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Aesthetic Terraforming. Cosmo-morphologies for Troubled Times

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ABSTRACT
Although more common in science-fiction than in philosophy, the concept of terraforming intercepts a particularly significant vein of contemporary thought. The world-making practices belong to an ancient morphological art that brings together humans and other species: every living being, as such, shapes an Earth, thus becoming a condition of life itself. Moreover, every living being does so together with other beings, following the systemic structure of life.
This paper aims to introduce a cosmo-morphic aesthetics through the concept of terraforming, which literally means the act of shaping a planet into a habitable world. We will claim that this concept evokes different understandings of the traditional notions of artefact, creative act and artistic doing, particularly in relation to the ideas of non-objectivability, deep agency and ecopoiesis.

KEYWORDS
Aesthetic morphology, Hyperobjects, Material Agency, Ecopoiesis

The notion of 'terraforming', belonging to science-fiction and planetary engineering, refers to "the process by which a planet is made Earth-like, and by implication a world capable of supporting human life".[1] As it happened with Earth, some cosmic entities (planets and moons) can theoretically be transformed into biospheres by endogenous and exogenous factors: life on other planets can not only be discovered, but also established from scratch by civilizations of cosmic growers and gardeners. Although technically improbable, the idea of seeing ourselves as such figures is capable of cherishing new utopias and collective narratives that move beyond literary fiction.[2] Drawing on recent projects and reports realized by NASA, as well as on a rather long-standing research in

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[1] Beech M., *Terraforming: The Creating of Habitable Worlds*, Springer Science, New York 2009, p. 9. See also Fogg M.J., *Terraforming: A Review for Environmentalists*, in "The Environmentalist", 13/1 (1993), pp. 7-17, and *Terraforming: Engineering Planetary Environments*, SAE International, Warrendale 1995.

[2] Cf. Pak C., *Terraforming: Ecopolitical Transformations and Environmentalism in Science Fiction*, Liverpool University Press, Liverpool 2016.

astronomy and astrobiology, some philosophical studies have dealt with the ethical implications of terraforming.[3] Our interest, however, will focus on how terraforming results into a concept that lies at the intersection of certain wide-ranging theoretical junctions, such as planetary thinking and the anthropocenic turn, world-making, and neo-cosmological reflections.

As astro- and xenobiologists know, whatever 'life' we could eventually find outside our planet will not necessarily involve the conditions that we, as earthlings, are acquainted to. The only true precondition of xeno-life is the relationship of mutual transformation between living systems and environment, probably in the sense of a non-equilibrium set of conditions:[4] the "intra-action of living-systems and habitability"[5] is the ontological fact that humans would have to replicate in order to create a second Gaia. The sheer conceivability of world creation, then, raises the question on what a lifeform is and simultaneously on how to deal with a lifeform – i.e., what kind of practices it evokes and requires. We will claim that a form is exactly that relation of inter-ontological coexistence in an Earth-shaping texture, hence endowed with morphogenetic and territorial features. From this morphological statement follows that establishing a plane of forms implies eliciting the possibility of a complex range of ontological communications that would overcome our faculty of direct control and causation. Finally, we will argue that this domain of solutions has the power of mobilizing our aesthetic categories, encouraging us to rethink our concept of creative production.

1. *Every Form Shapes an Earth*

Haraway defines terraforming as an "old art" that brings together humans and other species in converting (and possibly re-converting) a space into a habitable place.[6] In this sense, existing, for

[3] Cf. Braun D., *Cost Benefit Analysis of Space Exploration: Some Ethical Considerations*, in "Science Direct", 25 (2009), pp. 705-29; Kramer W., *Colonizing Mars: An Opportunity for Reconsidering Bioethical Standards and Obligations to Future Generations*, in "Futures", 45/5 (2011), pp. 545-51; French R.H., *Environmental Philosophy and the Ethics of Terraforming Mars: Adding the Voices of Environmental Justice and Ecofeminism on the Ongoing Debate*, master thesis, University of North Texas, 2013; Schwartz J.J., *On the Moral Permissibility of Terraforming*, in "Ethics & The Environment", 18/2, 1 (2013), pp. 1-31.

[4] Pryor A., *Living with Tiny Aliens: The Image of God for the Anthropocene*, Fordham University Press, New York 2020, p. 37.

[5] Ivi, p. 32.

[6] Haraway D., *Staying with the Trouble: Making Kin in the Chthulucene*, Duke University Press, Durham 2016, p. 11.

any earthly being, means to co-exist, to ontologically cooperate and subsist on a complex network. Every living being, as such, shapes an Earth, thus becoming a condition of life itself. More importantly, every living being does so together with other beings, thus constituting the operative structure of an ecosystem. Our planet, for example, exists in deep time as an articulation of processes performed by a multitude of agentive elements, such as water, single-celled beings, bacteria, plants and so on:[7] it is hard to claim that planet Earth precedes its population, since it is not possible to conceive it as a floating cosmic rock gifted with life. Life happens *to* a planet, not *on* a planet.[8] Earth presents itself as a super-ecosystem, a multitude of symbiotic and coevolutive relations,[9] a network of ontological alliances. From this perspective, our planet is an absolute contingency that can hardly be reproduced, even on a speculative level: such ever-becoming concrescence of ontological realms is just too complicated to be represented and appropriated, let alone replicated. This is why an Earth is not a world: a *mundus* is always a *locus mundus*, a discernible and ordered place (the moralized nature), whereas an Earth is essentially a *territory*, a place in which a human subject cannot project himself completely. Only human beings have worlds, and can ultimately make a world their own.

An Earth-shaping activity, instead, is prerogative of the living in general. In this sense, one could maintain the Greek concept of *kosmos* only by radically de-anthropomorphizing it. Every living being constitutes itself as a *form* as it bears and invents a specific line of becoming together with a set of given conditions. We use the notion of 'form' for every agentive being endowed with expressive consistency, i.e., characterized as a process of formation taking place in the differential continuity between individual and territory. A form is not simply a finite individuality; rather, it is a morphing relational essence. A territory, symmetrically, is not necessarily a surrounding place or a biological ecosystem: it is an ontological niche, a set of material and immaterial trails and activities. An individual, say a migrating bird, *is* its territory, because it consists in the contingent expression of characterizing behaviours (certain migration routes); insofar as it is a process of expression, this essential relation is neither predetermined nor fixed once and for all. Analogously, a

[7] Cf. Rudwick M.J.S., *Earth's Deep History: How It Was Discovered and Why It Matters*, University of Chicago Press, Chicago 2014.

[8] Cf. Grinspoon D. *Earth in Human Hands: Shaping Our Planet's Future*, Grand Central Publishing, New York 2016, p. 77.

[9] Cf. Margulis L. *Symbiotic Planet: A New Look at Evolution*, Basic Books, New York 1998; Lovelock J., *Gaia: A New Look at Life on Earth* (1979), Oxford University Press, Oxford/New York 2000.

biological organism is the epigenetic unfolding of a genetic code; the hunting expedition is the developmental unfolding of the wasp's instinctive drive; the mapping chants are the cultural unfolding of the Australian tribes narrated by Chatwin.[10] "Every form is the dream of a world, that thinks itself while doing itself"[11] – or better, the dream of an Earth.

This cosmo-morphological view encompasses specific concepts such as those of territoriality, milieu and niche. In *A Thousand Plateaus*, Deleuze and Guattari offer an extended interpretation of the ethological notion of territoriality as a heterogeneous plane of patterns that creatively re-organizes biological functions as behaviours on an ecological level. For Deleuze and Guattari, a territory is the material *a priori* of becoming; as such, it is intimately exterior and divergent, never simply defensive.[12] It grounds what geographer Augustin Berque calls "*mouvance*", the co-implication of belonging and mobility.[13] A territory represents an exteriority, not because it stands in contrast with an individual interiority: a living activity can never be reduced to a mechanic combination of internal drives and external stimuli,[14] or to a sequence of actions and feedback. Unlike self-organizing physical systems, the living individual mobilizes the material and energetic flows that cross it by refining and perverting given rules.[15] This is the reason why a living node does not represent a negative physical term, as in the concept of negentropy.[16] By inhabiting a territory, the individual establishes itself as a singular way of composing with the world, thus gaining the possibility of differing from its species.[17]

A form coincides with the affective landscape it can trace: its ontological order is "trajective"[18], as in an expressive – and therefore plastic – orientation. The territorial essence of the form, then,

[10] Chatwin B., *The Songlines*, Franklin Press, Minneapolis 1987.

[11] Bailly J.-C., *Le Partit-pris des animaux*, Christian Bourgois, Paris 2013, p. 46.

[12] Cf. Parry J., *Philosophy as terraforming: Deleuze and Guattari on designing a new Earth*, in "Diacritics", 47/3 (2019), pp. 108-38.

[13] Cf. Berque A., Écoumène. *Introduction à l'étude dex milieux humains*, Belin, Paris 2001.

[14] Montebello P., *Métaphysiques cosmomorphes. La fin du monde humain*, Les presses du reel, Dijon 2015, p. 139.

[15] Cf. Koutroufinis S.A., *Beyond Systems Theoretical Explanation of an Organism's Becoming: A Process Philosophical Approach*, in S.A. Koutroufinis (ed.), *Life and Process. Towards a New Philosophy*, De Gruyter, Berlin/Boston 2014, pp. 99-132.

[16] Cf. Bailly F., Longo G., *Biological organization and anti-entropy*, in "Journal of Biological Systems", 17/1 (2009), pp. 63-96; Longo G., Montévil M., 'Biological Order as a Consequence of Randomness: Antientropy and Symmetry Changes', in G. Longo, M. Montévil, *Perspectives on Organism*, Springer, Berlin/Heidelberg 2014, pp. 215-48.

[17] Deleuze G., Guattari F., *A Thousand Plateaus: Capitalism and Schizophrenia* (1980), University of Minnesota Press, Minneapolis/London 1987, p. 322.

[18] Cf. Berque, cit.

is a morphing transcendental. Nothing like von Uexküll's "bubble", this "shattered" and open milieu[19] is ubiquitous and oblique, but also dense like a path unfolding before the eyes of the searcher. Let us define the notion of territory as the zone of expression that always exceeds the *exprimendum* (that is an intensive set of valences), constituting its effectuality. A morphogenetic process always evokes a landscape of becoming, a habitability, that is also the constant presence of an exteriority and the possibility of bending previous regularities; a form is exactly this genetic anchoring, a living orientation and inventive extraction of unexpressed valences. In biology, all this has to do with the reassessment of ecological contingence. We can say for example that like a biological niche, a territory is constructed by modification of evolutionary constraints and transmitted by ecological inheritance.[20] In this sense, there is nothing comparable to immutable and homogeneous laws in a living becoming; there are instead transmitted generative patterns which perpetually re-organize themselves through expressive realization, a process of "delocalization of memory".[21] A whole new metaphysics could be built on this bio-philosophical principle: the being depends on manifestation, the form consists on material generativity.[22] If life is to be found in novelty, novelty inhabits relations, assemblages, morphogenetic trajectories – the fibres that form a contingent and mostly non-actualized space of organization.

The first result of our inquiry is that a territory cannot be appropriated neither by its inhabitants, nor by hypothetical observers: the first ones being part of it, the latter failing to grasp its intrinsic features. As the only viable knowledge in life sciences – in Can-

[19] Cf. Buchanan M., *Onto-Ethologies: The Animal Environments of Uexküll, Heidegger, Merleau-Ponty, and Deleuze*, Suny Press, New York 2008, p. 175.

[20] Pocheville A., *La Niche écologique. Concepts, modèles, applications*, doctoral thesis, École Normale Supérieur de Paris, 2010; Tedesco S., 'Niche', in F. Vercellone, S. Tedesco (Eds.), *Glossary of Morphology*, Springer, Cham 2020, pp. 355-58.

[21] Miquel P.-A., *Sur le concept de Nature*, Harmann, Paris 2015, p. 163; cf. also Prochiantz A., *Qu'est-ce que le vivant?*, Seuil, Paris 2012, pp. 23-39.

[22] The first step toward this "other metaphysics" was certainly made by Darwinian evolutionism; nowadays, the overcoming of modern synthesis – centred on adaptive incrementalism and genetic inheritance – has brought renewed focus on ecological plasticity, developmental expression, and the role of epigenesis (cf. Pigliucci M., Müller G.B., *Evolution: The Extended Synthesis*, MIT Press, Cambridge, Mass. 2010; Huneman P., Walsh D.M., *Challenging the Modern Synthesis. Adaptation, Development, and Inheritance*, Oxford University Press, Oxford/New York 2017); and, in general, on an ontology of *ethos* instead of laws. The last 'biological law', in this sense, was that of genetic program (cf. Keller E.F., *The Century of the Gene*, Harvard University Press, Cambridge, Mass. 2000; Malabou C., *Before Tomorrow: Epigenesis and Rationality*, Polity Press, Cambridge 2016). This paradigm negates the possibility of thinking a form as separated from its relational environment and of excluding the history of the individual from variation.

guilhem's words[23] – is a form of *pathos*, it is impossible to have a non-ecological notion of the ecological fact. A territorial relationship cannot be reduced to and treated as a simple *datum*, devoid of its teeming germinative flows that require cognitive proximity and ontological immersion. Taking planet Earth as *an* Earth, then, implies renouncing to consider it as a transparent space, an already exhausted world. The problematic realization of Kant's cosmopolitical dream has found completion with the acknowledgment of human capacity of acting on a geological scale, as a consequence of the global extension of modern society; through "the imposition of the same system of exchange everywhere […] we achieve something that resembles that abstract ball covered in latitudes and longitudes", of which we can only say: "no one lives there".[24] After all, as noted by Carl Sagan and his group,[25] it would be almost impossible to recognize earthly life from space without a previous conception of what life is. It is no case, then, that the total moralization of nature culminates in the ecological catastrophe, when the planet becomes completely disposable.

Our planet consists in the pulsating effect of a multitude of morphogenetic relations enmeshed in a common process, and this vital balance cannot be subject of symbolical and technological appropriation. This fundamental point, Heideggerian in inspiration, marks again the difference between an Earth and a world. A world is the narrated and calculated space that embodies the dream of Kafka's land surveyor: the final correspondence of nature and limit, the complete moralization of nature. An Earth, instead, is an internal activity with no origin and purpose, hence without possible narration. The problem of an Earth is not that of limits, but rather that of contingent genetic effectuation.[26] The Earth of our planet, for example, has refined a completely contingent toolkit for self-reproduction and transindividual self-regulation, which is however nothing but "a moment in the greater dynamic unfolding of what is not life".[27] The human species is ontologically immersed in this hyper-territory that proliferates by letting axiomatic lines emerge from itself, without thematising its own contingency. The faculty of abstraction is clearly a possibility provided by life itself, a path that

[23] Canguilhem G., *The Normal and the Pathological* (1966), Zone Books, New York 1991, p. 222.

[24] Spivak G.C., *An Aesthetic Education in the Era of Globalization*, Harvard University Press, Cambridge (Mass.) 2012, p. 338.

[25] Sagan C. *et al.*, *A Search for Life on Earth from the Galileo Spacecraft*, in "Nature", 365, n. 6448 (1993), pp. 715-21.

[26] Cf. Montebello, *Métaphysiques cosmomorphes*, cit., p. 81; and also Malabou, cit.

[27] Tusa G., *De-limitations: Of other Earths*, in "Stasis", 9/1 (2020), p. 178.

earthly life, in its blind evolutive search, has opted for. The question is whether it represents a good and viable evolutive strategy, or it will bring a large portion of its agents to extinction. The fact that mankind can raise the ecological question does not mean that it can resect its own bonds of territorial belonging without disappearing.

In the specifically human modes of an Earth-shaping praxis lies the possibility for mankind to anchor in its own reality. Human activity can be considered as a particular regime of the morphogenetic entanglement that forms every territory and planet Earth as such: a way of making ontological alliances and expressing a psychical individual in a material and symbolical ecosystem. But this specific kind of activity must be connected to the countless other ways in which nature mobilizes its flows. The very fact that man does nothing alone establishes a plane of communication on which human activity is homologous to that of any other living being, at least enough to form ontological and existential synergies. Human beings always act by partaking a greater process of concrescence. To think of a cosmopoietic practice, then, it is necessary to acknowledge that an agency is always commensurate, co-existential.

2. *Crafting a Planet*

Let us return, then, to the concept of terraforming in its proper sense. What does it mean to shape a planet into a habitable Earth? According to what said so far, it could not possibly mean to fabricate a physico-chemical space through the work of enormous instruments, imposing the form dictated by certain earthly conditions on brute cosmic matter. The misguided dream of alter a hostile environment into one that is Earth-like through "the indomitable grinding of colossal machines"[28] resembles the boldest Promethean projects of the 20th century, like Mao Zedong's Four Pests Campaign or the desiccation of the Aral Sea. Conceiving a molar action on a planetary scale can easily represent the culmination of man's delusions of grandeur; but it can also be the speculative shore on which these delusions finally shipwreck. Faced with the planetary task, we have to acknowledge the inadequacy of our current technology; we may also realize, then, that life can only be *elicited*, and therefore is not subject of an engineering action. Shaping a new territory suitable for mankind requires *inducing* the growth of certain conditions by elicitation of given materials and inoculation of

[28] Beech, cit., p. 7.

germinal elements endowed with their own agency. A cosmopoietic process cannot be mechanically caused: it can only be triggered as further expression of pre-existing formative planes. This means not only that a 'second Earth' would hardly be similar to the first, but also that we, as their inhabitants, will most probably have to modify ourselves to dwell upon it.

Let us think of what Darwin called the "action of the worms", beings that exist by transforming the land they inhabit; or, even more, of the action of microbes, that performed most of the terraforming task on planet Earth, far below the mesoscopic scale of human experience[29]. On other planets, this task would be carried out by pioneer organisms capable of living in extreme conditions, the extremophiles,[30] or perhaps by technical individual with a high level of autonomy. In order to terraform a hostile planet, man would have to make decisive alliances and aim to ever vaster and more stable agentive networks; thus, human action would see its causal influence decline in favour of its communicative power. A terraforming activity would resemble an exercise of sowing, directed toward other environmental processes, like stimulating chains of catalytic reactions, establishing a nitrogen cycle, inducing a runaway greenhouse effect and the creation of an atmosphere. Now, this subterranean and indirect kind of doing evokes a whole different view on production in general. In order to be effective, the eliciting action cannot lapse into a relationship of exploitation; it has to be lateral and concomitant with its means, respectful of the ontological order that it crosses. Thus, the scheme of the action is no longer that of a subject that employs an object (instrumentalization) or of a master that employs a worker (*maîtrise*): it is rather close to what Gilbert Simondon describes as "technical life", a peaceful coexistence between men and their means.[31] More generally, it refers to the realized symbiosis of man with the living and the non-living. Yuk Hui uses the term "cosmotechnics" to name this convergence of practices and agentive environment;[32] Haraway, instead, describes the art of "sympoiesis" as the vital engagement

[29] Cf. Falkowski P.G., *Life's Engines: How Microbes Made Earth Habitable*, Princeton University Press, Princeton (NJ) 2016.

[30] Cf. Thomas D.J. *et al*., *Extremophiles for ecopoiesis: Desirable traits for and survivability of pioneer Martian organisms*, in "Gravitational and Space Biology", 19/2 (2006), pp. 91-103.

[31] Cf. Simondon G., *On the Mode of Existence of Technical Objects* (1958), University of Minnesota Press, Minneapolis/London 2016.

[32] Cf. Hui Y., *The Question Concerning Technology in China: An Essay in Cosmotechnics*, MIT Press, Cambridge (MA) 2016 and *On Cosmotechnics: For a renewed relation between technology and nature in the Anthropocene*, in "Techne", 21/2-3 (2017), pp. 1-23.

in the game of eco-ontological contagion.[33] Everything changes in the way we think of productive practices when we realize that "earthlings are never *alone*".[34]

The first problem to address is the necessity of rethinking the concept of objectivity. In activities that take part in an Earth-shaping process, the object is implicitly represented by an environmental and diffused determination that can never be globally represented, nor moulded directly. The object in question overcomes the scale of individual experience, not necessarily because of its spatial or temporal magnitude, but also by virtue of its effects and significance. Timothy Morton has coined the term "hyperobject" for describing objects that surround and penetrate the individual without being 'there' at his disposal. Ecological interconnectedness, in Morton's vision, is "viscous", nonlocal, and re-emerges in time.[35] Without contradicting the critical inflection that animates this theory, we can refer this argument to a more general "metaphysics of mixture",[36] in the morphological sense we have already described. An Earth is an object from which one cannot distance himself, that envelops one's experience and grounds one's existence without ever being at hand (and when it is at hand, it usually becomes something else). A represented planet can be dominated in its entirety, it can be subject of melancholic contemplation or burning optimism; but it also ceases to be a zone of expression and becomes a potential instrument of action. Drawing on Morton's claims, Ben Woodard hints that in order to recognize an object as a fibre of a territory that we ourselves are in, we could perform an exercise of "reverse framing": instead of placing it into the representative frame of our practical alternatives, framing our own action in the indefinite dynamic of a plastic and contingent nature.[37]

By taking place within a non-discreet, environmental field of presence, human action loses its role of primal source of agency. Without confronting the wide debate on distributed agency,[38]

[33] Cf. Haraway, cit.

[34] Ivi, p. 58.

[35] Cf. Morton T., *Hyperobjects: Philosophy and Ecology After the End of the World*, University of Minnesota Press, Minneapolis 2013.

[36] Coccia E., *The Life of Plants: A Metaphysics of Mixture* (2016), Polity Press, Cambridge 2018.

[37] Woodard B., *Uncomfortable Aesthetics*, in R. Mackay, L. Pendrell, J. Trafford (eds.), *Speculative Aesthetics*, Urbanomic, Cambridge (Mass.) 2014, pp. 106-11.

[38] Cf. Sullivan H.I., 'Agency in the Anthropocene: Goethe, Radical Reality, and the New Materialisms', in J.A. McCarthy (ed.), *The Early History of Embodied Cognition 1740-1920*, Brill, Leiden/Boston/Köln 2016, pp. 284-304; C. Dalmasso, *Things that matter. Agency and performativity*, in "Aisthesis", 13/1 (2020), pp. 155-68.

we can start by noticing that by attributing whether a symbolical transparency or an irreducible opacity to nature and objectivity, many different trends in contemporary philosophy explore an idea of shared and non-strictly human agency.[39] Generally, harmonizing human agency with the material and vital concrescence of activities that surround it implies reuniting "the conditions of possibility of knowledge with the causes of existence",[40] that is understanding cognition as a part of reality itself. An action cannot extract itself from its course without losing grip of reality and ultimately self-destructing. An ontological territory bears just enough abstraction to prolong its morphogenetic flows. The consistence of an agentive instance does not lie in its degree of detachment and superordination, but rather in its creative effectuality, in its capacity of transformative relations: transcendental is the living creation of norms. To ontologically consist – this is Simondon's *dictum* – means to have generative relations; "the Being", writes Merleau-Ponty, is "*what requires creation* for us to experience it".[41] An Earth is always concrete, and perpetually goes beyond itself by virtue of plasticity.

By exploring the analogy between natural becoming and human praxis in the frame of an "ethics of planetary flourishing",[42] we can let emerge the features of a general morphological paradigm, for which we introduce the notion of *deep creativity*. To the morphological quality of plastic consistence corresponds human "metaplasticity",[43] that is the faculty of privileging plasticity through plasticity. Thanks to this aspect, symbolic production is much faster and divergent than natural production, and intrinsically tends to acceleration. Just like natural morphogenesis, cultural morphogenesis is characterized by the faculty of creating the unpredictable and the unforeseen, but also by the capacity of fixing the variation through methods of transmission. Human action must be provided with *evolvability* (a

[39] Cf. for example the biosocial perspective that, drawing inspiration from Tim Ingold's philosophical anthropology, integrate human and biological becomings (cf. Fuentes A., 'Blurring the Biological and Social in Human Becomings', in Ingold T., Palsson G. (eds.), *Biosocial Becomings: Integrating Social and Biological Anthropology*, Cambridge University Press, Cambridge/New York 2013, pp. 42-58), with specific regard to biocultural environments (cf. Ramirez-Goicoechea E., 'Life-in-the-making: epigenesis, biocultural environments and human becomings', in T. Ingold, G. Palsson (eds.) and *Biosocial Becomings: Integrating Social and Biological Anthropology*, cit., pp. 59-83).

[40] Simondon G., *L'individuation à la lumière des notions de forme et d'information*, Jérôme Millon, Paris 2005, p. 257.

[41] Merleau-Ponty M., *The Visible and the Invisible. Followed by Working Notes* (1964), Northwestern University Press, Evanston 1968, p. 197.

[42] Pryor, cit., p. 111.

[43] Cf. Malafouris L., *How Things Shape the Mind: A Theory of Material Engagement*, MIT Press, Cambridge (Mass.) 2013, p. 46.

long-range order of effectuality) and *robustness*,[44] which is the power of crafting ontological basins, grooves and trails. In the logic of cultural invention and transmission, the acts of genius are the analogous of mutagenic events, while the hermeneutical process of passing instances and formulas throughout generations corresponds to the subterranean work of conveying and bending established constraints. Every shift in context evokes a creative act, and every significative act sets a lineament of effects, thus transforming the context. This last feature can be defined as *adaptability*.[45]

In natural morphogenesis, a process *knows how* to do what it does without *knowing that* it is acting and without knowing that it knows. In this sense, agency is coextensive with the "propagating organization" of life itself rather than with human consciousness.[46] In more speculative terms we could say that a living act possesses itself entirely: its being is not separated from its activity. A form "thinks itself while doing itself"; a form is "primary consciousness", writes Raymond Ruyer,[47] where "consciousness" refers to a non-thematic and immediately productive contemplation, comparable to a continuous act of self-enjoyment. Even if we do not want to retrieve any kind of finalism (as Ruyer does instead), we have to give account of the fact that forms create a way of their realization in absence of subjective cognition, that is in absence of awareness of their means and goals. Natural morphogenesis is without any doubt a form of creativity. And it does not belong just – nor primarily – to biological beings: even matter, combined with energy, 'behaves' and organizes itself, possesses active and expressive qualities, grows and runs in flows.[48] "We are beginning to understand", notes Delanda, "that any complex system, whether composed of interacting molecules, organic creatures or economic agents, is capable of spontaneously generating order and of actively organizing itself into new structures and forms".[49]

[44] Cf. Minelli A., 'Biodiversity, Disparity and Evolvability', in E. Casetta, J.M. da Silva, D. Vecchi, *From Assessing to Conserving Biodiversity. Conceptual and Practical Challenges*, Springer, Cham 2019, p. 240.

[45] Cf. Miquel, cit., p. 170.

[46] Cf. Kauffman S.A., *Investigations*, Oxford University Press, Oxford/New York 2000. "What is happening in a biosphere", writes Kauffman (ivi, p. 5) "is that autonomous agents are co-constructing and propagating organizations of work, of constraint construction, and of task completion that continue to propagate and proliferate diversifying organization".

[47] Cf. Ruyer R., *Neo-finalism* (1952), University of Minnesota Press, Minneapolis/London 2016.

[48] Cf. Leach N., *Matter Matters: A Philosophical Preface*, in S. Tibbits (ed.), *Active Matter*, MIT Press, Cambridge (Mass.) 2017, pp. 18-24; see also Coole D., Frost S. (Eds.), *New Materialisms: Ontology, Agency, and Politics*, Duke University Press, Durham/London 2017.

[49] Delanda M., *Material Complexity*, in N. Leach, D. Turnbull, C. Williams, *Digital Tectonics*, Wiley, London 2004, p. 17.

As a consequence of these claims, we define a self-possessing and self-organizing practice as a practice guided by that "immediate consciousness" of which Deleuze speaks with clear reference to Ruyer:[50] a practice in which action and abstraction resonate in perpetual creative tension. Such activity would be internal to itself, but nevertheless evolvable, robust and adaptable; this would assure its communicative significance and informational value. The artistic practice, taken in its most general terms, provides us again with a useful example. The artist is bearer of a particular kind of agency that does not come from his subjectivity intended as an original and autonomous source; however, it is neither learned nor innate. The artist is able to intercept and modulate a 'surrounding' agency, that stems from a semantic exteriority. The environment of his activity is both extremely rich and open, receiving flows and forms that come from far beyond his experiential domain. Within this affective territory, the artist embodies a nonlinear and largely contingent causality to further express an environmental information: during all his life, he cultivates form as a principle; for him, a form is – in Paul Klee's words – "genesis, growth, essence", rather than "solution, result, end".[51] Understood in this way, a created form is a way of composing an Earth: an ontological ramification, a structuring of co-existences, the composition of a generative soil.

3. *Conclusions. On Ecopoiesis*

Exercising our thought over the concept of terraforming, we have come to the conclusion that human patterns of dwelling are isomorphous with morphogenetic landscapes and trajectories of living forms. The act of shaping a planet requires to explore this link, to the point of a fundamental shift from *production* to *plasticity*. We claim that the deepest consequences of this shift in paradigm emerge in the field of aesthetics, in connection with the problem of creative practice. With the term 'art', we usually designate the most refined morphogenetic balance that mankind has achieved: aesthetics aims first of all to the complete comprehension of this kind of practice. But even when it does not deal specifically with artistic phenomena, the aesthetic perspective is the one that could correct the engineering spirit of modern technology. Ethics is not

[50] Deleuze G., *Pure Immanence: Essays on A Life* (1995), Zone Books, New York 2001, p. 29.

[51] Klee P., *Notebooks. Vol. 1. The Thinking Eye*, Lund Humphries, London 1961, p. 69.

useful in this respect, unless it denies itself by drifting toward the pure manifestation of *ethos*. Aesthetics, instead, is purely a matter of consistency, to paraphrase Deleuze and Guattari.[52] It is undeniable that aesthetics – intended also, but not only, as a theory of art – is the field that directly addresses the plastic consistence that pertains to human becoming, that is the singular and concrete texture of human expression. Let us retrace our argumentations, then, in order to examine the potential effects of a morphological philosophy of terraforming on the aesthetic categories.

We have seen that if an Earth could ever be taken as a product, it would represent some kind of "hyper-object", world-object or "weather-world".[53] 20th-century aesthetics has accustomed us to the possibility of experiential reversal, in which things become spirals of meaning and acquire environmental and atmospheric value (Wood 2019, 106). In the case of terraforming, this power of artifactuality has to do with the immediate overcoming of the scale of our individual experience, as well as with the impossibility of conceiving an individual subject linearly acting as a productive cause. In shaping an Earth, we aim to exert an influence on something that, by definition, exerts an influence on us first. Now, thinking of an artefact as an encountered environment can provide us with a better understanding of what it means to act ecologically. In Lars von Trier's *Melancholia* (2011), for example, the ominous presence of an approaching planet has the power of reorienting earthly life, exposing inveterate hypocrisies and breathing new life in people's actions and manifestations. Olafur Eliasson's *Weather Project* (2003), instead, establishes a whole environment inside the Turbine Hall of Tate Modern by creating a minimal ecosystem composed by a giant sun, a sky, mist and cloud-like formations; spectators are thus invited to linger in a parallel dimension that reproduces the basic features of earthly life. But many other artistic expressions deal with cosmopoietic processes on a practical level, instead of just representing them. Let us mention, to name one, Marco Casagrande's bio-urbanism: Casagrande realizes bio-inspired architectures to suggest new ways of dwelling, based on re-occupation of abandoned spaces and re-use of wasted materials, and often addressing marginalized communities. These are all examples of artistic ways of dealing with the concept of territory; they all presuppose an idea of experience and praxis as integrated with a multitude of expressive process of symbolical, biological and material nature.

[52] Deleuze G., Guattari F., *A Thousand Plateaus: Capitalism and Schizophrenia* (1980), University of Minnesota Press, Minneapolis/London 1987, p. 323.

[53] Cf. Ingold T., *The Life of Lines*, Routledge, London/New York 2015.

We have also seen that, in order to have some kind of agency on a planetary level, a human collectivity should learn to align its agency to greater expressive planes, intersecting and prolonging a network of non-human creative trails and inventing ad hoc ways of eliciting unpredictable processes. This is also what an artist consciously does: eliciting an agency which is deeper and vaster than him, without knowing the results. This aspect is highlighted by contemporary artistic manifestations that recognize and interact with non-human agency, such as bioart.[54] South-African artist William Kentridge remembers that in the middle of an ant plague in Johannesburg, when every method of killing the infesting insects resulted useless, he realized how to attract and direct them with sugar-water and finally managed to artistically cooperate with them. In his studio invaded by ants, Kentridge carried out a full-fledged experiment of 'drawing with ants'.[55] Another bioartist, Pierre Huyghe, performs in the subtle art of creating real ecosystems, as in the series *Zoodram*, composed by living marine environments. In his work *Influants* (2011), Huyghe displayed the expressive interactions of a territory by putting a flu virus, an ant colony and a handful of spiders in the same room in which the 'spectators' enter. However, bioart can also be intended in a broader sense: Neri Oxman, for instance, experiments with 'living materials' by crafting objects that behave differently depending on their interactions.[56] In the project titled *Wanderers: An Astrobiological Exploration* (2014), she designed clothes capable of protecting their wearers on other planets by forming portable biospheres and mobile habitats.

The term "ecopoiesis", first introduced in astrobiology, can be taken here as a philosophical term referring to the aesthetic significance of terraforming. Considering the artefact as a territory, a world-object, or an Earth, and understanding human agency as morphogenetic participation (instead of as programmed subjective action) reshapes our idea of poiesis, casting light on the human capacity of cooperating with the self-organizing forces of reality. The aesthetic value of ecopoiesis, then, is not reduced to the meaning of artistic expression as a symptom or as a model, nor to the value of experience that concretely roots us in reality: it refers, more broadly, to a lesson of ontological consistence. Just like morphology,

[54] Daubner E., Poissant L. (eds.), *Bioart. Transformations du vivant*, Presses de l'Université du Québec, Québec 2012; M. Radomska, *Uncontainable Life: A Biophilosophy of Bioart*, Linköping University, Linköping 2016.

[55] Concilio C., *Postcolonial literature and Land Art in the Anthropocene*, in "Cosmo", 15 (2019), pp. 250-52.

[56] Parry, cit., pp. 124-25.

aesthetics encourages to draw our categories directly from the singular multitude of intra-active phenomena that surrounds us. Only this kind of operative and speculative connection can nourish the dreams of perpetuating life on always new levels.

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