Ecological Plasticity. Forming Affective Morphologies, with a Case Study on Olfaction

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We introduce the concept of ecological plasticity and develop it through the case study of human olfaction. Extending the model of plasticity to the ecological discourse, we define ecological plasticity as a principle of systemic relationality according to which an agent takes on a form by interacting with a complex affective reality while, reciprocally, giving it a form. The concept of form is here conceived as a synthetic unity that encapsulates the possibilities of existence, sensibility and interaction of an agent immersed in a complex world of other agent-forms. An agent is always aesthetically and affectively immersed in a complex or ecological system: a body is that which is affected and assumes form within a complex affective reality, which is, in turn, co-formed in this process. This perspective, in contrast with static morphology, contributes to configuring a dynamic eco-affective ontology, as body forms are experientially and affectively renegotiated in loops of co-individuation, impeding a clear distinction between activity and passivity, subject and object. Those concepts are illustrated and crafted with reference to olfactory perception, as olfaction discloses an embodied and reciprocal field of co-affection. Via the perception of smells, bodies make sense of their environment, and this shaping cannot take place without the same bodies being touched, affected, and thus renegotiated.

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— ECOLOGY
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— COMPLEXITY
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In this article, we introduce the concept of *ecological plasticity* and develop it through the case study of human olfaction. [1] Extending the model of plasticity to the ecological discourse, we define ecological plasticity as a principle of systemic relationality according to which an agent takes on a form by interacting with a complex affective reality while, reciprocally, giving it a form. The concept of form is here conceived as a synthetic unity that encapsulates the possibilities of existence, sensibility and interaction of an agent immersed in a complex world of other agent-forms.

[1] This article is the result of a collaborative effort between the two authors. Sections I and II are attributed to Emanuele Capozziello, while Section III is attributed to Sofia Livi. Despite this formal division, both the ideas and the results should be understood as the product of joint work conducted shoulder-to-shoulder, with each author providing consistent input and contributions to the sections written by the other.

The article is structured into two parts: the first one (sections I and II) develops the concept of ecological plasticity in the light of the notion of complexity. The second one (section III) takes the case of olfactory perception as a concrete example to illustrate the type of analysis that the concept of ecological plasticity calls for. We adopt this order of exposition due to criteria of clarity, but we consider a stark division between an abstract and a concrete moment to be artificial. The two parts are necessary to each other, and as such, deeply intertwined.

1. Complexity, Morphology, Ecology

The jargon of complexity seems to have now permeated almost every realm of knowledge, political-institutional practice, and group or individual way of life (Urry 2005). The expression "the world is complex" has become both a catchphrase and an epoch-defining epistemological orientation that challenges any image of the world centred on criteria such as linearity, immutability, reductionism, and homogeneity (Prigogine & Stengers 2018; Cilliers 1998; Bocchi & Ceruti 2007). The emergence of ordered systems from initial conditions of disorder is one of the many expressions of complexity, which Edgar Morin describes as a peculiar multidisciplinary ontology preaching the universal «transformation of chaos into *logos*» (1992, 54). From contexts or conditions of disorder, delirium, and fragmentation, criteria and tendencies towards order, structure, and form emerge autopoietically or sympoietically. Reflections on complex systems are pervasive, as they confer intelligibility to phenomena spanning from the origin of life to economic crises, from car traffic to the biosphere-atmosphere feedback loops.

Complexity, therefore, does not mean *chaos*: [2] a complexity theorist in any field of knowledge will address processes and contexts that, despite the heterogeneity, multiplicity, time lag, or dispersion of factors, still give rise to macroscopic structures, emergent properties, or synergistic regularities. In other words, *form* is what distinguishes complexity from chaos; complexity always calls for a morphology (Riedl 2019), a theory of form as «the totality of the complex organized unit which is manifested phenomenally insofar as whole in time and space» (Morin 1992, 112). Indeed, as observed by René Thom:

[2] The use of the term "chaos" in this context is not intended in the technical sense associated with the physical and mathematical reflections on "deterministic chaos", which – beginning ideally with the work of Henri Poincaré – has significantly contributed to shaping and directing the cluster of disciplines and multidisciplinary approaches encompassed by "complexity theory" (Ruelle 1991). As will be clarified in the course of this discussion, "chaos" here assumes, perhaps more classically from a philosophical perspective, the meaning of "formlessness".

> Whatever is the ultimate nature of reality (assuming that this expression has meaning), it is indisputable that our universe is not chaos. We perceive beings, objects,

> things to which we give names. These beings or things are forms or structures endowed with a degree of stability; they take up some part of space and last for some period of time. (1975, 1)

In Thom's analyses, the Universe is conceived as a geometric *continuum* that manifests itself through forms (i.e., expressions of structural stability in space-time; see Thom 1993, 53-54). [3] According to Thom, the scientific focus of the morphologist should be directed towards those discontinuities that constitute "edges" perceptible in universal morphism, the *loci* of "catastrophe" (Thom 1993, 28). If we understand form as a unit of manifestation (more or less arbitrarily denoted) in a universal morphological *continuum* – which, therefore, by definition, does not admit emptiness or a-geometric and infra-morphic spaces within it [4] – *catastrophe* is understood as that point of discontinuity, interruption, or turning point that marks a boundary between phenomena (i.e., forms) that qualitatively manifest themselves as distinct. A catastrophe marking the edge of a plate, and thus allowing the distinguishability of the plate from the table it rests upon, is a rupture of the morphological equilibrium surface, of the topological *continuum* (Zeeman 1976). Understood as geometric-perceptive discontinuities, the singular catastrophic breaks of an ideal space-time homogeneity are the forms that serve as the bulwark against formless chaos, elements of structural stability that testify to recognizable order and organization.

[3] The key principle of morphology, according to J.W. Goethe, is that «everything that is must also manifests and shows itself» (qtd. in Vercellone & Tedesco 2020, 8).

[4] «Now it is precisely because all absolute forms are incapable of being contradicted that they can belong to a same Being and, in being able to, they effectively belong to it. Since they are forms. their real distinction is formal and carries no ontological difference among beings to which each might be attributed: they are all attributed to a single and same Being that is both ontologically one and formally diverse. There the real distinction already does not involve separability» (Deleuze 1993, 44-5).

Therefore, if the world is complex, this complexity manifests itself through forms or structures interconnected by complex relationships. As Thom acknowledges (1993, 63), understanding complexity in morphological terms, and therefore in terms of its possibilities of manifestation, implies the instantiation of an agent capable of perceiving a qualitative discontinuity, that is, a catastrophe, in the morphological *continuum* that is the world. Developing an epistemology of complexity always implies attention to the sensitivity of agents within a complex system to the forms through which the latter manifests. As Whitehead already intuited (1920, 21), reflection on the *objective* processes of structural organization alone is not sufficient to provide a complex image of the world, as one must also consider the *qualitative* dimension of experience or perception of those structures by the agents inhabiting the world. We can understand ecology as the knowledge or thought of this perennial exchange, in complex systems, between the qualitative and the systemic, the affective and the structural, the experiential and the observable.

According to Bateson, ecology is the ensemble of practices of knowledge of what he calls «the pattern which connects» (or «meta-pattern»): «What pattern connects the crab to the lobster and the orchid to the primrose and all the four of them to me? And me to you?» (1979, 8). Therefore, ecology fundamentally results in «an aesthetic question: *How are you related to this creature? What pattern connects you to it?*» (9). Ecology can be understood as another name for complexity, but with a clear focus on the living dimension of our complex world(s), and so with a disposition to address the aesthetic, qualitative, experiential, perceptive, affective

exchanges between living agents and living environments. This is what Oele successfully grasps interpreting ecology through the idea of "e-co-affectivity". [5] Hustak and Myers (2012) contend that ecology, in addition to its requisite evolutionary and adaptative framework, must incorporate an *involutionary* character. [6] This involves delving into the complex «stories of affinities, attractions, and intimacies» that bind living beings with each other and with their physical environments «in an affectively charged, multisensory partnership» (78-79). Ecology is the study of the formation of (affective) ecosystemic complexities: stories or scenes of bodies that «*learn to be affected*, meaning "effectuated", moved, put into motion by other entities, humans or non-humans» (Latour 2004, 205). The life of a body within an ecosystem embodies what Despret (2004) has conceptualized as «an experience of "making available"», wherein «the body and what affects it produce each other»: «The world disposes us to feel, and our body makes the world available» (127).

[5] «*Instead of seeing affectivity merely in terms of the passive effect of a cause, the kind of affectivity I propose puts at its center stage the receptive, responsive power of living beings to react to what happens to them, which may include their ability to participate in, and shape, how they are affected.* […] With the term "e-co-affectivity", I seek to emphasize that affectivity neither occurs in a vacuum nor pertains to singular, discrete entities: it implies a certain place or milieu (hence "eco", as in the Greek "oikos") and connection to others (hence "co"), whose mediation may have either destructive, or constructive, or ambiguous effects» (Oele 2020, 5).

[6] Without thereby reducing evolutionism to "adaptationism". In this sense, the reference to the renowned essay by Gould and Lewontin (1979) is suggestive, wherein the two evolutionists, critiquing the faith in the universal explanatory capacity of natural selection for functionalization and optimization ("*what for* did this trait adapt?"), present an "architectural" approach focused on morphological constraints (i.e., structural, relational) to evolution, not limited to teleological and functionalist reasoning. Gould and Lewontin's perspective, in other words, embodies an evolutionism that is somewhat "ecological" because it promotes a morphological-structural interpretation of the evolution of bodies, species, and environments. The "involutive" proposal by Hustak and Myers constitutes an appropriate and necessary complement aimed at emphasizing the affective nature of these structurings.

Ecology, following Latour, describes «the exchange of forms of action through the transactions between agencies of multiple origins and forms». Therefore, it configures the world as a «metamorphic zone», a space of perennial morphogenesis and transformation (2017, 58). "Being of this Earth", that is, inhabiting a complex metamorphic zone, means «being enveloped in sensor circuits in the form of loops» (139). The forms through which the world expresses its complexity are characterized by traits, borders, and folds that are the result of histories of e-co-affective metamorphoses: «the metamorphoses that beings have experienced while living with others are so many *material-semiotic traces*: thus the shape of the orchid flower, thus the stripes of the zebras» (Despret & Chrulew 2020). Every ecological form – from ecosystemic configurations, to socio-natural co-adaptations, to animal shapes, and so on – testifies to a process of organization that involves both sensible agents and transformative structures.

2. Ecological Plasticity: Making Sense of Affective Complexities

We develop the concept of ecological plasticity in order to account for this qualitative/affective/aesthetic dimension in addressing an ecologically complex world. In the last decades, the notion of plasticity has garnered renewed interest due to the philosophical work of Catherine Malabou. She gives a twofold definition of plasticity: «the capacity to *receive form* (clay is called plastic, for example) and the capacity to *give form* (as in the plastic arts or plastic surgery)» (Malabou 2009, 5). The concept of plasticity directs our attention to processes of simultaneous *formativeness* and *formability*. We emphasize the "processual" nature of this definition. Following the

morphological tradition inaugurated by Goethe, Malabou addresses the question of form through a reflection on dynamic-relational processes of formation (*Bildung*), giving secondary analytical value to the fixed, already given form (*Gestalt*). [7] Rather than focusing on instantaneous observations of structural stability, form should be investigated within the dynamics of stabilization and organization; it should always be understood as captured in processes of transformation, metamorphosis: a form always already preceded by other forms, and about to change form. [8] That being said, Malabou claims, a reflection on the complexity of the world – a world of intricate interrelations between perceptual, environmental, cognitive, political and ontogenetic elements – finds in plasticity «the poetical and aesthetic force» that configures it (Malabou 2009, 39). As we will attempt to show, if taken as a model, plasticity allows us to think about the transformative reciprocities that define ecological complexities, holding together aesthetic-qualitative aspects and morphological-systemic ones. With some partial exceptions (Malabou 2017), Malabou has not directly and systematically extended the model of plasticity to the ecological discourse. One of the objectives of this article – whose aims, however, go beyond a comparison with the thought of the French author – is to attempt this expansion.

[7] «The Germans have a word for the complex of existence presented by a physical organism: *Gestalt* [structured form]. With this expression they exclude what is changeable and assume that an interrelated whole is identified, defined, and fixed in character. But if we look at all these *Gestalten,* especially the organic ones, we will discover that nothing in them is permanent, nothing is at rest or defined – everything is in a flux of continual motion. This is why German frequently and fittingly makes use of the word *Bildung* [formation] to describe the end product and what is in process of production as well. Thus in setting forth a morphology we should not speak of *Gestalt,* or if we use the term we should at least do so only in reference to the idea, the concept, or to an empirical element held fast for a mere moment of time» (Goethe 1988, 63-64).

[8] The morphological or morphogenetic question, according to Malabou, is «the question of *the differentiated structure of all form* and hence the *formal or figural unity of all difference and articulation*» (2010, 2).

«Today, *new metamorphic occurrences* are appearing», «the privileged regime of change today is the continuous implosion of form, through which it recasts and reforms itself continually» (Malabou 2010, 57); plasticity is the «motor scheme», the *Stimmung* of an epoch of complexification. Like Thom's universe, Malabou's world is also to be understood as a morphological *continuum*, more precisely as a metamorphic zone: «Nothing happens except self-transformation. […] The plasticity of unavoidable transformation» (44). In this sense, «[p]lasticity refers to *the spontaneous organization of fragments*» (7). The introduction of the concept of plasticity to describe our complex world seems to serve the ecological purpose of highlighting the *affective complexities* through which the world and the agents that populate it give and receive form – individuating themself and stabilizing the outer, embodying and moulding, structuring their own capacities and configuring the environment. In this regard, we can recall another philosopher of plasticity, Nietzsche, who speaks of «*plastic power*» as «the power distinctively to grow out of itself, transforming and assimilating everything past and alien, to heal wounds, replace what is lost, and reshape broken forms out of itself» (1980, 10). Plasticity is a properly vital force in that it is a force of ecological interaction and relationship: the "objective", systemic, structural complexity of a reality cannot be conceived without instantiating an agent that "makes sense" of its own reality, in a common and continuous metamorphic loop that incessantly transforms both of them. Plasticity is thus a concept that speaks of the *capacity of "making sense"* as a fundamental factor in understanding complexity and therefore necessitates thinking about complexity in ecological terms, namely as affective complexity.

But what do we mean by "the capacity of making sense"? For *sense*, we can understand both sensitivity – what makes our sensible access to the world possible – and the «indeterminate condition of meaning, of the sense-making of experience, language, and the meanings of concepts and words» (Garroni 1992, 196, our trans.). In this twofold definition, "making sense" is an aesthetic practice: triggering and elaborating a perceptual, sensible, affective experience; but also *feeling at home* in the experience of the world – the world of which I experience *must* make sense, or it would be absurd, disorienting, chaotic. "Making sense" means the capacity of orienting in the world. And, as we have seen, it is possible to navigate a complex world only morphologically, that is, plastically: by exercising a capacity to give and receive forms; by entering the metamorphic zone. Sense is a plastic product of ecological interactions that require a description that is both qualitative-affective and structural-systemic. «Sense – [...] that's metamorphosis», writes Malabou (2010, 62): [9] making sense means inserting oneself, as a plastic agent, into the metamorphoses of a world of affective complexity. Therefore, as Malabou writes, plasticity lays on an understanding of «sense as *incorporation*» (9): making sense is something that not abstract agents, but *bodies* do.

If ecological plasticity is a conceptual tool for addressing affective complexities, describing agents that make sense of their reality by giving and receiving forms, then we should stress the embodied nature of these forms (animal morphologies, ecosystemic configurations, sensory schemes, ethological patterns...). [10] A fundamental premise for this understanding of form as always already "embodied form" is a complex and extended conception of the body, one that does not conceive it as an isolated individuality within a skin. Speaking of a body as "plastic", indeed, means understanding the body as simultaneously capable of containing, maintaining, nurturing its individual form, and open to receiving that form from outside. According to Malabou, «[p]lasticity expresses the contradictory nature of hetero-affection» (Malabou & Butler 2011, 623). The body is simultaneously what is capable of maintaining itself identical (and autopoietic) in its own form or structure, and what is always «out of itself (*außer sich*)», «lived elsewhere» (612). Agent and system, body and environment, «shape» and «scene», as Butler calls them, «emerge at once»: «To enter onto a scene is to assume a shape, and to assume a shape is, indeed, to enter onto a scene» (627).

From this emerges a fundamental principle of ecological plasticity: «I am at once here and there», or «*For a body to be a body, it must be bound to another body*» (631). One acquires form and gives form to one's own reality exclusively within a metamorphic zone, within an affective and complex (from the Latin *complexus*: intertwined, embraced) *continuum* of bodies in transformation.

[9] In this citation, as in the following one, we replaced the word "meaning" with "sense", believing that this maintains a closer proximity to the original French "*sens*", which, according to the Larousse Dictionary, includes, among others, definitions such as: «1. *Chacune des fonctions psychophysiologiques par lesquelles un organisme reçoit des informations sur certains éléments du milieu extérieur, de nature physique (vue, audition, sensibilité à la pesanteur, toucher) ou chimique (goût, odorat)*»; «3. *Ce que quelque chose signifie, ensemble d'idées que représente un signe, un symbole*»; «5. *Raison d'être, valeur, finalité de quelque chose, ce qui le justifie et l'explique*» (https://www.larousse.fr/dictionnaires/francais/sens/72087, accessed April 12, 2024).

[10] Notably, enactivism is the address of research that has investigated how embodied, biological entities make sense of the environment they encounter. See, for example, Thompson 2007; Varela et al. 1991. For what concerns enactivist studies on affectivity, our paper is indebted to Giovanna Colombetti's notable research on situated affectivity, quoted various times throughout the paper.

3. A Case Study: Human Olfaction

The co-emergence of the embodied agent and their ecological "scene" is thus at the core of the concept of ecological plasticity. The word *scene* is etymologically tainted by visual connotates: in classical Latin, *scēna* is the background against which the performance of a play takes place; in Ancient Greek, σκηνή originally denoted any light construction of cloth hung between tree branches to provide shade. This word, therefore, discloses a sense of delimitation, of giving form – possibly, through a game of lights and shadows – in which a play can acquire its meaning and legitimation. Our aim in this paragraph is to develop an analysis of the co-metamorphosis of the scene and an agent – their plastic co-emergence – set in a non-visuocentric scenario: namely, the one of the olfactive scene in humans. This field is particularly apt to deepen a theory of ecological plasticity: due to the lack of attention it has traditionally received, it can be useful to open new insights to put into question our visualist biases, that tend to posit the independence of subjects and objects. [11] However, two points have to be clarified here. The first one, is that the choice of focusing on this sense is not antithetical to the idea that human experience is strongly multimodal: the talk of olfaction lies in the conviction that to analyse one perceptual modality in isolation is an intellectual abstraction. [12] The second one, is that the anthropocentric point of departure (the focus on *human* olfaction) is here adopted with the aim of its deconstruction, as it will be shown by focusing on the role of the microbiome.

What does it mean, to reflect on the olfactive scene? The perception of smells discloses a scene that envelops, surrounds and moves the subject in various affective ways – smells can make subjects feel *at home*. [13] Not only does the absence of the aroma of the world – a condition called *anosmia* – erase the pleasure of being in it, but it dissolves the very feeling of inhabiting a world: the de-odorization of the experience is reported as triggering a sense of «detachment, dissociation and unreality» (Watson et al. 2021, 11). Olfaction is characterized by the pervasive presence of a hedonic tonality (Ferdenzi et al. 2015; Martínez 2015; Skrzypulec 2023; Yeshurun & Sobel 2010): when we sniff, we are struck not only by the qualities of the smell itself, but also by the affective value that a smell has for a subject, where «"affectivity" refers to the capacity of possibility to be "done something", to be "struck" or "influenced" [...]. It refers to the capacity to be personally affected, to be "touched" in a meaningful way by what is affecting one» (Colombetti 2014, 1-2). [14] In this sense, emotions are affective states, but not all affective states are emotions, as «one is affected when something merely strikes one as meaningful, relevant, or salient» (Colombetti 2014, 2). The experience of odours, according to ecological theories of olfactory

[11] On vision as the sense of detachment, see Jonas (1954). On the dominance of vision in the paradigm of research on the senses, see Hutmacher (2019).

[12] See Fulkerson 2020, O'Callaghan 2019. We also acknowledge the arbitrary nature of the traditional Western penta-partitioning of the senses (Classen 1993). More generally, we adopt the view that the senses should be considered not in abstract isolation (as in artificial and controlled encounters with the world, the usual situations recreated in laboratory settings). Rather, the activity of perception should be comprehended in an ecological complexity. This is a principle that, as one of the main sources of inspiration for embodied approaches, J. J. Gibson has notoriously defended in his works (see, for example, Gibson 1966, 1979).

[13] The olfactive scene has been also investigated in the study of atmospheres. For example, see Griffero 2022, Mancioppi 2023, Stenslund 2015. Studies on atmospheres are close in spirit to our approach, as they highlight the relational and affective aspects of perceptual activity.

[14] More generally speaking, in the philosophy of perception there have been, recently, various attempts to recognise the affective component of perception, not only for what concerns olfaction. Those studies distinguish the sensory from the affective

perception, [15] is strongly synthetic and «multidimensional, with odour representations coming to integrally include, for example, both multimodal components (e.g., taste) and affective component» (Wilson & Stevenson 2006, 8). As Andreas Keller (2016) states, olfaction has evolved to be an evaluative sense, more than a descriptive one. [16] *Smellscapes* are not just about the presence of certain smells in the atmosphere, but, more interestingly, they include the affective tonality that smells elicit in our body: as Porteous (1985, 375) writes, «the smellscape is an emotive environment, not an intellectual one». [17] Those complex affective processes strongly depend on cortical plasticity and mnemonic processes, as «experience and cortical plasticity are not only important for traditional associative olfactory memory» (9), but they rather play a constitutive role in olfactive perception. [18] In this sense, «human olfaction demonstrates a high level of plasticity» (Wilson & Stevenson 2006, 187). This means that smells are not simply good or bad, intrinsically *homely* or *unhomely*. Certain stimuli are universally perceived as being unpleasant by humans, but the majority of the odorants trigger an affective response that depends on the cultural norms a subject is exposed to (Classen et al. 2002; Kapoor 2022), the biography of the subject itself, their internal state at the moment of the sniffing (Plailly et al. 2011), and the context in which the stimulus is presented. [19] In line with this multiform variety, Wilson and Stevenson (2006) problematize the idea that particular features of a chemical stimulus generate systematic reactions.

To smell, does not just mean to keep track of the qualities in the atmosphere: it implies being moved – to experience psycho-physical reactions – by the pleasantness or unpleasantness of the scents and, through this formative movement, to correlatively give form to the environment. This exemplifies what we mean by the concept of ecological plasticity. The incorporation of the body of the subject in the metamorphic zone is a constitutive part of the experience of smells: as a grass blade, our bodies swing, moved by the scented breeze. And that is how a certain aroma acquires hedonic values for our subjective experience. But it would be an error to consider this swinging to merely be passive movement. As the anthropologist David Le Breton writes, the senses are not neutral ways of accessing the environment, as they were «windows» on the world, rather, «they are filters that trap and retain only what we have learned to put there or what we seek to identify by mobilizing our resources» (Le Breton 2022, 3-4). Accordingly, perception «is a process that involves *interpretation* and the ascribing of meaning; it is not a stimulus-response system» (Wilson & Stevenson 2006, 249, our emphasis). Subjects learn to recognize familiar smells and they contextually learn to value them as being pleasant or unpleasant – and this evaluation primarily consists of bodily reactions: think of your experience when meeting smells

[15] See Young 2016, 4. Young also cites Gottfried (2010) as a proponent of an ecological theory of olfaction.

[16] This is coherent with the admission of an affective component: as, in the previous quote, affectivity concerns what is relevant for the individual's interests.

[17] Psychological studies, for example, sometimes measure the affective component of an olfactory experience by measuring the level of arousal (Bensafi et al. 2002).

[18] Rachel Herz has conducted several experiments on how associative processes can influence the affective component of a smell. See Herz 2003, 2006, Herz et al. 2004, Herz & Von Clef 2001.

[19] «Affect is not tightly scripted. It is not a predetermined response automatically triggered by stimulus structure. Except for a few notable cases, such as cadaverine (even that yields variations), most smells are markedly ambiguous in their hedonic assessments by humans» (Barwich 2020, 130). See Chrea et al. 2009; Ferdenzi et al. 2011, 2013; Herz & Von Clef 2001.

components of perception; in doing so, they inherit a distinction that has been developed particularly in the studies concerning physical pain. See, for example, De Vignemont 2023, Fulkerson 2020. The work of De Vignemont is particularly useful as it traces a taxonomy of the various positions of the supporters of affective perception.

that for you are disgusting, arousing, or deliciously fragrant. Through olfaction, subjects are tuned to an «emotional map» (Tafalla 2013, 1293), a scene that is filled with phenomenal affective qualities that depend on synthetic processes, in which embodied agents plastically learn to interpret the environment and assign value to it.

Coming back to the perception of *homely* smells: to inhale a smell that has *for us* the phenomenal properties of warmly and conformably making us feel at home or in a safe space, means that our body has been morphologically tuned, through the years, to the practice of assigning positive value to that kind of odour that we usually encounter in safe settings. The environment plastically shapes bodies and their tendencies to make sense in one way or another to the stimuli they encounter, through a process of learning; conversely, bodies affectively organize the environment – they do not perceive chaotic fragments of senseless perception. The sensing is full of *sense*. As Colombetti puts it, «all living systems are sense-making systems, namely […] they inhabit a world that is significant for them, a world that they themselves enact or bring forth as the correlate of their needs and concerns» (2014, 1-2). In this sense, olfaction is a modality in which the co-formation of the subject and a correlative *sensible* environment is evident. The possibilities of my olfactory perception (the *scene* in which my perceptual play takes place) are informed by my previous interactions with the environment: there are constraints on what I can perceive as being a discontinuity in the olfactory atmosphere (familiar smells are usually kept under the threshold of consciousness and not registered in consciousness as being the rupture of a *continuum*), of what I can perceive as being pleasant or unpleasant, and these morphological bounds manifest the form of my previous interactions. This form is continually renegotiated: it is *plastic*. Subjects, through exposition and repetitive association, change their hedonic evaluation of smells – some odours that at first exposure cause uneasiness might be perceived, with time, as being familiar or comforting.

The interactions with the environment do not shape our olfactory abilities only via the malleability of our capacity to hedonically interpret the environment. The discourse on plasticity usually refers to the plasticity of the brain (Malabou 2009), as being shaped and pruned by experience is a characteristic of the synaptic substance, and this morphological re-organization of the neurological matter is at the core of the cerebral processes and their notable capacity for adaptivity. However, the body itself is a plastic and continuous re-negotiation of surfaces and their interfaces (Oele 2020), and the case of olfaction can help illuminate this aspect of dynamic configuration of the ecological borders.

Recent studies focus on the role of nasal microbiome in overall human health, and in particular in the functioning of the olfactive system (Biswas et al. 2020; Koskinen et al. 2018; Lazarini et al. 2022). The term "microbiome" refers to the system of microorganisms which live in and on a host organism, and with "nasal microbiome" it is meant the community of microorganisms that inhabit the mucosa of the nasal cavity. This colony of microbes modulates the olfactory epithelium, thus influencing the perceptual olfactory capacities (Royet & Plailly 2004). The concept of *symbiosis* is usually employed to describe this kind of relationship between microbiome and host (see, notably, Margulis 1971). However, to talk about

colonizers and colonized suggests the implicit adoption of a certain ecological perspective – in this case, the anthropocentric one. Also, the relationship of symbiosis may be interpreted as occurring among individuated, discrete and autonomous biological entities. To avoid this segmentation, the term *holobiont* is used to refer not to a complex of «as autonomous entities but rather [to] […] biomolecular networks» (Bordenstein & Theis 2015, 1). This conceptual shift is called for by the fact that, for example in humans, the microbiome is constitutive of key biological processes such as the immune system, the functioning of cognitive capacities and also the genetical basis of the individual phenotype – functions that are usually considered to be individuating of the organism: this complexity of biological interrelations put into question the concept of an individual biological entity (Rees et al. 2018). As said, the olfactory capacities are influenced by the type of microbes that enter in relation to the nasal mucosa. In particular, levels of performance in olfaction (in particular, odorant threshold and discrimination) in adult healthy subjects are correlated with the presence of certain microbial communities (Koskinen et al. 2018). This means that the perceptual ability to discriminate and sense odorants in the environment depends on the richness and composition of the microbiome in the nose, illustrating how olfactory perception relies on a complex network of interactions that plastically morph and define surfaces, questioning the idea of biological enclosure.

As mentioned, the analysis of microbiome is an innovative area of research that requires the reframing of the classical concepts of biological individuality, of organism, body and interfaces. [20] In particular, the role of the nasal microbiome in the olfactive capacity is a topic still in need of further investigation (François et al. 2016; Lazarini et al. 2022), and it requires to embrace an ecological perspective towards the perceptual ability of a biological system, in which the perceptual endeavour becomes an extended process in which *continua* of bodies plastically enter in complex affective relationships. Sustaining the adoption of such a perspective, we think that the concept of ecological plasticity highlights the complexity of ecological interrelations, the irreducibility of activity and passivity, the co-formation of biological complexes and their correlative aesthetic scenarios. Those biological reflections are part of a larger conceptual embroider co-habited by ethical problematizations of the concept of the self and the body «figured as discrete and coherent individual subjects, and as fundamentally autonomous» (Neimanis 2017, 2). [21] The development of the Western concept of the individual as confined in a privatised space delimited by the borders of the skin has historical origins, dependent on socio-economic dynamics and structures of power (Lupton 1998). The properties of openness and fluidity have been historically attributed to subjectivities and bodies that derange from the norm (Bordo 1993) and removed from the idealization of the neutral subject (Grosz 1994). Recently, many feminist enterprises have tried to question the «rather dry, if convenient, myth» of the «[d]iscrete individualism» (Neimanis 2017, 2), for example through the concept of fluidity, «as bodies of water we leak and

[20] See, for example, in philosophy of mind: Boem et al. 2021. For a review of the present-day biology's approach to these questions, see McFall-Ngai et al. 2013.

[21] Feminist thinkers have often expressed antibiologistic position, to support a strong social constructivist take on the body. But, for example, Wilson argues that «sustained interest in biological detail will have a reorganizing effect on feminist theories of the body», and that «exploring the entanglements of biochemistry, affectivity, and the physiology of the internal organs will provide us with new avenues into the body» (2004, 14). See also Birke 2020, Wilson 2015.

seethe, our borders always vulnerable to rupture and renegotiation» (2). An ecological deconstruction of the myth of organismic autonomy, and a consequent focus on the inescapable web of interrelations and co-dependence of living systems, pave the theoretical way for an ethical practice of *sym-poiesis* (Haraway 2016). This is the type of *ethos* that we hope the concept of ecological plasticity might inspire, as the emphasis on the necessary intermingling of living beings calls for our morphological responsibility. The *hybris* of the human subject is in fact humbled by the constitutive dependency on other forms of life – ecosystems that are, among other things, affected in complex and unexpected (but not chaotic) ways by the many actions the humans themselves perform on the environment.

Emblematically, the act of smelling is, therefore, a Janus complex. The perception looks back to past interactions, as previous networks of biological encounters inform the capacities of the holobiontic complex of both discriminating smells and assigning a hedonic value to them. But smells also face the future, as being exposed to a certain environment and smelling a certain odour opens to a change in the future conditions of olfactory possibilities: being exposed to a certain aroma can modify the surfaces of the biological complex that is the subject of the perception, but also of the hedonics of the next encounter with that very scent – that is to say, the form of the affective perception. The subject and their smellscapes are therefore intertwined in a plastic dance, in which a continual bi-stability between what is contained and what contains, what gives and what receives form, can be described as a complex e-co-affective metamorphosis. In this dynamic and recursive interaction lies the lymph of ecological plasticity.

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