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Plasticumwelt and umwelt diffraction: A new materialist ecosemiotics

Nicola Zengiaro[1]

Abstract. The article explores the intricate relationship between plastic materials, semiotics and ecology, offering a novel perspective on the concept of umwelt in the context of pervasive plastic pollution. Drawing on semiotic, ecosemiotic and neo-materialist theories, it examines how plastic has become a ubiquitous presence in ecosystems, profoundly shaping the subjective worlds of organisms. The paper presents a theoretical analogy between the world of the spider and the production of its web on the one hand, and the human world and the production of plastic on the other hand, to show how the minds of animals extend along the production of their materials. Through the lens of material semiotics, the study elaborates the notion of 'umwelt diffraction', highlighting how synthetic materials disrupt the ecological dynamics and perception of organisms, forming the structure of a 'plasticumwelt'. This reconceptualization underlines the urgent need for interdisciplinary approaches to address the challenges posed by plastic pollution. Ultimately, the article argues that plastic proliferation creates a toxic heritage, underlining the importance of sustainable practices to mitigate the harmful effects of plastic on biodiversity and ecosystem resilience.

Keywords: materialist ecosemiotics; material semiotics; plasticumwelt; umwelt diffraction

Introduction

Modern ecosemiotics does not primarily concern itself with analysing the environment as an ontologically fixed entity, nor does it limit its focus to the linear signifying relations between organisms and their environments. Instead, it addresses the processes through which meaning emerges within the perpetual transformations of nature, emphasizing the dynamic interplay that weaves the constituent elements into an ongoing becoming of forms. In fact, unlike the early 1990s, when ecosemiotics was determined from a biological or a cultural perspective, this dichotomy is losing its meaning now that one has to refer to the ongoing ecological and climate crisis. These crises force us to confront our inability to distinguish culture from nature, as well as the human from the nonhuman and

[1] University of Bologna, Bologna, Italy; e-mail: nicola.zengiaro2@unibo.it.

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life from nonlife, as they present themselves as macro-phenomena (or hyperobjects) involving multiple intertwinings with processes of continuity and intermingling (Morton 2014). The paradoxical situation in which ecosemiotics finds itself, places it, however, in a privileged situation as to determining new perspectives concerning the contemporary and the prediction of a future ecosystemic scenario. Moreover, ecosemiotic methodology aims to activate a pragmatic perspective suitable for identifying points of intersection for dealing with issues arising from the current ecological crisis (Tønnessen 2021).

This paper is organized into three sections, each aiming to delineate distinct semiotic levels or strata that are interrelated and build upon one another. The idea is to start from an ecological perspective, crossed with an ecosemiotic methodology (Maran 2022, 2023a), in order to understand how the environment in which organisms are found determines their subjective worlds or umwelten. This serves to show, through a case study of the relationship between the spider and its web, how the production of material by the animal expands and modifies the world-environment of the organism. The purpose of this first plane is to define two theoretical perspectives: one that shows how the spider's web is nothing more than an extension of its mind, and another that tries to explain how the materiality of the web can be understood as a material intelligence with its own particular agency that modifies, through its own ecosystemic capacities, the spider's world. Thus, on the one hand we have the agency of the spider that extends to its material products, and on the other hand the agency of the matter of the web that modifies the spider's perceptual world and the ecosemiosphere (Maran 2021).

The second plane narrows the perspective by proposing an analogy, through cognitive semiotics and enactivism, between the web produced by the spider and the plastic material produced by humans within the capitalist system. This analogy is used as a theoretical move to show how the mind of humans extends through the production of synthetic materials, and how the plastic material has an agency that modifies and coordinates the humans' perceptual world and part of the semiosphere.

On the third plane, the perspective is again expanded through a holistic view of the impossibility of distinguishing what is plastic from what is considered "natural". In this hybridized landscape, the plastic material is nothing but an extension of the human animal that mixes with the environment, changing the evolutionary directionalities of organic and inorganic matter. According to this perspective, an attempt is made to interpret the plastic material as a synthetic net produced by the human that captures and traps it.

Plastic as a material that interposes itself between the perceptual apparatuses of animals and their environment will be the key to theorizing *umwelt diffraction*,

i.e. a phenomenon involving the emergence of a new sensitivity resulting from the pervasiveness of plastic material. In other words, we are prey to our own synthetic web. Ecosemiotics and umwelt theory are contemporary analytical tools for understanding the genesis of meaning within the evolving dynamics between the components of an ecosystem. Cognitive semiotics examines how meaning and cognitive processes interact, extending its focus beyond animals to include material and broader contextual frameworks. This approach plays a crucial role in exploring how meaning is generated and negotiated at the intersection of living organisms and the material world, highlighting the continuity between biological life and non-living systems in the creation and interpretation of meaning. In the context of the plastisphere (see Section 3 below), the investigation focuses on what I have termed 'plasticumwelt', a new plasticized universe. This domain deserves to be examined through a methodological lens that applies umwelt theory to the organism–plastic interface. It will be about activating plastic thinking, that is, an inquiry that does not focus *on* plastic but thinks *through* plastic.

1. Materialist ecosemiotics: the ecosemiosphere

Ecosemiotics, in its modern connotations, is charged with a very different responsibility than the theoretical intentions presented between the 1980s and 1990s (see Farina, James 2021; Maran, Kull 2014; Maran 2018, 2020; Magnus 2023). The challenge of ecosemiotics is to hold together the multiple ways in which all organisms perceive and change the environment based on their modelling and interpretation. Consequently, it is possible to distinguish between different types of environmental change, based on the different types of modelling and interpretation of which a certain species is capable, thus understanding what is called the 'extended organism' (Maran 2014). However, a materialist interpretation of ecosemiotics, as we shall see, tends to analyse how the structures and properties of matter direct and constrain our interpretations with an *environmental agency* (Zengiaro 2023b).

The aim is not to view culture as diverse and nature as singular, but rather to reinterpret the dynamic evolution of nature and culture as interwoven, open systems that are constantly interacting and shaping one another. Such intertwining, although ignored by late-20th-century ecosemiotics, must be analysed in its inherently ambiguous status. In fact, if *natureculture* structure (Haraway 2003) is not analysed as a phenomenon with ambiguous aspects, one runs the risk of removing meaning from the semiotic structures of nature, bringing the whole debate back toward a cultural interpretation of an immobile, inert and passive nature, understood only as the foundation of an anthroposemiotic discursiveness.

According to the first definition of 'ecosemiosphere' given by Alfred Siewers (2014: 4), "an ecosemiosphere literally means an ecological bubble of meaning (borrowing the term 'semiosphere' from semiotics). It involves not a 'reenchantment' of nature, but recognition of nature as a meld of physical and cultural communication, which can be considered spiritual as well as material."

In other words, it is a matter of being able to unravel through ecosemiotic analysis what is called 'worlding' (Descola 2014), that is, the process of putting together what is perceived in our environment. In fact, the world is not a complete and enclosed space waiting to be represented according to different points of view, but rather a set of qualities and relations that may or may not be actualized by organisms depending on operational invitations. Indeed, the materials that make up a certain environment are not static objects, but actants that offer affordances that follow basic lines of inferences about the relationship between things in the world and experiences. As Paolo Peverini (2024) explains, what qualifies an actor is the ability to produce a difference – somewhat in the tradition of Bateson –, while the actant is defined as an actor who is still without a concrete configuration. Ecosemiotics, in this sense, should offer the possibility of mapping such relations through an innovative methodology:

> We could use similar argumentation for the broader view of the ecosemiosphere as the sphere of semiotic processes in ecosystems involving humans. The ecosemiosphere would include material structures and patterns inasmuch as they take part in semiosis and are relevant for the organisms constituting the ecosystem. Matter may become relevant as *affordances* or *meaning surfaces*, as media of communication (e.g. places for traces and tracts), or as resources that animals search for and that are related to their ecofields. (Maran 2021: 522)

It is precisely in order to map these natural signifying relations, seeking a third way between biologically and culturally oriented ecosemiotics, that I am proposing to activate a *materialist ecosemiotics*. The new materialisms (Coole, Frost 2010), or neo-materialisms (DeLanda 2012), properly derive from the linguistic turn within deconstruction, reacting to the exclusive focus on the human discursive plane and leading to a return to the materiality of the body which produces its own discursive plane. The new materialisms operate collectively against inert, extra-discursive and non-generative conceptions of matter, giving rise to a plurality of innovative methodological approaches.

Contemporary materialism in philosophy, but also in semiotics (Law 2009), gives us the opportunity to understand the physical dimension of humans and living things in general by placing them in a signifying material continuum in which they do not stand out as singularities. If we follow Maran's (2021: 524;

original emphasis) definition of the ecosemiosphere, one notices immediately the materialist – undeclared – direction that contemporary ecosemiotic methodology is taking: "[...], we can describe the *ecosemiosphere as a semiotic system that comprises all species with their umwelts and the diverse semiotic relations (including humans with their culture) that they have in the given ecosystem, as well as the material support structures that enable the ecosemiosphere to thrive*." This allows us to understand how cognitive regimes (*sensu* Maturana and Varela), the ontological positions that make such regimes possible, and the ways of dealing with complex phenomena in nature all change in the same measure.

This is an issue that concerns the new applications of umwelt theory in semiotics as well as in anthropology and biology, showing that there is a need not so much to demonstrate that each organism lives in its own world-environment, but rather to investigate the ways in which this relationship is inherently dynamic and open. The theory of the umwelt must be rethought from the critique regarding monadological closure and the claim to a static nature: "The dynamism characterizing the dialectic between organism and environment is on the one hand an effect of the changing behaviour of the organism; but on the other hand is also a consequence of that 'quasi-negative environment' that exposes the Umwelt to the unpredictability of non-predetermined external stimuli, compromising the harmonious agreement between the two poles [...]." (Pagan, Dal Pozzolo 2024: 15)

Materialist ecosemiotics appears, as we articulate it, as an effective tool for understanding how ecological meanings are composed without automatically resorting to our particular way of composing signifying elements. By defining a *materialist ecosemiotics* I am evoking a new ecosemiotic outlook in response to the feeling that the radicalism of the dominant discourses that have flourished under the cultural and biosemiotic turn (everything is text; semiosis and life are co-extensive) is now more or less exhausted. An important feature is the ecological materialization as a complex, pluralistic and relatively open-ended process, on the one hand, and, on the other hand, recognizing that human beings, and biological life in general, are as fully immersed in the productive contingencies of materiality. In contrast to some recent examples of ecosemiotics, materialist ecosemiotics emphasizes the productivity and resilience of matter in order to be able to understand the living and non-living signifying relationships in an ecosystem by not exclusively privileging biological agency or what we call (according to a certain paradigm) 'living'.[2]

[2] Diana Coole and Samantha Frost (2010: 9) formulate the following materialist idea: "Hostilities between these respective approaches have traditionally been staged as an opposition between mechanistic and vitalist understandings of (dead versus lively) matter. Typically, they were resolved by distinguishing between the sort of mechanical, inorganic matter described by

1.1. Plastic zoosemiotics

In Greimassian generative semiotics, the term 'plastic' has a specific meaning as applied to the semiotics of the image. If for Greimas (1989) the figurative plane allows us to recognize objects of the world, the plastic plane allows us to derive meanings beyond the imitation of reality that images represent, considering the organization of their lines, colours, and spaces. Taking a cue from the latter, which will not be explored in this paper, one can modify its meaning to adapt it to the zoosemiotic and ecological context in analysing the environmental perception of an animal such as a spider. Unlike figurative semiotics, plastic semiotics is, in fact, disinterested in the recognition of real-world objects and tries to explain how lines, colours, etc. can mean something in the meaning-making process.

The spider is a peculiar subject to analyse through visual plastic semiotics because it is, in a play on words, blind. Its way of interpreting the world around it comes from the reading of vibratory signs (Hill *et al.* 2021). It is interesting, on the other hand, how historian James Elkins (1996) used the metaphor of a spider's web to describe the "skein of vision" within which the human catches the objects of his or her attention or is caught by them. To say that a vibrating object constructed as a web thread produces meaning is already to postulate it as a signifying object that depends, as such, on a semiotic or zoosemiotic system. However, although we may think that animal umwelten are inaccessible to us, we can say that the existence of a semiotic system does not prevent us from recognizing at the same time that this system is unknown to us. In semiotic analysis, such an existing but unknown system can only be grasped and made explicit in the examination of the semiotic processes through which it is realized. This perspective of generative semiotics intersects well, in my opinion, with Jakob von Uexküll's theory of meaning:

> In the spider's Umwelt the web represents a meaning-utilizer of the meaning-carrier "prey". The meaning-utilizer is attuned exactly to the meaning-carrier, so that one can designate the spider's web as an image of the fly. The spider as tailor reproduces the fly's image without the human tailor's tools. The spider cannot take measurements of its own body to build the web, because its shape differs completely from the fly's shape. Nevertheless, it spins the size of the mesh to accord with the size of the fly's body. [...] The web is truly a refined work of art that

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physicists and the evolving organic systems described by biologists. But new materialists are attracted to forms of vitalism that refuse this latter distinction. They often discern emergent, generative powers (or agentic capacities) even within inorganic matter, and they generally eschew the distinction between organic and inorganic, or animate and inanimate, at the ontological level."

> the spider has painted of the fly. But stop! That is not what the spider does at all. It weaves its web before it is ever confronted with an actual fly. The web, therefore, cannot represent the physical image of a fly, but rather it is a representation of the archetype of a fly, which does not exist in the physical world. (Uexküll 1982: 42)

Thus, it seems that for the spider the fly is a kind of image, but archetypal, immaterial and immanent to the geometric and behavioural structures of the species-prey. Uexküll himself argues that there is a kind of original program (or archetype) common to the fly and the spider, which influences the material structure of the spider's web.[3] In this sense, the plastic semiotics of the spider is faithful to the attempt to construct a pattern whose operations are interdefined and captured by a common natural metalanguage. However, the constituent elements of the plastic signifier of the fly image are always defined relationally and locally, never substantively – contrary to Uexküll's indirect claims. In fact, the spatiality and dimensionality of the canvas seem to be defined not by the quality of the materials, but by the way relationships between the elements are established. The plastic dimension of the organism goes beyond the aprioristic structure of the plan of the structure, becoming an overall function of the organism. However, if, as Greimas argues, semiotics investigates the recurring patterns of similarity and difference, sameness and otherness, these elements together constitute the texture that overlays a constructed surface. This texture becomes recognizable through tensions and isotopies of expectation (Greimas, Courtés, 1979). In this framework, it is essential to identify these articulations not only within the realm of animal semiosis but also in the material agency that communicates and reveals insights about the spider, the fly, and the environmental elements involved.

1.2. Reassembling the ecological

From a biosemiotic point of view, we can investigate the signifying relations of a certain species from the umwelt theory, that is, by analysing the interaction and structuring of its functional circles. This makes it possible to understand how meaning arises between the signs of the environment and the functional responses of a given organism, in this case the spider. However, such an analysis gives us no way to see the ecosystemic interactions in which the spider is caught. The signifying meshes of the environment are very complex, so ecosemiotics must present itself as an approach between ecology, complexity theories and (bio)semiotics. In this sense, these three approaches, when organized together, can lead to an

[3] For a more detailed explanation of this process, see the chapter "The interpretation of the spider-web" in Uexküll 1982.

analysis of the material structures underlying the stimuli that trigger functional circles – both on the side of the animal and on the side of the environment. The problem with umwelt theory in contemporary research is that it seems to privilege animal agency.

In an interpretation that follows the dynamics of Latourian semiotics, the notion of agency presents a number of controversies in the field of semiotics as well as ecology. The question an ecosemiotician should answer with respect to the investigation of the emergence of meaning among living things in a given environment is: does that entity introduce a difference in the course of action of some other agent or not? Is there any test that allows an observer to detect this difference? (Latour 2005) If we can argue that a specific temperature, a particular interaction with local insects, certain atmospheric currents, or tourist excursions are not relevant to understanding the evolution, behaviour, and meaningful environmental interaction of a spider, then perhaps we are implementing a reductionist view of the semiosis of the living.

As Latour explains, it is not that these participants determine the action or dictate a certain behaviour of the spider, but rather this complex analysis of the ecosystem shows us that there can be multiple metaphysical nuances between full causality and pure nonexistence. Natural elements (organic and inorganic, living and non-living) could authorize, allow, guarantee, encourage, enable, influence, hinder, and prohibit spider action.[4] The umwelt theory, in light of ecosystem complexity, needs to be reinterpreted to understand fully who or what participates in the structuring and activation of functional circles.

Of course, thanks to Uexküll, the environment of animal species has been revealed as a field of meaning, which on the one hand is rooted in the physiology of the species, but on the other hand allows the animal subject a high plasticity of action. However, this plasticity is provided, ensured, and constituted by a multitude of actants that form the environment [an environment that I am not sure can be divided into inside/outside, umwelt/*innenwelt*/*umgebung* with extreme clarity as Morten Tønnessen (2021) does]. It is in this ecosystemic setting that ecosemiotics must reveal that the distinction between the natural and the cultural, the material and the social, the inorganic and the organic, becomes precisely what

[4] This assertion, derived from Latour's semiotic reading, is not a metaphor at all (although metaphor is an effective tool for scientific justification, as demonstrated throughout the semiotic tradition). Environmental conditions allow organisms to perform certain actions while restricting others, thus constraining and releasing species-specific traits. This interpretation stems from a Latourian reinterpretation of Greimas' generative semiotics, the application of which can provide us with tools for reinterpreting the narrative programs of living beings situated in a specific context.

obfuscates any inquiry into how collective action that intersects the organism and the environment is possible, by bringing out a certain kind of meaning-making (Zengiaro 2023a).

An action brings together different kinds of forces associated with each other precisely because they are heterogeneous. It is a matter of *reassembling the ecological*, which means considering ecosystems as the result of multiple interactions between human and non-human actors, and thus reconstructing the complexity of these connections, rather than reducing them to predetermined categories or structures. It is important at this point that those ecological elements, by the very nature of their connections to the actions of living things, quickly move from the status of intermediaries to that of mediators. In Latour's (2005) conceptualization, intermediaries are characterized as socio-technical agents that merely convey information, while mediators possess the capacity not only to convey but also to alter, translate, distort, and thereby shape the meaning of the information they transmit.[5] This perspective allows ecosemiotics to be used as a tool for revealing actions and material performance.

Returning to the spider and its web, in the absence of the animal, we can, through the web and the material composition of the canvas, make it speak as a trace of the presence of a living being. However, it is not only a sign of an individual spider, but of a complex situation: the temperature of the environment, atmospheric conditions, the duration of the web's creation, as well as the spider's potential prey, partners, the species to which it belongs, and its position at the time the web was made. This is to say that the materiality of the spider tells us much about the functional circles of the animal, on the one hand, and on the other hand it reveals the characteristics of the material itself. The spider, however, is not simply the complex composition of its parts, including the glands capable of secreting silk, but it is the web itself and also its prey. The spider is intrinsically connected to the web it produces because its organs are externalized through the web. In other words, the spider's presence and identity extend wherever the web extends. This is not only because its perception travels along the threads of the web, but also because the threads themselves carry the spider's DNA. We could say that every animal is an '*opera aperta*', where internal and external relational intensities characterize organisms without clear boundaries. All organisms are *opera aperta* in Eco's sense of the term (see Eco 1962), where they appear as a kind of author whose bodily work, made up of organic and inorganic, internal and

[5] 'Intermediaries' refers to that which carries meaning or force without transformations, so that once the input is defined, the output is also known. Conversely, a mediator transforms what it carries (meaning, force, or anything else), its output cannot be entirely predicted based on the input.

external materials, must be continually reorganized by users, who are continually challenged to make interpretive choices (Zengiaro 2024a). The emergence of meaning between an organism and its environment is structured through the specialization of internal and spatial functions that intersect, producing a relationship that is not merely the sum of the organism's and the environment's respective encodings. Instead, it forms a new assemblage that integrates elements of these codes into novel configurations.

In opposition to the Latourian point of view, Tim Ingold proposes a network approach in which, unlike the Actor-Network Theory (ANT), that looks at events as the effects of distributed agency in a very large meshwork of actors, comparable to the spider's web, he argues that the web is not really a web. According to Ingold, the threads are lines along which the spider perceives and acts; they are real lifelines: "Thus whereas ANT conceives of the world as an assemblage of heterogeneous bits and pieces, SPIDER's world is a tangle of threads and pathways; not a network but a meshwork. Action, then, emerges from the interplay of forces conducted along the lines of the meshwork." (Ingold 2011: 64) Following umwelt theory, Ingold states that living systems are characterized by a coupling between perception and action that arises within ontogenetic developmental processes. This coupling is both a condition for the exercise of agency and the foundation of ability:

> The world, for me, is not an assemblage of bits and pieces but a tangle of threads and pathways. Let us call it a *meshwork*, so as to distinguish it from your *network*. My claim, then, is that action is not the result of an agency that is distributed around the network, but rather emerges from the interplay of forces that are conducted along the lines of the meshwork. (Ingold 2011: 91–92)

These theoretical differences, I strongly believe, can be dispelled through a materialist ecosemiotic view, which presents itself as a third way to reinterpret umwelt theory in the light of theories from the social sciences, particularly anthropological, semiotic and philosophical ones, and contemporary ecological sciences. This perspective extends to include elements traditionally considered external to the organism, such as the wind, which becomes an integral part of the spider through its interaction with the vibrating web. Therefore, the resilience of the spider's web against the wind must be understood as a quality attributed to the spider in relation to its environment. This is particularly pertinent considering the diverse composition of spider silk, which can vary significantly among species, with each type produced by distinct glands in the abdomen.

These considerations drive the investigation of the boundaries of organismal techniques within an ecosystemic framework. Where does the nonlinear chain of causality underlying spider techniques end? How far does the relational capacity of spider web properties extend in a complex environment? How far does the umwelt of the spider extend? Where does an individual's functional circle begin and end? These questions stress the need for a complex understanding of organisms in their ecological contexts, emphasizing the interconnectedness and dynamic nature of living and non-living systems. Such questions belong to contemporary semiotics and bio-ecosemiotics. On the other hand, Charles Sanders Peirce's own semiotic theory (CP 6.169) – which lies at the foundation of both biosemiotics and ecosemiotics – defined in the synechism, states that there is a continuum, which is something whose possibilities of determination cannot be exhausted by a multitude of individuals – "As it attributes to mind, one of the properties of matter, extension, and attributes to all matter, 'a certain low of degree of feeling together with a certain power of taking habits', Peirce's hypothesis may be called materialistic." (Santaella 2001: 58–59)

1.3. The intelligence of the web

Spiders, varying from species to species, possess three to seven types of glands in the abdomen, which are used to produce different types of silk. The spider's use and application of silk served throughout its evolution and colonization of landmasses some 400 million years ago to strengthen its shelter and protect its offspring, as well as for simple hunting and travel. The common spiral web, characteristic of the family *Araneidae*, dates back to 200 million years ago, while earlier ones are speculated to have had shapes other than vertical. Evolutionary change in spiders was largely driven by a series of small changes at the molecular level of silk that allowed them to build functional and complex structures, ensuring their survival in increasingly diverse environments (Pennisi 2017). The toughness, strength and viscosity of the mesh have drawn the attention of scientific research to the material's properties (Gosline *et al.* 1999). Indeed, the most relevant ability seems to be the silk's capacity to respond to stimuli by adapting its characteristics to environmental conditions. The silk transforms its structure from liquid to solid in a very short time, depending on the speed of the stimulus it encounters. Consequently, whether it is a free-falling spider or an insect colliding with the threads at high speed, the material rapidly restructures due to the phenomenon of hysteresis. The notion of 'hysteresis', in physics, but also in biology and economics, refers to an inheritance phenomenon in which instantaneous value is determined by a value that instantaneously precedes it. When applied to materials, it refers

to the behaviour of matter that changes its response to a stimulus based on its previous history (Tripaldi 2022). This can be understood as a memory effect of the material in which, the moment it is subjected to tension, the silk responds by reorganizing its molecular structure to dissipate as much energy as possible:

> When flies, moths, and other flying insects hit the spider web, the spider silk is stretched and tends to shrink back to its original state. When the silk shrinks, part of the mechanical energy will be converted into thermal energy, which will prevent the spider web from rebounding. With the cohesiveness of the spider web, it will be difficult for flying insects to escape once they enter the web. [...] Spider silk is very sensitive to water. When immersed in water, spider silk fibers will shrink and affect the mechanical properties of spider silk. This shrinkage phenomenon of spider silk is called super contraction. Influenced by humidity, the size of spider silk fibers will change, and its tensile properties will also change. (Gu *et al.* 2020: 445)

The intelligence of this material is determined not only by the composition of the structure, but also by the ability of the spider to interpret information by using it as an extended sense organ, relying on a form of material intelligence and structural directionality. Intelligence, in fact, is a decentralized and diffuse phenomenon that emerges from the way different bodies relate to each other. Because of its structure, thickness and tension, silk transmits and amplifies vibrations through its filaments. The lines of the threads of the web establish the conditions of possibility for the spider to interact with the fly. But they are not lines of interaction *per se*. If these lines are relationships, then they are relationships not *between*, but *along*. Of course, as in the case of the spider, the lives of organisms in general extend along not one but several lines, knotted together at the centre but dragging countless free extremities at the edges (Ingold 2011: 85). There is no intentional patterning in these processes of natural assembly (even if there were, it would be a design entirely internal to the physical system that produces it), but it is a process that reveals meaning through spontaneity. In scientific terms, spontaneity is related to how a physical phenomenon manages its energy balance in relation to the environment. Spontaneous transformation of the system occurs without necessarily referring to an external force acting on it.

The spider, depending on the situation it finds itself in (from its relationship with food, enemy, partner or medium, i.e. through the interpretation of the environment), focuses its attention on the most sensitive areas (Viera, Gonzaga 2018).

It is therefore possible to show that the web is an extension of the spider's mind, through which it communicates and interprets the information that the material makes available to it. The spider alters its perception of the world by altering the web (shape and tension) both from the perspective of chemical structure

and design, but at the same time silk, as a complex and sensitive material, influences how the spider perceives the world and acts in its environment (Yarger *et al.* 2018). In general, the most significant emergent property of a complex system is its very existence as a system, that is, its ability to keep its relational structure intact, without which it would fall back into a disorganized state. This capacity of materials, in relation to living beings, derives from the phenomenon of self-organization of complex structures in a given environment. A system capable of self-organization is able to increase its level of internal order spontaneously, restoring its structure within certain limits even when it has been changed by an external force. For example, spider silk proteins can build, transform, and reconstruct their hierarchical structure in a self-organizing way. It is in this complex relationship that the continuous influence between the animal mind and the material mind emerges (Zengiaro 2022a, 2022b). The web as a signifying field becomes an "event" (Cimatti 2018), a spatio-temporal mesh within which the entities we try to separate – life and nonlife, things and energy, space and time – mingle and blur. In analogy with this ecosemiotic approach, we can address a certain kind of cognitive semiotics that investigates our cultural relationship with materials, identifying the degree to which humans have evolved toward the environment through the creation and use of certain materials.

2. Cognitive semiotics: the noosphere

In the first decade of the 2000s there was an explosion of psychological, cognitive, philosophical and linguistic studies that was called the 'embodied turn'. Seeking to anchor cognitive processes in a bodily dimension, models of embodiment branched off into different paradigms that theorized different models of the body, sometimes understood as body-brain, now as situated, sometimes as body schemata. The theories of embodied cognition (Varela *et al.* 1991; Lakoff, Johnson 1999), which posit that the nature of the human mind is influenced by the body's characteristics, have faced criticism in Italy from Patrizia Violi for their portrayal of the body as a pre-existing and well-defined entity (Lobaccaro 2022). According to Violi (2003), in fact, a representation of the body is constructed every time one tries to explain how the body plays a role in cognition. The body, therefore, can be understood not so much as a form of origin of meaning, but as an instance of translation in continuous negotiation with the corporeity of the world, that is, constitutively relational insofar as it is already always in the world, as Charles Sanders Peirce himself emphasized by tracing the primacy of the relation in the set of cognitive results of living (CP 7.527).

Afterwards, the new reflections coming from cognitive sciences, the 4E Cognition (embodied, embedded, enactive and extended), showed how the body dimension is not sufficient to explain cognition (Fusaroli *et al.* 2011). The body is always situated in an environment that provides the materials for cognitive development. In other words, cognition is a distributed process involving objects, cultural practices, language, other subjects and institutions (Hutchins 1995). The idea is to reorient the study of the mind by recognizing the impact of materiality (the world of things, objects, materials, artefacts) in shaping the mind and in the formation of emergent dynamic patterns in constituting the extension and reorganization of the mind (Newen *et al.* 2018). Thus, the environment takes an active processual form in the structuring of cognition, the dynamics of which are mirrored in an externalized way with respect to the mere body. It is in this new look that biosemiotics, interpretative semiotics, cognitive semiotics, and (according to the point of view I offer in this article) materialist ecosemiotics hybridize.

Within the anthroposemiotic framework, starting from the Lotmanian notion of the semiosphere, we can reread the interactions between culture and that on which culture exerts a meaning-making action by combining this principle with the theory of the umwelt. As is well known, several biosemioticians have attempted to redefine the semiosphere, trying to identify it with the biosphere (Alexandrov 2000). However, even in Lotman there are some passages that seem to suggest that the boundaries of the semiosphere may somehow encompass living organisms. The uncertainty about Lotman's (1990, 2009) definition of the boundaries, especially its extent, stems from the fact that the semiosphere includes everything that comes into contact with human semiotic activity. And this, at the time of the ecological crisis and the question of anthropization of the planet, becomes very interesting.

The discussion of the Anthropocene calls into question the limits of the semiosphere, regarding which we used to contemplate human agency in the realm of culture only. Nowadays, the exponential intermingling of culture and nature extends human activity to the chemical composition of the elements that make up Earth. Indeed, in this cognitive extension of mind to the environment, and in the Peircean identification of mind with matter and semiosis, the notion of the *noosphere* is of profound interest. Vladimir Vernadsky advanced the idea of a possible transition from the biosphere to the noosphere, in which the human mind, thanks to the development of science and technology, opens such horizons as to enable it to tackle the most daunting problems of transforming nature. The term 'noosphere' is derived from the Greek 'noos' (mind) and 'sphere' in the sense of the Earth's envelope. Vernadsky saw the noosphere as part of the biosphere and Lotman considered it as part of the semiosphere, while materialist

ecosemiotics becomes a system-knowledge regulator of the semiosphere and biosphere through the interaction of an extended mind. In fact, if the noosphere as a biosphere developed or modified by humans is connected to the semiosphere as a sphere of communication and self-communication, it is possible to highlight the existence of a bidirectional material communication between human activity and the responsiveness of the materials that make up Earth's structure. In this regard, semiotics must account for a population of hybrid actors in society, comprised of networks composed of both human and non-human agents that only reductionist naturalism insists on subjecting to a process of purification, namely a separation between two seemingly irreconcilable poles (Latour 1993).

2.1. Material values and meaning

In semiotic terms, Lucia Santaella (2001: 57), following Peirce's synechism, argues that "mind and matter are terms of a single continuum, and so are the organic and inorganic, the artificial and the natural, culture and nature". The mind, in all its expressions, can be reinserted within what Lambros Malafouris (2013: 227) calls a 'hylonoetic field', a mental landscape that literally extends into the extra-organic environment and material culture.

In the contemporary reinterpretation of the umwelt, we can note the theorizations of Ezequiel Di Paolo (2005) in which the notion of 'adaptivity' prescribes that the organism not only self-individuates but also actively modifies its structural coupling with the environment to give rise to processes of vitality. In line with this, Andreas Weber and Francisco Varela (2002) determine the organism through sense-making operations that serve to select its own possibilities of action in the environment, creating and structuring its own umwelt. It is under this light that the notion of organism agency emerges, although the material agency we were previously discussing is not explicitly articulated.

Felice Cimatti (2018: 74), in this regard, highlights material agency when explaining that oil, produced from fragments of oil shale rocks, semiotically becomes a matter of expression whose meaning is: cheap gasoline, energy independence for the United States, groundwater pollution, etc. Cimatti argues that a thing, as soon as it enters the human world, becomes a sign, that is, a *value*.

Examined from a semiotic perspective of textual analysis, the proliferation of plastic as a material has been noted to pervade various domains such as media, scientific inquiry, anthropology, and social discourse (Zengiaro 2023c). The allocation of values and meanings constitutes a fundamentally semiotic endeavour within the conceptual framework of culture. It is imperative to contemplate not only the active valuation of an element from a human standpoint but also its

acquisition of value contingent upon its material attributes and sense-making capacity.

Plastic imposes itself as an object of value because of the meaning it has on the living conditions of organisms and the modification of the environment. The idea is that, on the one hand, the distribution of values and meanings serves to reduce the complexity of the material world by the organism, while on the other hand the material resists with its qualities by imposing certain values based on its relational sense-making. The question of the extended mind brings us back to a level of reading the analogy between the spider and the production of its web and humans and the production of plastic in society. It is a matter of understanding that plastic matter derives from human capacities and extends itself properly as an externalization of the material mind. Plastic today permeates the life of organisms and traps humans and non-humans in a dense material-semiotic web, changing evolutionary directions, conditioning the life and death of organisms, hybridizing with material bodies, influencing sign systems and meaning-making processes.

3. Plasticumwelt: the plastisphere

From a material-semiotic standpoint, we must account for the fact that, much like meaning, plastic material is not an individually articulated or static entity. If we follow Karen Barad's (2010) materialist discourse, it can be asserted that matter is never a *tabula rasa*, nor does it passively await signification. Furthermore, matter is not a support, a place, a referent; it does not need the imprint of an external force like culture to be complete. Matter is a process of materializing phenomena. In this sense, materiality is discursive, reconfiguring boundaries in a mutual articulation through intra-action. Barad (2007) articulates an alternative to the closed ontology with which we are accustomed to thinking about things in the world. Without intending to reinterpret this idea (thus diverging from the original author's perspective, with whom I feel a strong affinity), but without clinging too tightly to it (as it is difficult to conceptualize except through metaphor and imagery), the notion of 'intra-action' seeks to deactivate those defined borders with which we typically categorize objects in the world and differentiate them from a certain type of undifferentiated background. The deactivation of onto-epistemological borders reawakens a relational ontology based on indeterminacy, used by the author (Barad 2007) as a performative force of nature. This concept is antithetical to that of interaction, which presumes the existence of independent entities extracted from the context in which they manifest. In plain terms, intra-action is the process by which entities exist in their relational and inseparable

being from a mutable, hybrid, mestizo, queer context that makes them what they are. For the purposes of this paper, 'intra-' refers to the impossibility of separating subject and object, as well as object and object (unless by separating them through a Cartesian metaphysical fallacy) in a continuous mingling, interference, and simultaneous modification. 'Action', however, concerns the processual activity in which everything is caught, thus becoming the cognitive process and the ontologically dynamic entity within this vortex constituted of material and discursive mixtures.

In this sense, in which things do not simply exist in the world but are part of the world in its continuous intra-activity, plastic material can be reinterpreted as a significant actor that pervasively shapes (modifies) the umwelt of living beings. Its pervasiveness on the planet can be understood as a transversal overlapping of umwelten on the level of plastic material. Just as the air we breathe, every actor is immersed in the "plastisphere", an invisible synthetic universe that concentrates life forms and toxic substances (Amaral-Zettler *et al.* 2020; Nurra 2022). As Elizabeth Povinelli (2022) has argued, plastic makes us *morphumans* who constantly hybridize with its matter. Similarly, the discursivity[6] on microplastic elements is making it increasingly difficult to speak about plastic material, as its hybrid alchemical substance continuously decentres its status, undermining every process of signification. Semiotics, which analyses the emergence of meaning, generating multiple intertextual discourses, should deeply examine this material, indicating at the same time not only our relationship with it but also the resignification of *a life* (Deleuze 1997) *with* plastic. The aim is to identify the gray areas and overlaps associated with this element, highlighting the scientific and cultural challenges in addressing plastics and microplastics. Semiotics, when applied to the subject of plastics, has to account for the overlapping of complex intertextual chains, each time negotiating the relevance of the plastisphere in the natural and cultural world. In other words, the task is to employ semiotics as a tool to explore how to discuss plastic and its relationship to the present, and more importantly, to the future. In this context, agency within the plastisphere is not merely an inherent attribute but rather a dynamic process of continuously reconfiguring the world (Barad 2003).

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6 'Discursivity' here means Greimas' semiotic approach according to which the discursive universe is seen as a mediating instance articulating the two macrosemiotics of language and the natural world, which are vast reservoirs of signs where numerous semiotic systems manifest.

3.1. A map to trace hybrids

Tracing how plastic material has become an actor, both in contemporary society and in the ecosystem, entails careful consideration of the ways in which its specific material-semiotic capacities have emerged and acquired distinct forms of agency in different contexts. How have the particular material-semiotic qualities of plastic been involved in the emergence of new qualities in our surrounding environment, our minds, and evolution, as well as in new consumption practices? Of course, many other objects, institutions, regulatory processes and technologies have been involved in the organization and distribution of the material. However, from an ecosemiotic perspective, we are interested in plastic as performative, as something that helps to give rise to new realities and practices that have socially binding effects.

> As bottled water becomes a political object, it acquires the capacity for new forms of expressivity that extend across multiple sites – not just those designated as activism. Its material semiotics become denser and more layered through the accumulation of new affects and information permeating market assemblages. The challenge is to investigate how these political affects, information, and other realities become implicated in the reflexive organization of the market. (Gay *et al.* 2015: 184)

The problem that arises in precisely distinguishing a certain type of discourse (scientific, political, ecological) stems from the dimensions (for example, in the case of microplastics and nanoplastics) that make plastic material pervasive, infiltrating, and hybrid – not so much in relation to the degradation of consumer objects, but regarding the difficulty of separating plastic from organic and inorganic elements with which this material blends. Whereas we have always managed, when looking at the material world around us, to distinguish with some clarity the plastic objects that shape our surroundings, the phenomenon of microplastics challenges this recognition system at the discursive level.[7] This prevents clear communication of the dangerousness of this material and, at the same time, prescribes a sort of impossibility of resolution and a constant sense of powerlessness – in the political-ecological sector – in addressing this issue. Attention to microplastics arises from the fact that the degradation of plastic materials produces particles so small that they evade standard measurement and collection tools. Moreover, these studies reveal that the size of plastic particles determines their ability to infiltrate

[7] As argued in Zengiaro 2023c, there exists a profound difficulty in both media and scientific discourse in communicating and figuratively representing plastic and microplastic material due to its hybrid and mutable organization.

and hybridize with any natural entity: minerals, bacteria, plants, and animals. Within the scientific community, there is a growing understanding that plastic is not merely a material with myriad uses or an 'alchemical substance' (Barthes 1957), but rather a substance that is becoming unidentifiable, as microplastics can embed themselves in any body. The challenge lies in the indistinguishability of plastic from other inorganic elements. This creates a demarcation problem: how do we differentiate between what is plastic and what is not? Hybrids emerge from the contact between these heterogeneous elements, giving rise to new natural phenomena. In this sense, plastic material retroactively challenges the distinction between the natural and the artificial, as these elements nest together to form hybrid substances.

In 2020, the article "A Plasticene lexicon" (Haram *et al.* 2020), funded by NASA, was published in the journal *Marine Pollution Bulletin*, collecting the scientific lexicon that testifies to the emergence of research fields – ecology, geology, chemistry, and garbology (the study of waste and garbage) – and the creation of neologisms to denote new discoveries about plastics and microplastics. The aim of the article was to create new systems for observing and describing phenomena arising from plastics in a more integrated manner. The research sought to establish a synthesis of an emerging lexicon for the study of the environmental impact of plastic proliferation in terrestrial, freshwater and marine habitats. This semantic map traces the need for a new lexicon capable of capturing plastic in its heterogeneity, pervasiveness, infiltration, and persistence. The mixing and absorption of microplastics into inorganic and organic elements has also led to reflections on the dichotomy between nature and culture, the natural and the artificial, the human and the non-human, arousing new suspicions regarding the possibility of separating the cultural world from the natural one in scientific research. The map shows assemblages of meanings that have challenged the boundaries and thresholds between natural and artificial.

3.2. Umwelt diffraction

The pervasiveness of plastic material now clarifies the analogy initiated with the spider and its web. Where the spider weaves the web and humans produce plastic material, we can, metaphysically and through a material semiotics, comprehend how human umwelt is synthesizing in a certain way. If the mind is embodied in the environment, we can suggest that the mind is partly constituted by plastic material, extending into synthetic material as a form of expression and form of content for a certain species. Plastic material, like the spider's web, does not merely belong to an extrinsic externality to the organism but also concerns the

inner sphere of the humans. The mixing of the human body with plastic material is increasingly evident, as it disperses and integrates into the blood, through the skin's porosity, into the immune system, into foetuses in the womb, conditioning ontogenetic and phylogenetic evolutionary directions.

Plastic is so pervasive that we breathe it, absorb it, ingest it, our clothes release it onto the skin, car tires pollute groundwater and rain, and atmospheric events transport it around, degrading it in oceans and soil. In this sense, the *plasticumwelt* is a phenomenology of a world made of synthetic, organic, inorganic, material, and immaterial mixtures, both corporeal and symbolic. Plastic, therefore, not only interferes with the semiotic cycles of living organisms (Puura 2013; Posner 2000; Maran 2023b), but properly creates a series of significant novelties that function as perceptual markers, participating in a veritable plasticized environment. This constitutes a reinterpretation of Tønnessen's 'umwelt transition', distinguished by the fact that this universe is shaped and influenced by plastic material. In terms of Tønnessen (2009: 49, original emphasis),

> [a]n *Umwelt transition* [...] can tentatively be defined as a lasting, systematic change, within the life cycle of a being, considered from an ontogenetic (individual), phylogenetic (population-, species-) or cultural perspective, from one typical appearance of its Umwelt to another. An Umwelt transition, in other words, can be regular, irregular or a singular, extraordinary event. In the last case we are entitled to talk about *historical events*. In a similar vein, transitional *Umwelten* can be taken to refer to Umwelten undergoing an Umwelt transition or Umwelten in so far as they typically go through a certain kind of Umwelt transitions.

Therefore, if plastic material becomes an increase of environmental variety, modifying the biosemiotic cycles of living beings (Alnıaçık Özyer, Çavuş Peksöz 2024), it will also create a constellation of synthetic perceptual and operative markers (technological apparatuses conditioning social relations, plastics integrated with non-living entities, plastic prostheses collaborating within the body, aesthetic plasticization, etc.). The plasticumwelt is the realization of a synthetic subjective universe in which the perceptual forms of the environment (semiotic niche) are filtered through a synthetic material. There is a continuous translation of different informational resources, which are filtered by the materials constituting the surrounding environment, giving rise to 'mediated umwelts' (Tønnessen 2015), but also forming a biological modification of perceptual apparatuses and thus affecting and modifying the 'core umwelt' and scratching the 'minimal umwelt'[8] (Tønnessen 2019).

[8] According to Tønnessen's hypothesis, the 'core umwelt' encompasses direct encounters and experiences with other subjects and objects, in a physiological connection (thus depending on the organism's structure to which the umwelt belongs, unlike our argument which attributes

Recent research has begun to elucidate several potential outcomes, including fish aneurysms, impaired cognitive functions in hermit crabs, and reduced physical capabilities in mussels (Green *et al.* 2019; Hu *et al.* 2020). Microplastics pervade various consumer products such as salt, beer, fresh fruits and vegetables, and water. Airborne microplastic particles can cross the globe in a matter of days and precipitate from the atmosphere like rainfall. Animals become vectors by carrying the plastic within them, e.g. as jellyfish do in trophic webs. As for humans, there are three main routes by which microplastics and nanoplastics can end up in the human body: inhalation, ingestion and skin contact. However, another factor influencing phylogeny is the presence of plastics in the mother's uterus and immune system, as well as their circulation in the bloodstream, thus passing through the brain (Osman *et al.* 2023). The pervasive nature of plastic hybridization leaves no environment or organism untouched.

When Tønnessen (2014) speaks of 'umwelt trajectory' as the evolutionary path of a particular organism in relation to other umwelten, he constructs a theory concerning the mutual understanding of living beings that modify the umwelten upon encounter. However, when materials are the actors modifying the umwelt of organisms, we can say that what occurs is a sort of *umwelt diffraction*. In physics, 'diffraction' refers to phenomena concerning the observation plane; therefore, it arises from a perspectival position, leading to phenomenological and epistemological effects shaped by the qualities of matter. With the notion of 'umwelt diffraction', I refer to the phenomenon associated with the deviation of the evolutionary directions of organisms' umwelten when encountering a material obstacle along their path. This phenomenon occurs in particular situations where matter exhibits pervasive properties that can significantly modify the environment. It is a discontinuity arising from an obstacle that emerges along a source of information and modifies the plane of reality. Diffraction is not just a matter of interference but of entanglement where cuts not only create violence in the subjective world but also simultaneously open up new conditions of possibility (Barad 2014). By

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an active agency to plastic material that actively modifies the experiential core). The 'minimal umwelt', on the other hand, is a basic structure formed by planetary conditions that is limited by the physiological plane of the organism but also extends to universal laws of physics: gravity, radiation, atmospheric composition, etc. In the 'plasticumwelt', instead, the determination and modification of the subjective world are synthetic, i.e. it occurs through a plastic material constructed by humans that does not exist in nature in its current form. The plasticumwelt emerges from a diffraction of material on the experiential plane of living organisms, where plastic serves as a noise element that is internalized both materially (the body absorbs or rejects it) and immaterially (organisms recognize and interpret it). For this reason, plastic material affects every level of the umwelt described by Tønnessen.

this, I mean that in giving rise to an umwelt diffraction, all materials, even synthetic ones, create multiple entanglements, differences that disjoin and mutually reassemble the ecological worlds of organisms.

Diffraction is a physical phenomenon produced by waves when they meet and occupy the same space, giving rise to new configurations that combine the characteristics of each wave. This highlights the relational and at the same time differential nature of the umwelt. The trace of all reconfigurations is imprinted in the materialized threads of what emerges from ecosystemic meaning relationships. *Umwelt diffraction* thus presents itself as an intersubjective history of interaction, interference, reinforcement, and difference between organisms and materials, between material and immaterial elements, whose diffraction records a heterogeneous history through a narrative, bodily, political technology to signify consequentially (Haraway 1999). Umwelt diffraction marks a layered multiplicity among matter, texts, and world as relata, correlatives whose effects are specified through the contemporary relationship between subject and object, mind and body, matter and discourse, apparatus and world, plastic and animals.

3.3. Plastic as a toxic heritage

The material that is articulated as discourse – and *vice versa* – gives us the opportunity to reconsider the theory of the umwelt from a renewed perspective. Semiotic, biosemiotic, ecosemiotic, and cognitive semiotic methodologies lead us to a complex reinterpretation of the subjective worlds of animals. In this vision, we have attempted to revise the umwelt as a significant pluriverse constituted by actants and actors intersecting in a chain of meanings that illuminate ecosystemic complexity. Under this light, the materialist view of ecosemiotics has allowed us to identify different significant universes, from the ecosemiosphere, through the noosphere, to the plastisphere, revealing the onto-epistemological entanglements that matter and organisms create in their amalgamation. It is therefore a matter of revising the umwelt not only from a zoomorphic perspective but from a material-semiotic perspective that makes causal processes of subjective world structuring bidirectional.

The functional circles underlying umwelt theory must, therefore, be examined within a world that consists not only of signs that hold meaning for a given organism through the processes of phylogenesis and ontogenesis but also reflect a disposition of matter to be interpreted and signified in specific ways. The agency of matter allows us to rethink functional circles as a circular extension between meaning and materiality. This circularity marks something that we can empirically verify with semiotic analyses on our bodies, where our clothing speaks to

us about plastic, food packaging, advertising, everyday objects that populate our homes, apparatuses introduced into our bodies, the air we breathe, the water we drink, and the contaminations we introduce and externalize, elevating semiotic analysis to a fruitful tool for understanding how such dynamics are structured.

In this sense, just as the spider uses its web to hunt, at the same time we are prey to ourselves in this synthetic web that permeates our physical and subjective world. Plastic matter thus becomes a kind of *toxic heritage* (Wollentz *et al.* 2020). The instability of the boundaries between nature and culture produces diffraction movements in the materialization processes of the world-subject that can open up new onto-epistemological horizons. Materialist ecosemiotics thus allows us to use a diffraction method that identifies an ecological disturbance by mapping it, i.e. not by intercepting the difference where it appears but where its effects emerge. What was perceived by past generations as the quintessence of alchemical matter, fuelled by technological progress, today reveals itself as the disturbing scenario of a toxic legacy. Hence the urgency of an exercise that questions the contradiction that permeates the subjective world of us as individuals and as a community.

Conclusion

In this paper, I wished to explore the significance of the spider's web as a trace of its presence and as a reflection of the surrounding environmental conditions, justifying how it is an extension of the animal mind. This includes the material composition of the web, as well as various factors such as temperature, weather conditions and the presence of prey and mates. This emphasizes that the materiality of the web reveals both the biological functions of the spider and the characteristics of the material itself and the agency of the environment in its complexity. I proposed that organisms can be likened to the concept of the '*opera aperta*', where internal and external relational intensities characterize organisms without defined boundaries. This concept is contrasted with Uexküll's approach and the classic umwelt theory, which advocate an interpretation of organisms' subjective worlds within a static and passive environment. The present study seeks to argue that understanding living organisms requires an approach that embraces the complexity of their interactions with the environment and other organisms from a materialist ecosemiotic perspective.

In summary, the discourse presented in this article highlights the intricate interplay between materiality, semiotics, and ecology in shaping the subjective worlds of organisms, particularly in the context of the pervasive presence of plastic material in our environment. Through a material-semiotic lens, we have

elucidated how the umwelt, traditionally understood as the subjective perceptual world of an organism, undergoes diffraction when encountering synthetic materials such as plastic, leading to a reconfiguration of ecological dynamics.

Furthermore, our discussion underscores the urgent need for interdisciplinary approaches, blending semiotic analysis with ecological and evolutionary perspectives, to foster a comprehensive understanding of the implications of plastic proliferation on ecosystems and organismal adaptation. By recognizing plastic as not only a material entity but also a semiotic agent that influences perception, behaviour, and ecological interactions, we can better address the challenges posed by plastic pollution and its impact on biodiversity and ecosystem health.

Ultimately, this exploration will lead to critical reflection on anthropogenic alterations of the environment and calls for concerted efforts to mitigate plastic pollution through informed policies, innovative technological solutions and individual behavioural changes. By embracing a holistic understanding of the complex relationships between organisms, materials and environments, we will be able to strive for a more sustainable coexistence with the natural world, fostering resilience and biodiversity for generations to come.

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Plasticumwelt e diffrazione dell'Umwelt: una nuova ecosemiotica materialista

L'articolo esplora la complessa relazione tra materiali plastici, semiotica ed ecologia, offrendo una prospettiva innovativa sul concetto di *Umwelt* nel contesto dell›inquinamento plastico pervasivo. Attingendo alle teorie semiotiche, ecosemiotiche e neomaterialiste, esamina come la plastica sia diventata una presenza onnipervasiva negli ecosistemi, plasmando profondamente i mondi soggettivi degli organismi. Il testo presenta un'analogia

teorica tra il mondo del ragno e la produzione della sua tela e il mondo umano e la produzione di plastica, per mostrare come le menti degli animali siano estese attraverso la produzione dei loro materiali. Attraverso la lente della semiotica materiale, lo studio elabora la nozione di diffrazione dell'Umwelt [*Umwelt diffraction*], evidenziando come i materiali sintetici interrompano le dinamiche ecologiche e la percezione degli organismi, formando una sorta di "Plasticumwelt". Questa riconcettualizzazione sottolinea l'urgenza di approcci interdisciplinari per affrontare le sfide poste dall'inquinamento plastico. In conclusione, l'articolo sostiene che la proliferazione della plastica crea un'eredità tossica, evidenziando l'importanza di pratiche sostenibili per mitigare gli effetti dannosi della plastica sulla biodiversità e sulla resilienza degli ecosistemi.

Plastomailm ja omailmadifraktsioon: uusmaterialistlik ökosemiootika

Artiklis käsitletakse plastmaterjalide, semiootika ja ökoloogia vahelist keerukat suhet ning pakutakse välja uudne vaatenurk omailma mõistele kõikehõlmava plastireostuse kontekstis. Lähtudes semiootilistest, ökosemiootilistest ning uusmaterjalistlikest teooritest vaadeldakse, kuidas plast on muutunud ökosüsteemides kõikjalviibivaks, kujundades sügavuti organismide subjektiivseid maailmu. Artiklis pakutakse välja teoreetiline analoogia ühest küljest ämbliku maailma ning temapoolse võrguloomise ning teisalt inimeste ilma ja plastitootmise vahel, näitamaks, kuidas loomade meel laieneb nende toodetava materjali kaudu. Läbi materialistliku semiootika filtri käsitletakse üksikasjalisemalt „omailmadifraktsiooni" mõistet, rõhutades seda, kuidas sünteetilised materjalid katkestavad ökoloogilist dünaamikat ning organismide taju, moodustades „plastomailma" struktuuri. Selle ümberkontseptualiseerimisega joonitakse alla pakilist vajadust interdistsiplinaarsete lähenemiste järele, et tegelda plastireostuse esitatavate väljakutsetega. Viimaks väidetakse artiklis, et plastipaljusus jätab maha toksilise pärandi, ning toonitatakse jätkusuutlike praktikate olulisust, leevendamaks plasti kahjulikku mõju elurikkusele ning ökosüsteemide säilenõtkusele.