knowledge and effective governmental control have become impossible. In Luhmann's world of social systems, the manifest reality of ecological challenges, and the necessity to politically address them, go hand in hand with the idea that society's focus on nonhuman shaping power is already a social response to the challenge of managing disruptive environmental complexity.

Notes

1. The vital role that an always both conditioned and productive complexity, which perpetually returns to epistemic and social order in the form of disruptive events, plays in Luhmann's ontology places the former in close proximity to Gilles Deleuze's evental, postfoundational ontology (see Richter 2023). Because the latter's work is used frequently in materialist-ecological scholarship, this ontological link could form the basis of further fruitful exploration of an 'ecological Luhmann'.
2. Luhmann himself however appears rather pessimistic about the prospects of such political adaption. He deems it more likely that the political system will merely develop 'politically convenient and acceptable solutions' (Luhmann, 1989, p. 120) which do not involve meaningful change in the functioning of governance, and its social responsibility. A consequence of such failure to adapt could however have 'destructive consequences' (ibid.) for the political system if it becomes overburdened with social, and especially citizens', expectations regarding the resolution of ecological challenges which it cannot meet.
3. It would of course be overly simplistic to assume that materialist-ecological theory is completely unaware of epistemic shaping power and the difficulties it poses for asserting progress in knowledge. The charge of bracketing epistemic productivity in favour of ontological creativity certainly applies to some thinkers subsumed under the umbrella label 'materialist-ecological' here more than to others. However, I suggest that even thinkers that are sensitive to questions of epistemic situatedness and therefore do not straightforwardly make truth-claims about materiality dissociated from social observation fall back to implicit assertions that what they observe about material shaping-power is grounded in external reality. In *After Lockdown*, Latour (2021, pp. 100–104), for instance, contrasts our inability to produce secure knowledge about the local actor-networks we are entangled with in multiple ways with distant material phenomena, such as the universe, which can be known more accurately. Barad's account of materiality as emerging from practices of boundary-making (Barad, 2007, p. 42; pp. 74–76) seems congruent with the Luhmannian perspectivism developed in this paper. However, her extrapolating of ideas from quantum physics as ontological claims for social theory (Barad, 2007, pp. 3–25) here also, in a different way, re-introduces grounding presumptions about the manifest reality of what is being observed, and the accuracy of materialist-ecological modes of conceptualising being (see also: Bergthaller, 2014).

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