THE *UMWELTEN* OF PLANTS, AN AGENTIVE PERSPECTIVE

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Abstract

This article reconsiders the concept of *Umwelt* in relation to plant life, exploring whether and how plants may possess their own world of meaning and subjective agency. Drawing on Jakob von Uexküll's biosemiotic theory, the author distinguishes between active and passive forms of agency to redefine what counts as meaningful action in plants. While traditional interpretations of *Umwelt* rely on intentionality and mobility, often excluding sessile organisms like plants, this study argues for a broader understanding of agency rooted in processes such as growth, synthesis, and morphological imagination. The notion of "magic *Umwelten*" is extended to plants, proposing that their subjectivity is revealed not through instrumental behavior, but through an inward-facing imagination capable of forming non-objective realities. The article introduces the concepts of marginal and radical *Umwelten* to differentiate between animal-like adaptive strategies and the more pervasive, holistic expressions of "plantness". Ultimately, this agentive perspective opens the path toward a non-anthropocentric ethics that recognizes vegetal subjectivity and its epistemological and ecological implications.

Keywords: Plant Agency; Umwelt; Biosemiotics; Plant Imagination; Vegetal Subjectivity.

Introduction

Does the concept of "world" apply to plants? Can it help us understand what it means to live and cooperate with plants? The idea that we human beings have a world, or even worlds, seems like common sense. But do plants also have a "world", and how do we define it? How do our worlds, human and plant, overlap? Do we all share the same world, a universal world as it is described by naturalistic science? The Estonian biologist and philosopher Jacob von Uexküll challenged this universality by contrasting it with the notion of *Umwelt*, i.e. "self-centered world". An animal's *Umwelt* is a world of meaning signified by the performances and activities of

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that animal (Uexküll 1992). This approach to meaning through the actions and performances of animals goes beyond a behavioral and ethological perspective. It introduces a biosemiotic perspective that allows us to study the sign-making and meaning-making processes of the animal in question. An animal, like a human being is an inhabitant of the world, and not just a constituent of the world, and it is also as a "world-maker". It carries within itself the capacity to name and produce its own world of meaning, significance and value, a world that gradually takes shape through its concrete actions and becomes perceptible as such to the observer who does not need a prior theoretical framework of interpretation.

Although Uexküll suggested that his biosemiotic approach to animal and human *Umwelten* could be extended to plants, he remained rather ambiguous on the subject. Because they have no nervous system, "plants are not able to construct and be in command of an *Umwelt*. The plant possesses no special *Umwelt* organs but is immersed directly in its habitat" (Uexküll 1982, p. 33). Instead of a nervous system, plants have a living cell-layer, "the dwelling integument", whose activity is determined by its "ego-qualities" (Uexküll, 1982 p. 34). In this way, Uexküll finally confined plants to an infra-subjectivity whose *Umwelt* was also only quasi-subjective (Duicu 2019). More generally, the twentieth century has been characterized by "plant blindness" (Wandersee & Schussler, 1999), in which plants are seen as non-subjects equated with passive things, biological material or machines (Ryan 2012; Gerber and Hiernaux 2022). However, the question of plant subjectivity was already discussed in the 18th century (Delaporte, 1979) and has been revived in the last three decades by a "vegetal turn" (Di Paola 2024). This revival challenges the view of plants as simply passive and silent and raises new questions about their moral standing, agency, intentionality and personhood (Hall, 2011; Kallhoff *et al*. 2018). As a related issue, the concept of plant *Umwelt* has also been re-evaluated on new grounds (Hiernaux 2020; Pouteau 2020; Comollo 2024).

However, this reappraisal may entail some theoretical difficulties. Firstly, should the "ego-quality" be supported by a substantial personification of plants and the attribution of anthropomorphic capacities – intelligence, problem-solving rationality, sociability, communication, sensitivity, movement etc.? In this case, do we fall prey to a hidden teleology, and is the notion of plant *Umwelt* tied to a Kantian ratiocentrism (Duicu 2019)? Secondly, can we ascribe anthropomorphic properties to plants without first defining their exteriority and what a world, an environment or a habitat, is for them? In this case, does the notion of plant Umwelt involve a spa-

tial determination of the surroundings, which are objectified as a milieu in which plant bodies are directly immersed? Even if these bodies have a "dwelling-integument" that can be interpreted as an Umwelt organ, do we still think that plants thrive in their external environment?

In this article, I will address these theoretical difficulties in order to rethink the concept of plant *Umwelt*. First, I will address the entanglement between the concepts of *Umwelt* and agency and describe the reasons why humans and animals have a self-centered world, and why these same reasons cannot apply directly to plants. Second, I will compare what counts as agency for animals and plants and propose to distinguish two types of agency, passive and active. Third, I will consider how this distinction translates into two categories of *Umwelt*: radical and marginal *Umwelten*. Finally, I will explore how the comparison between these two categories can help to rethink plant subjectivity beyond Kantian ratiocentrism. To do this, I will apply Uexküll's notion of "magic *Umwelt*" (1992, p. 376) to plants and try to make sense of plant imagination.

1. *The co-determination of Umwelt and agency, theoretical issues*

The notion of Umwelt is a subjective determination, not only of what a living being demonstrates through its actual interaction with its surrounding, but also of how the observer interprets what is significant in that behavior. This may explain why there has been a persistent tendency to objectify the *Umwelt* as a milieu, a setting or an environment. Although much of Uexküll's original meaning has been preserved within contemporary biosemiotics, the modern use of the term has often retained mainly its holistic or ecological element and neglected its subjectivism. The new synthetic Darwinism has also led to a shift in biological thinking and has played a prominent role in the objectification of the *Umwelt* as a balance or result of the mutual interaction between genotype and environment. However, the assumption that *Umwelt* and surrounding or environment are interchangeable terms can be confusing and even lend support to distorted ideologies such as "blood and soil" theory of race (Stella and Kleisner 2010). From the outset, Uexküll himself endeavored to provide an objective basis for subjectivity that would avoid anthropomorphic speculations on interiority (Uexküll T. von 1992). Acting, performing, or agency was a key concept to achieve this purpose and to support the notion that the *Umwelt* is actively built by a subject. In this context, agency entails both an objectified subjectivity and a subjective objectification, linking the subject to the objective

environment of science. Thus, a central issue is the way agency itself is interpreted, rather than the environment with its various parts or the subject with its genetic make-up (Comollo 2024).

Shifting the focus on action, raises a number of theoretical issues. First, the notion of agency is historically tied to the Kantian determination of a human moral agent, his ability to act purposefully, to exhibit intentionality and to project his action outwards (Stjernfelt, 2001). Although this notion is now commonly extended to non-human entities, including artefacts (Sayes 2014), this extension may obscure the need to specify an active subject that actually exhibits the capacity to create its *Umwelt*. On the other hand, this requirement seems to maintain a boundary between beings that are able to move and produce sounds, mostly animals, and sessile beings that are perceived as immobile and silent, especially plants. To deal with this contradiction, the distinction between active and passive creation of *Umwelt* may be relevant (Schiedt 1930 cited by Stella & Kleisner 2010). Active creation encompasses what is generally recognized as agency, ranging from animal performance to human moral action with a social or even cultural content. In contrast, passive creation may sound like an oxymoron, blurring the distinction between subject and object. But its definition as a process by which organisms absorb parts of their surroundings, e.g. abiotic and biotic stimuli and various chemicals including food, is well suited to describing the ubiquitous peculiarities of plant life, which is at once outwardly active (proliferating and reproducing) and inwardly passive (immobile and dumb). In the following sections, I will use the term "passive agency" to emphasize this ubiquity and to prevent any attempt to reinterpret this misunderstood passivity in a mechanistic framework, for example as a norm of reaction (Sultan 2021). The question, then, is: what counts as passive and active agency in plants?

Second, the definition of agency implies a spatial distinction between a subject and its environment, i.e. the outside in which the action takes place. Both the terms environment and surrounding imply that something external surrounds or encloses. The subject is not only an agent or an agentive being, but it is also enclosed or surrounded by an outside. Its agency consists in externalizing or actualizing actions in this outside with respect to what is assumed to be its inside. This implicit assumption underlies the Cartesian dichotomy between a non-extended intentional subject and an extended objective substance (Marder & Parise 2024). Obviously, the subjective inside is not part of the surrounding, it is assumed to be virtually non-extended and more or less equated with the body or its virtual center. Although this dichotomy can be reassessed to include the specific features

of plants (Marder and Parise 2024), the question of how to locate plant agency remains. For example, if plants are "facing only outward" (Houle 2018), how should their spatial agency be interpreted? Alternatively, if plants are "open beings" that have neither an inside nor an outside (Pouteau 2018), what can be considered to constitute their *Umwelt*?

It may be recalled that in the past the very argument of an open form of organization has been used to belittle plants by comparison to animals, which are characterized by a closed form of organization (Comollo 2024). The closing paragraph of "A stroll through the worlds of animals and men" is interesting to this concern.

> And yet all these diverse *Umwelten* are harbored and borne by the One that remains forever barred to all *Umwelten*. Behind all the worlds created by Him, there lies concealed, eternally beyond the reach of knowledge, the subject – Nature (Uexküll, 1992, p. 390).

Here, the oak tree appears as a metaphor of nature in which different animals build their respective *Umwelten*. This metaphor illustrates Uexküll's ambivalence in trying to bridge the Kantian conception of the subject, translated into an "ego quality", with the idealistic background of German *Naturphilosophie* (Uexküll T. von 1992; Marcus 2001). Indeed, it recalls Goethe's famous hymn to "Nature" and the implicit identification of plants with nature.

> We live in her midst and know her not. She is incessantly speaking to us, but betrays not her secret. […] Everyone sees her in his fashion. She hides under a thousand names and phrases, and is always the same (Goethe, 1869, pp. 9-10).

Likewise, in Uexküll's metaphor the wholeness of the oak tree suggests that it is an all-encompassing subject with no exteriority, no outside. But if the tree, like nature, is claimed to be "the One" or "the Oneness" always out of reach, then what can be considered as plant agency and *Umwelt*? Instead of facing only outward, are plants "facing only inward"? In that case, how can we define their inward-facing *Umwelt*? Alternatively, do plants have both an outward-facing *Umwelt* and an inward-facing *Umwelt*? How can we address such "only-one-side-facing" *Umwelten*?

Third, action alone does not provide an objective explanation of its subjective determination, so its meaning must be interpreted by the observer. From a behaviorist point of view, every performance can be reduced to a mechanistic explanation, and any departure from a reductionist interpretation may seem unrealistic metaphysics (Uexküll 1982, p. 42). However,

Uexküll also drew attention to specific situations whereby action is divorced from an objective reality, which he called "magic *Umwelten*" (Uexküll 1992, p. 376). In this way, a completely subjective or imagined reality can be found in a milieu, whose reference is the witch that a little girl has imagined while playing with a match. This example alone proves that the interpretation of action cannot be completely free of anthropomorphic extrapolation. As pointed out by Thure, Uexküll's son:

> The theory proceeds from the assumption that we must first examine the 'primary receiver' of signs, that is ourselves and our minds, and that only then can we place other subjects, especially animals, in the role of sign receivers (Uexküll T. von, 1992).

In the case of imagination, we need to imagine that: i) non-human beings also have the capacity to imagine; and ii) what the content of their imagined action images might be. Because of its anthropomorphic content, the notion of magic *Umwelt* can be convincingly used to interpret the agency of animals such as dogs or chickens. But it seems more difficult to speculate about the realities that are "imagined" by sessile organisms such as mussels or plants. Beyond the objective realities encountered in their habitat, their putative "imagination" is likely to be equated with that of animals or with some kind of genetic determinism. Finally, it can be subsumed under a mechanistic explanation, according to which plants, like "all animals are mere mechanisms, steered here and there by physical and chemical agents" (Uexküll, p. 45). Arguably, the very notion of imagination may be inconsistent for entities that lack image-forming organs, such as earthworms (Uexküll 1982, p. 58). But in this case, why should we believe that the notions of intelligence and "problem solving" are consistent? (Trewavas 2003). Here, I suggest that imagination can help us uncover our implicit assumptions about the kind of subjectivity that underlies plant life. If we are to secure a subjectivist position, these questions may prove crucial: is plant agency guided by some kind of imagination? How do we identify the underlying imagined realities? What might be a magic *Umwelt* for a plant?

In the following sections I will address these three theoretical issues.

2. *In-out, what counts as agency for animals and plants*

By assuming a virtual center for agency, we tend to overlook the inside of the body as a black box, neither extensive nor intensive. This seems to be a given in the case of animals. On the contrary, plants are the paradig-

matic figures of embodiment, and this black box must be considered in order to account for their agency and *Umwelten*. It also obscures the most important feature of plant activity, which is the continuous production of what is known as "biomass", i.e. vast quantities of plant beings, plant bodies, plant parts, plant matter – not to mention the fact that this plant matter is the ever-renewable substrate for all other living beings and even part of the mineral world. To address this paradox, I will first compare what counts and what does not count as agency for plants and animals.

If a bird catches a fly, it makes sense to say that the fly is part of the bird's *Umwelt*. But as soon as the fly is swallowed, it falls into the black box of the body. There, it will no longer count as an *Umwelt* element and will virtually disappear. Inside the body, its status will change. The fly will be turned into food, which will then be broken down and analyzed by the digestive machinery. In fact, it is only then that the actual nutrition process begins, allowing de novo synthesis of the nutritious substances needed for the body's growth, regeneration and reproduction (Bognon-Küss 2023). Similarly, for a breastfed baby, the mother's breast and the milk in it are part of the baby's *Umwelt*. But as soon as it is swallowed, the milk also falls in the black box of the body. Given these two examples, we need to provisionally admit that what plants continuously do, i.e. de novo synthesis or photosynthesis, is by and large beyond what is meant by agency and *Umwelt* in the case of animals.

In addition to food, sexual reproduction is another important area of social life for animals. Finding a mate and the right conditions for copulation fall into the category of *Umwelt*. But what happens in the female body after copulation is no longer considered in this category. The fertilized egg is assumed to be taken over by the reproductive machinery. In this case, however, a new living being is created inside the body. For the embryo and then the foetus developing inside, the *Umwelt* will coincide with the mother's womb until the time of birth. Fecundation and gestation illustrate two aspects: i) the way *Umwelten* become entangled; and ii) the changing status of the body.

The mother's passive agency and the baby's nesting in her body seem to be relevant to address the kind of agency that plants exhibit. On the one hand, no woman would agree with the idea that pregnancy is merely a passive biological mechanism, on the contrary it involves some kind of intimate interaction between the mother and her baby. Pregnancy is a specific gesture. As such, it seems paradigmatic of passive agency, i.e. agency "facing only inward". On the other hand, the status of embryonic development is currently ambiguous since it can be interpreted both as a mechanistic

process and as a subjective process in which the child participates to some degree[1]. Within the womb it displays its own particular gesture, a different kind of passive agency. In the same way, plants nourish all other beings around them with their own specific gesture and substance, while at the same time pursuing their own embryonic development through continuous growth and metamorphosis.

The notion of passive agency, facing only inward, can make justice to the most basic, radical plant activities. However, it does not constitute the bulk of discussion about plant agency, behavior and intention. This discussion revolves mainly around examples that aim to show that plants behave like animals, throwing themselves outwards and trying to catch things in their surroundings, thus actively rather than passively creating their *Umwelt*. For example, climbing plants such as legumes use modified leaves called tendrils to cling on to a stick or similar object nearby such as a fence or the stem of another plant. The growth of the tendrils is characterized by a rotational movement called circumnutation, which follows an ultradian rhythm of about two hours or less. This movement is not oriented until the tendril touches an object and begins to orient its rotation around it (Wang *et al*. 2023). Oriented growth has also been reported for roots exploring their environment underground (Baluška *et al*. 2009). Another popular example is the case of carnivorous plants such as Venus flytraps (*Dionaea muscipula*), pitcher plants and bladderworts (*Utricularia* spp.) which have different types of trap leaves and can trap and digest animal or protozoan preys – typically insects and other arthropods. The trap can be active depending on whether movement helps capture prey, such as snap traps that allow rapid leaf movement (Durak *et al*. 2022). It can also be passive, relying for example on sticky mucus or inward-facing hairs. A third popular example is the sensitive plant (*Mimosa pudica*), which, in response to repeated physical disturbance, displays a defensive leaf-folding behavior, as if trying to retreat and protect itself from a threat (Gagliano *et al*. 2014; Abramson & Chicas-Mosier Ana 2016).

In these three case studies, plants are seen as behaving largely like animals, striving to analyze and separate what is inside from what is outside, thus actively creating their *Umwelten*. There is now a sufficient body of evidence to suggest that this analytical ability is clearly emerging from the more general nutritive and generative plant background. However, it is this

1 For instance, recent evidence has shown that during embryogenesis the vertebrate brain has a pre-behavioral function in guiding body morphogenesis (Herrera-Rincorn & Levin 2018).

background that needs to be understood in order to make sense of plant agency for all plants, not just those that show active agency. To this end, I will now examine how active and passive agencies can be translated into plant *Umwelten* and, more specifically, how the concept of *Umwelt* can make sense for an agency that is facing only inward.

3. *Marginal and radical plant* Umwelten

If we focus on active agency, we can approach plant *Umwelten* in much the same way as for animals, by trying to make sense of their action images. In the case of climbing plants, anything that stands upright can become a climbing signal, or index, depending on its size and shape. Once a tendril has touched a stick, the latter is no longer an anonymous element of the environment, but something that can even be partially internalized or fused with the plant's body. Wisteria species, for example, climb by twisting their stems around any available solid structure, gradually absorbing it as the stem thickens radially, as if the plant were trying to merge with it. The solid structure does not need to be upright, because whatever its orientation, it conveys the meaning "standing" from which the quality of support is derived. In the case of carnivorous plants, anything that touches a leaf trap can become a trap index, triggering a snap shut. However, the size of the object must be neither too large nor too small, its weight must be neither too heavy nor too light, its substance must be susceptible to enzymatic digestion etc. Thus, the plant somehow analyzes the object to be ingested, and the result of this analysis is mostly determined by its physical and chemical properties. In this case, the object is buried even deeper, and its substance is eventually absorbed and becomes part of the plant's flesh. The object must be moving, as the plant will not reach out and actively try to catch it. Whatever its form and identity, it will convey the meaning "ingest" and/or "unite" (i.e. "incorporate" or "embody"), from which the quality of the resource emanates. Finally, in the case of sensitive plants, anything that touches the leaves can become a containment index, leading to a retreat in a virtual interior, if the intensity of the contact is sufficient. The index does not have to be a potential predator such as insects, it can be anything that could hit and injure the plant, including its own body when shaken by the wind. In this case, the plant seems to be trying to protect itself by burrowing into its own body. Whatever the source of the movement that triggers a touch index, it will convey the meaning "accommodate" from which the quality of containment issues.

These case studies are particularly fascinating because they emphasize animal rather than plant characteristics and seem to blur the line between plants and animals. But we should ask ourselves: would they be fascinating if they did not contradict our intuition of what it means to be a plant? If we turn the question around, we can see that our interest comes from the fact that they actually present a counter-image of what it means to be a plant. Although these zoomorphic adaptations represent highly sophisticated responses to some environments, their relevance to plant *Umwelten* may be only marginal, representing ways of overcoming adverse conditions at the expense of more radical plant specificities. For example, climbing can be very useful in a rainforest to gain access to the top of the canopy; developing heterotrophy can compensate for growth limitation in soils that are deprived of mineral nitrogen sources, such as peatlands; retreating into oneself can help prevent mechanical injury, e.g. from storms, hail or animal movement. But these adaptations are specific, and most plants do not need them. Moreover, their focus is limited to instrumental activity. However, if all plants were to evolve towards instrumental agency, this would probably undermine what Uexküll (2001, p. 116) called the "laws of musical harmonics" in nature.

Animal-like agency cannot be the only relevant criterion for addressing plant *Umwelten*, otherwise the concept would remain essentially rhetorical for most of the vegetal kingdom. The oak tree and the wheat blade would be at the bottom of a scale based on agency and *Umwelt*. They could even be considered, to be the least perfect of all plants, which seems rather counter intuitive. To get around this paradox, we can turn to what happens underground and focus on the agency of the roots. For all terrestrial plants, root foraging reveals what are interpreted as food hunting and social behaviors from which the quality of *Umwelt* can be inferred. The root network is supposed to be the brain of the plant while the aerial parts can be seen as its legs (Baluška *et al*. 2009). In the case of animals, we usually assume that only the brain knows and intends what it is doing while the limbs are merely instruments at the service of the subject. Although this distinction between aerial and subterranean activities is useful for identifying different plant gestures, it is not satisfactory for the purpose of addressing plant *Umwelten* as a whole. To this end, I will explore another direction: what some plants can only achieve by instrumental means, most plants achieve much more easily by passive agency. For all plants, the three meanings identified above can be observed: standing, ingest/unite and accommodate. Instead of demonstrating a more evolved habit, plants that rely on instrumentalization might really be handicapped compared to the higher perfection of their

relatives. Under the criterion of instrumentalization, we can only identify marginal *Umwelten*. But radical *Umwelten* remain undefined. If we want to make sense of the notion of plant *Umwelt*, it cannot be limited to special plant attributes while ignoring the most pervasive, radical expression of "plantness" (Darley 1990; Hallé, 1999).

Climbing plants can be likened to elderly people who need a cane to stay upright. Without a material "standing" index in their surroundings, they would fall and crawl on the ground. Left to their own devices, like animals indeed, they would remain horizontal or at best inclined. In contrast, upright plants like healthy human beings need no support other than the ground on which they stand and which keeps them upright as if they had internalized a virtual cane. Carnivorous plants are similar to parasites – they can only survive at the expense of other beings. Again, like animals, they would be condemned to starvation if they could not get food from others. In contrast, autotrophic plants do not need to parasitize others in order to flourish, as if they had virtually internalized others and merged with them through their photosynthetic capacity. Sensitive plants are like weak people who need to be plastered over to keep their body strong and prevent it from breaking. Like animals, they need a nest, a hole or a shield to protect their physical integrity from external threats. In contrast, responsive plants need no shelter other than their own bodily plasticity as if they had internalized virtually all the possibilities for strengthening their own being (Trewavas 2003; Sultan 2021). This does not mean that analysis is not involved in passive agency. Plants that are not actively agentive need to assess their vertical axis. They need to analyze the water and carbon dioxide molecules for photosynthesis; the nitrate or ammonium molecules for nitrogen assimilation; the strength of the wind for radial growth and bending, etc. But instead of analyzing a limited number of objects in their milieus in an instrumental, utilitarian mode, they flourish because they can synthesize everything that surrounds them, including air, water, earth and sun, and ultimately the whole cosmos. Unlike marginal *Umwelten*, radical *Umwelten* are all-encompassing, extending beyond any limited point of attention. They are "facing only inward".

This conclusion may seem as unsatisfactory as the previous one because it supports the elusiveness of plant subjectivity as the One that stands in the background and is unattainable. However, I suggest that this elusive Oneness can be fleshed out by comparing marginal and radical *Umwelten* and their corresponding imagined action images, using the same kind of arguments as Uexküll (1992, p. 376) when he coined the notion of magic *Umwelt*.

4. *Plant imagination and magic* Umwelten

A mechanistic interpretation is no less teleological than a subjectivist one (Uexküll 1982, p. 42-43; Duicu, 2019). If plant agency is to be understood on the basis of purposefulness, then passive agency and its underlying activity of synthesis should not be subsumed under mechanical causality or instrumental agency. What is assumed to be simply mechanical in plant agency is in fact what we do not yet fully understand. It is that which is mysterious in the open day and, in a sense, "magic": nature that "lies concealed, eternally beyond the reach of knowledge". Uexküll (2001) argued that when we begin to look at the perceptual side of life, and not just the effectual side: "we have left the rumble of a mechanical workshop, with matter and forces that interact randomly, accidentally achieving something more enduring. Instead, we have now entered the grand theatre of Nature" (p. 118). We recognize that "a performance is always an action with a purpose" (p. 112) and that "the function is the 'spiritual band' that encircles the parts and the properties, and which is invisible as such" (p. 112). For Uexküll, the concept of function itself can only make sense within a "comprehensive harmonic totality" (p. 122), a "meaningful whole" (p. 112), in which every single thing is "connected to units according to a plan" (p. 122) and intervenes contrapuntally with other things.

Contrapuntal coherence applies not only to objective things but also, so to speak, to magic things. We need to convene that there is an invisible "spiritual band" behind agency, which amounts to a magic action image. This image is not visible to our sensual eyes and does not correspond to an objective reality, and yet it can be inferred from the performing subject. For Uexküll (1992), the subjective behaviors of animals can be explained by different types of magic images. "Otherwise utterly puzzling actions by various animals should be interpreted magically" (p. 378). Some magic images are innate, such as the magic path of the pea larva, the weevil or migratory birds. Others are acquired on the basis of an initial experience that is later recalled, such as the magic shadow of the guinea pea that once entered the chicken coop, the magic fly of the starling or the magic prospecting image of the dog. Although these images must be imagined, they can be linked to an objective reality. Innate magic images can be reported repeatedly for other members of the same species, and acquired magic images can be correlated with specific events. In both cases, there is an element of memory: genetic, shared by members of the same species, in the first case; biographical, belonging to an individual history, in the second (Thellier 2015). This distinction is usually used to draw a line between what is

mechanistic and what is truly subjective. Here, I would like to depart from the mechanistic interpretation and propose that innate and acquired magic images correspond to two different modes of subjective "imagination", a radical one and a marginal one.

While instrumental rationality deals only with marginal issues, an all-encompassing imagination reaches out to the contrapuntal harmony of the whole. This interpretation can be used to further characterize plant radical and marginal *Umwelten*. Radical *Umwelten* mostly correspond to innate magic action images, while marginal *Umwelten* may contain some degree of biographically acquired magic images. Starting with climbing plants, we can ask: how is a stick interpreted as a "standing" index, what is its connection to the internalized stick of erect plants, what might be their common plant imagination or magic *Umwelt*? One interpretation is that both climbing and erect plants are related to an *axis mundi* that is not an objective reality and must be imagined[2]. Gravity provides an objective explanation for top-down orientation but proves irrelevant for interpreting bottom-up orientation. For the latter, it is necessary to invoke an anti-gravitational effective action, the nature of which has yet to be scientifically demonstrated and remains at this stage a magic action image. In the case of climbing plants, the stick or other object has to be physically encountered before it can become a "standing" index. The plant will remember its position, so that the next circumnutation movement of the tendril will be towards that position (Abramson & Chicas-Mosier 2016). In the case of erect plants, the stick index is stored in the memory of the species or family line. But it can also be temporarily inhibited if its recall could threaten the plant's survival – for example, if there is a lack of light or if an external disturbance interferes with its upright elongation. So even with radical imagination and innate memory, there is still room for adapted individual responses.

If we now consider carnivorous plants, we can ask: how is the fly perceived as a resource or "ingest" index rather than a recipient of nutritive substance, how does this "ingest" index relate to the mineral nitrogen index in the soil (i.e. how does the plant analyze nitrogen), how does it relate more generally to synthesis, i.e. the ability to assemble and condense matter, what might be the common plant imagination underlying both analysis and synthesis? Both carnivorous and autotrophic plants refer to the contra-

2 For Uexküll, both time and space are subjective constructs and not objective facts. Accordingly, we should bear in mind that the way we conceive of our three-dimensional space, and its vertical axis is not only anthropomorphic but also cultural. For example, in many traditions the *axis mundi* is not an anonymous dimension of space, but the very pillar of the cosmos often represented by trees (Eliade 1952).

puntal harmony of embodiment, ingestion and gestation being two sides of the exchange and interweaving of organic substances. Attention is often drawn to the trapping movement involved in plant heterotrophy, but the emphasis should also be placed on the preceding morphogenetic movement, which makes it possible to imitate features of animal digestive tracts, such as a mouth or a tube. In fact, plants seem to have an innate ability to imitate the internal movements of animals, so that their morphogenetic movement can mimic the shape or the image of an animal's whole body, for example by evolving a zygomorphic symmetry or the coloring of their flowers. The famous example given by Gilles Deleuze and Félix Guattari (1980, p. 291), the pseudo-copulation between the bee and the orchid, supports the interpretation that the plant imagination could go so far as to seek a more intimate relationship with the animal world. In a similar way, plants could also imagine what goes on in the digestive system of animals. They seem to form a complete picture of the contrapuntal orchestra of nutritional exchanges, which does not correspond to an objective reality, but represents a metaphysical imagination. Although real animals can be physically encountered by plants, this alone cannot explain how vegetal beings can actualize an animal imagination in their bodies and movements, let alone in their synthesis of nutritional substances.

With the last example of sensitive plants, we can ask: how is an "accommodate" index translated into an elastoplastic, reversible and superficial change, how is it related to permanent, even adaptive and inherited phenotypic plasticity, what is their common magic image or plant imagination? Both sensitive and responsive plants need to imagine their own bodily integrity in the face of multiple stimuli and changes. This, in turn, does not correspond to an objective reality, but corresponds to a metaphysical imagination of the type or specific gesture of the plant, while at the same time undergoing multiple transformations. In all cases, plants need to behold their own image, so to speak, because their ultimate agency is focused on the processual actualization of themselves. This may be related to their innate ability to achieve their type through metamorphosis, which consists of a continuous transformation of their archetypal unity (Goethe 1999). Metamorphosis shows how the most rudimentary pattern can be refined from a round, ubiquitous cotyledon to the most finely serrated leaf and to the most delicate, colored petal. In many plants, the culmination of this gradual transformation is the flower, which can be seen as a magic image of the plant's eventual union with the sun. Radial, actinomorphic flowers are the most revealing case of the plant's solar imagination, while bilateral, zygomorphic flowers have deviated from this radical centrality and superim-

posed an animal magic image (Cubas 2004). Plants that simply repeat the same pattern, changing the position of their stems and leaves, rather than building on metamorphosis, display a more superficial, ubiquitous gesture. In their case, the interplay with the surrounding environment, the cosmos as a whole, seems to be more limited and the capacity to withstand or undergo multiple changes while expressing their archetype seems marginal.

This initial investigation shows that the three indices – "standing", "ingest" and "accommodate" – involve much more than an instrumental intentionality focused on "problem solving" (Mancuso & Viola 2018, p. 169). The notion of an all-encompassing plant imagination might be better suited to depicting the unity of the vegetal subject, facing only inward. In terms of instrumental agency, plant subjectivity ranks lower than that of animals and humans. But in terms of imagination, it is perhaps much more advanced. This apparent paradox may explain our ambivalent attitude towards plants, which is a mixture of wonder and domination.

5. *Plant ethics: beyond metaphors, towards a new analogism?*

In this paper, I have tried to approach plant *Umwelten* from a subjectivist, but not anthropomorphic, point of view. Comparing passive and active agencies, I propose that plants have their own magic *Umwelten*, which they create through their ability to imagine non-objective realities. Passive agency, as an internalized movement, emerges from the plant imagination, which creates radical, magic action images. Active agency, as an externalized movement, is stimulated by "thingified" plant imagination focused on "problem solving", which provides marginal, objectified action images. Against this interpretation, it could be argued that the notion of plant imagination and the magic *Umwelten* associated with it are just human imagination or fantasy. Indeed, it is difficult to get rid of any form of epistemic anthropomorphism. But if one agrees with Uexküll that subjectivity is demonstrated by agency, then the actual perception of action should take precedence over metaphors such as neurons and brain (Brenner *et al*. 2006; Struik *et al*. 2008). Furthermore, to overcome other utilitarian, anthropocentric assumptions, we should move away from an instrumental standpoint. There is no objective reason to speculate that plants store and process information or calculate like "green robots" (Calvo & Lawrence, 2022 p. 203). The adoption of a subjectivist standpoint is not only of general philosophical interest but may also have important epistemological and political consequences for the consideration of plant life.

First, the notion of plant imagination requires a shift from a reductionist to an analogical perspective. For example, mechanics can explain how the apple falls from the tree, but not how it "climbed" the tree in the first place and later happened to meet a bird or a gardener passing by. In contrast, the imagination can visualize how making an apple, climbing a tree or gradually developing from rudimentary to sophisticated plant units through metamorphosis are essentially based on the same agentive subjectivity. Plant imagination must be analogical, which makes it possible to equate an invisible *axis mundi* with a stick in a non-metaphorical way. On the contrary, comparing a tendril to an arm is merely metaphorical. Paradoxically, a subjectivist interpretation of plant *Umwelt*en allows for a much less anthropomorphic approach to plant life than approaches that claim to be more objective. The objectification of plant subjectivity and *Umwelten* only leads to more human metaphorical imagination and less plant imagination. Although an analogical ontology may seem outdated in our Western world dominated by a naturalistic ontology (Descola 2005), its reappraisal in a more contemporary context could make a significant contribution to further exploration of plant *Umwelten*. As a fine reader of "Goethe's wisdom" (1982, p. 65), Uexküll could not ignore its emphasis on "exact sensorial imagination" (Bortoft 2001 p. 53). He certainly agreed with the idea that explanatory principles should not be sought beyond the perceptual world in a metaphysical order consisting of "imaginable non-realities" (Anderson 2001, p. 186). Accordingly, plant imagination should be approached with a direct, non-mediated perceptual basis, as opposed to so-called plant "intelligence" which has only an indirect, mediated perceptual basis.

Second, recognizing that plant have magic *Umwelt*en goes beyond a stroll through "wonderland" (Anderson 2001). Because we need to address plant imagination on the basis of perception, we are led to the real issue of how to treat plants more ethically. For example, we can move away from forms of irrational magic thinking, such as "the magic of one" that underpins unsustainable monocultures (Uekoetter 2011). To ignore plant subjectivity, which is so different from our common subjectivity, is also to overlook the fact that they actively create and shape their *Umwelten*, not just ours. In all the situations where we do interact with vegetal subjects, we should ask ourselves whether what we do to them will contribute to the active creation or to the collapse of their *Umwelt* (Maran 2023). Even for the sake of defending our anthropocentric interests, we should be concerned that a collapse of plant *Umwelten* could precipitate the collapse of the One that stands in the background, leading to an unsustainable, unbreathable world (Krampen 2001). For this reason, plant ethics should no longer be seen as a marginal issue. On the contrary, it is one of the most pressing is-

sues for mitigating global change (Kallhoff *et al*. 2018). To make sense of plant ethics, it is not enough to visualize plants "beyond second-animals" (Pouteau 2014). We must also address their more-than-animal *Umwelten* within a non-instrumental, perceptual framework, making sense of contrapuntal coherence in a new analogical approach.

References

Abramson, C.I., Chicas-Mosier, A.M.
2016 Learning in plants: lessons from *Mimosa pudica*. *Frontiers in Psychology* 7, article 417, available online <doi: 10.3389/fpsyg.2016.00417> (accessed on 27 November 2024).

Anderson, M.
2001 Life and living in wonderworld. *Semiotica*, 134, (1/4), pp. 185-191.

Baluška, F., Mancuso, S., Volkmann, D., Barlow, P.W.
2009 The 'root-brain' hypothesis of Charles and Francis Darwin. *Plant Signaling & Behavior*, 4 (12), pp. 1121-1127.

Bognon-Küss, C.
2024 'Naked life': the vital meaning of nutrition in Claude Bernard's physiology. *History and Philosophy of the Life Sciences*, 46, (article 18), pp. 1-29.

Bortoft, H.
2001 *La démarche scientifique de Goethe*, Triades, Paris.

Brenner, E.D., Stahlberg, R., Mancuso, S., Vivanco, J., Baluska, F., van Volkenburgh, E.
2006 Plant neurobiology: an integrated view of plant signaling. *Trends in Plant Science*, 11, (8), pp. 413-419.

Calvo, P., Lawrence, N.
2022 *Planta Sapiens. Unmasking Plant Intelligence*, The Bridge Street, London.

Comollo, F.
2024 A foray into the worlds of plants and fungi. *Biosemiotics*, 17, (2), pp. 469-485.

Cubas, P.
2004 Floral zygomorphy, the recurring evolution of a successful trait. *Bioessays,* 26, (11), pp. 1175-84.

Darley, W.M.
1990 The Essence of 'plantness'. *The American Biology Teacher*, 52, (6), pp. 354-357.

Delaporte, F.
1979 *Le second règne de la nature: essai sur les questions de la végétalité au XVIIIe siècle*, Flammarion, Paris.

Deleuze, G., Guattari, F.
1980 *Capitalisme et schizophrénie 2. Mille plateaux*, Minuit, Paris.

Descola, P.
2005 *Par-delà nature et culture*, Gallimard, Paris.

Di Paola, M.
2024 *The Vegetal Turn. History, Concepts, Applications*, Springer, Cham.

Duicu, D.
2019 La téléologie cachée dans la pensée biologique d'Uexküll. *Revue de Métaphysique et de Morale*, 101, pp. 91-100.

Durak, G.M., Speck, T., Poppinga, S.
2022 Shapeshifting in the Venus flytrap (*Dionaea muscipula*): morphological and biomechanical adaptations and the potential costs of a failed hunting cycle. *Frontiers in Plant Sciences*, 13, available online <doi.org/10.3389/fpls.2022.970320> (accessed on 28 November 2024).

Eliade, M.
1952 *Images et symboles. Essais sur le symbolisme magico-religieux,* Gallimard, Paris.

Gagliano, M., Renton, M., Depczynski, M., Mancuso, S.
2014 Experience teaches plants to learn faster and forget slower in environments where it matters. *Oecologia*, 175, pp. 63-72.

Gerber, S., Hiernaux, Q.
2022 Plants as machines: history, philosophy and practical consequences of an idea. *Journal of Agricultural and Environmental Ethics*, 35, (1), pp. 1-24.

Goethe, J.W.
1869 Nature, in, Huxley, Thomas Henry "Nature: aphorisms by Goethe". *Nature*, 1, (1), p. 9-11. First published in German by Georg Christoph Tobler (1783).

1999 *La métamorphose des plantes et autres écrits botaniques*, Triades, Paris. First published in German (1790-1831).

Halle, F.
1999 Éloge de la plante – Pour une nouvelle biologie, Seuil, Paris.

Hall, M.
2011 *Plants as Persons: A Philosophical Botany*, SUNY Press, Albany (NY).

Herrera-Rincorn, C., Levin, M.
2018 Booting up the organism during development: pre-behavorial functions of the vertebrate brain in guiding body morphogenesis. *Communicative & Integrative Biology*, 11, (1), available online < doi.org/10.1080/19420889.2018.1433440> (accessed on 27 November 2024).

Hiernaux, Q.
Du comportement végétal à l'intelligence des plantes?, Quae, Versailles.

Houle, K.
2018 Facing only outward? Plant bodily morphogenesis and ethical conceptual genesis, in Kalhoff, A., Di Paola, M., Schörgenhumer, M. (a cura di) *Plant Ethics: Concepts and applications*, Routledge, London-New York, pp. 70-81.

Kalhoff, A., Di Paola, M., Schörgenhumer, M. (a cura di)
2018 *Plant Ethics. Concepts and applications*, Routledge, London-New York.

Krampen, M.
2001 No plant – no breath. *Semiotica*, 134, (1/4), pp. 415-421.

Mancuso, S., Viola, A.
2018 *L'intelligence des plantes*, Albin Michel, Paris.

Maran, T.
2023 Umwelt collapse: the loss of Umwelt-ecosystem integration. *Biosemiotics*, 16, (3), pp. 479-487.

Marcus, S.
2001 On the logical and semiotic status of Jacob von Uexküll's concept of Umwelt. *Semiotica*, 134, (1/4), pp. 201-210.

Marder, M., Parise, A.-G.
2024 Extending cognition: a vegetal rejoinder to extensionless thought and to extended cognition. *Plant Signaling & Behavior*, 19, (1), available online: <doi.org/10.1080/15592324.2024.2345984> (accessed on 21 November 2024).

Pouteau, S.
2014 Beyond 'second animals': making sense of plant ethics. *Journal of Agricultural and Environmental Ethics*, 27, (1), pp. 1-25.
2018 Plants as open beings: from Aesthetics to plant-human ethics, in Kalhoff, A., Di Paola, M., Schörgenhumer, M. (a cura di), *Plant Ethics. Concepts and Applications*, Routledge, London-New York, pp. 82-97.
2020 Mouvement et monde des êtres ouverts. Vers une écologie de la représentation des plantes. *La Pensée écologique*, 6, pp. 5-15.

Ryan, J.C.
2012 Passive flora? Reconsidering nature's agency through human-plant studies (HPS). *Societies*, 2, (3), pp. 101-121.

Sayes, E.
2014 Actor-Network Theory and methodology: Just what does it mean to say that nonhumans have agency?. *Social Studies of Science*, 44, (1), pp. 134-149.

Stella, M., Kleisner, K.
2010 Uexküllian Umwelt as science and as ideology: the light and the dark side of a concept. *Theory in Biosciences*, 129, (1), pp. 39-51.

Stjernfelt, F.
2001 A natural symphony? To what extent is Uexküll's *Bedeutungslehre* actual for the semiotics of our time? *Semiotica*, 134, (1/4), pp. 79-102.

Struik, P.C., Yin, X., Meinke, H.
2008 Plant neurobiology and green plant intelligence, science, metaphors and nonsense. *Journal of the Science of Food and Agriculture*, 88, (3), pp. 363-370.

Sultan, S.
2021 Phenotypic plasticity as an intrinsic property of organisms, in Pfening, D.W. (a cura di), *Phenotypic plasticity and evolution. Causes, consequences, controversies*, CRC Press, Boca Raton-London-New York.

Thellier, M.
2015 *Les plantes ont-elles une mémoire?*, Quæ, Versailles.

Trewavas, A.
2003 Aspects of plant intelligence. *Annals of Botany*, 92, (1), pp. 1-20.

Uekoetter, F.
2011 The magic of one: reflections on the pathologies of monoculture. *RCC Perspectives*, (2), pp. 1-20.

Uexküll, J. von
1982 The theory of meaning. *Semiotica*, 42, (1), pp. 25-82. First published in German (1940).
1992 A stroll through the worlds of animals and men. *Semiotica*, 89, (4), pp. 319-391. First published in German (1934).
2001 The new concept of Umwelt: A link between science and the humanities. *Semiotica*, 134, (1/4), pp. 111-123. First published in German (1937).

Uexküll, T. von
1992 The sign theory of Jakob von Uexküll. *Semiotica*, 89, (4), pp. 279-315. First published in German (1981).

Wandersee, J.H., Schussler, E.E.
1999 Preventing plant blindness. *The American Biology Teacher*, 61, (2), pp. 82-86.

Wang, Q., Guerra, S., Bonato, B., Simonetti, V., Bulgheroni, M., Castiello, U.
2023 Decision-making underlying support-searching in pea plants. *Plants*, 12, (8), 1597, available online <doi.org/10.3390/plants12081597> (accessed on 27 November 2024).