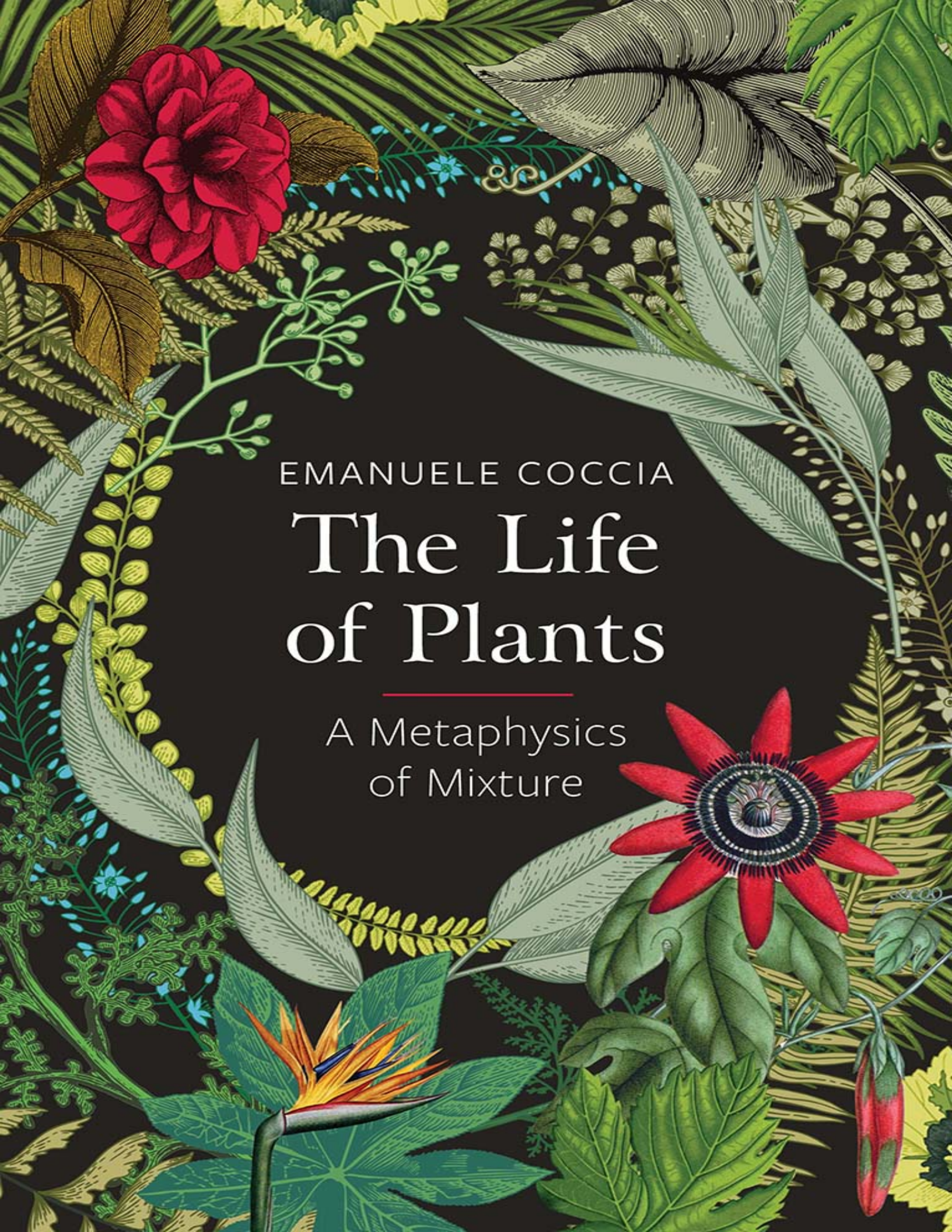

EMANUELE COCCIA
The Life of Plants
A Metaphysics of Mixture

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The Life of Plants

A Metaphysics of Mixture

Emanuele Coccia
Translated by Dylan J. Montanari

polity

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Matteo Coccia (1976–2001)
in memoriam

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This book is dedicated to the memory of my twin brother Matteo: it is with him by my side that I began to breathe.

Author's Preface

From the age of fourteen to the age of nineteen, I was a student in an agricultural high school in a small isolated town in the farmland of central Italy. I was there to learn "a real job." So, instead of devoting myself to the study of classical languages, literature, history, and mathematics, like all of my friends, I spent my adolescence immersed in books on botany, plant pathology, agricultural chemistry, market gardens, and entomology. Plants, with their needs and illnesses, were the privileged objects of all study that took place in this school. This daily and prolonged exposure to beings that were initially so far away from me left a permanent mark on my perspective on the world. This book is the attempt to revive the ideas produced by those five years spent contemplating their nature, their silence, and their apparent indifference to everything we call "culture."

It is therefore manifest that there is but one substance, not only of all bodies, but also of all souls, and that substance is nothing other than God himself. The substance from which all bodies are made is called matter; the substance from which all souls are made is called reason or mind. Therefore it is manifest that God is the reason of all souls and the matter of all bodies.

David de Dinant

This is a blue planet, but it is a green world.

Karl J. Niklas

I
Prologue

1
On Plants, or the Origin of Our World

We barely speak of them and their name escapes us. Philosophy has always overlooked them, more out of contempt than out of neglect.[1] They are the cosmic ornament, the inessential and multicolored accident that reigns in the margins of the cognitive field. The contemporary metropolis views them as superfluous trinkets of urban decoration. Outside the city walls, they are hosts—weeds—or objects of mass production. Plants are the always open wound of the metaphysical snobbery that defines our culture. The return of the repressed, of which we must rid ourselves in order to consider ourselves as "different": rational humans, spiritual beings. They are the cosmic tumor of humanism, the waste that the absolute spirit can't quite manage to eliminate. The life sciences have neglected them, too.[*] "Current biology, conceived of on the basis of our knowledge of animals, pays no attention to plants"—"the standard evolutionary literature is zoocentric."[2] And biology manuals approach plants "in bad faith," "as decorations on the tree of life, rather than as the forms that have allowed the tree itself to survive and grow."[3]

The problem is not just one of epistemological deficiency: "as animals, we identify much more immediately with other animals than with plants."[4] In this spirit, scientists, radical ecology, and civil society have fought for decades for the liberation of animals;[5] and affirming the separation between human and animal (the anthropological machine of which philosophy speaks)[6] has become commonplace in the intellectual world. By contrast, it seems that no one ever wanted to question the superiority of animal life over plant life and the rights of life and death of the former over those of the latter. A form of life without personality and without dignity, it does not seem to deserve any spontaneous empathy, or the exercise of a moralism that higher living beings are capable of eliciting.[7] Our animal chauvinism[8] refuses to go beyond "an animal language that

does not lend itself to a relation to plant truth."[9] In a sense, antispecies animalism is just another form of anthropocentrism and a kind of internalized Darwinism: it extends human narcissism to the animal realm.

Plants are untouched by this prolonged negligence: they affect a sovereign indifference toward the human world, the culture of civilizations, the succession of domains and ages. Plants seem absent, as though lost in a long, deaf, chemical dream. They don't have senses, but they are far from being shut in on themselves: no other being adheres to the world that surrounds it more than plants do. They don't have the eyes or ears that may have allowed them to distinguish the forms of the world and to multiply its image through the iridescence of colors and sounds that we give it.[10] They participate in the world in its totality in everything they meet. Plants do not run, they cannot fly; they are not capable of privileging a specific place in relation to the rest of space, they have to remain where they are. Space, for them, does not crumble into a heterogeneous chessboard of geographical difference; the world is condensed into the portion of ground and sky they occupy. Unlike most higher animals, they have no selective relation to what surrounds them: they are, and cannot be other than, constantly exposed to the world around them. Plant life is life as complete exposure, in absolute continuity and total communion with the environment. It is for the sake of adhering as much as possible to the world that they develop a body that privileges surface over volume: "In plants, the very high proportion of surface to volume is one of the most characteristic traits. It is through this vast surface, literally spread in the environment, that plants absorb from the space the diffuse resources that are necessary to their growth."[11] Their absence of movement is nothing but the reverse of their complete adhesion to what happens to them and their environment. One cannot separate the plant—*neither physically nor metaphysically*—from the world that accommodates it. It is the most intense, radical, and paradigmatic form of being in the world. To interrogate plants means to understand what it means to be in the world. Plants embody the most direct and elementary connection that life can establish with the world. The opposite is equally true: the plant is the purest observer when it comes to contemplating the world in its totality.

Under the sun or under the clouds, mixing with water and wind, their life is an endless cosmic contemplation, one that does not distinguish between objects and substances—or, to put differently, one that accepts all their nuances to the point of melting with the world, to the point of coinciding with its very substance. We will never be able to understand a plant unless we have understood what the world is.

Notes

* Translator's note: Unless otherwise specified, all the translations of quotations (French or otherwise) have been made by the book's translator, Dylan J. Montanari, from Coccia's French original. Material in square brackets has also been added by the translator.

1. The only great exception in modernity is the masterpiece by Gustav Theodor Fechner, *Nanna oder über das Seelenleben der Pflanzen* (Leipzig: Leopold Voss, 1848). Against this great silence, the voice of a small number of researchers and intellectuals has begun to rise, so much so that one hears talk of a "plant turn." See Elaine P. Miller, *The Vegetative Soul: From Philosophy of Nature to Subjectivity in the Feminine* (Albany: SUNY Press, 2002); Matthew Hall, *Plants as Persons: A Philosophical Botany* (Albany: SUNY Press, 2011); Eduardo Kohn, *How Forests Think: Toward an Anthropology of the Human* (Berkeley: University of California Press, 2013); Michael Marder, *Plant Thinking: A Philosophy of Vegetal Life* (New York: Columbia University Press, 2013); Michael Marder, *The Philosopher's Plant: An Intellectual Herbarium* (New York: Columbia University Press, 2014); and Jeffrey Nealon, *Plant Theory: Biopower and Vegetable Life* (New York: Columbia University Press, 2015). With a few exceptions (more or less), this literature insists on finding the truth about plants in purely *philosophical* or anthropological research, without having any truck with contemporary botanical thought—which, on the contrary, has produced remarkable masterpieces in the philosophy of nature. Here are only those that have influenced me most: Agnes Arber, *The Natural Philosophy of Plant Form* (Cambridge: Cambridge University Press, 1950); David Beerling,

The Emerald Planet: How Plants Changed Earth's History (Oxford: Oxford University Press, 2007); Daniel Chamovitz, *What a Plant Knows: A Field Guide to the Senses* (New York: Scientific American / Farrar, Straus & Giroux, 2012); Edred John Henry Corner, *The Life of Plants* (Cleveland: World, 1964); Karl J. Niklas, *Plant Evolution: An Introduction to the History of Life* (Chicago: University of Chicago Press, 2016); Sergio Stefano Tonzig, *Letture di biologia vegetale* (Milan: Mondadori, 1975); François Hallé, *Éloge de la plante: Pour la nouvelle biologie* (Paris: Seuil, 1999); Stefano Mancuso and Alessandra Viola, *Verde brillante: Sensibilità e intelligenza nel mondo vegetale* (Florence: Giunti, 2013). Attention to plants is also central in contemporary American anthropology, starting with Anna Lowenhaupt Tsing's masterpiece *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins* (Princeton: Princeton University Press, 2015), which is indeed centered around a mushroom, and with the works of Natasha Myers, who is also preparing a book on the subject. See especially Natasha Myers and Carla Hustak, "Involutionary Momentum: Affective Ecologies and the Sciences of Plant/Insect Encounters," *Differences: A Journal of Feminist Cultural Studies*, 23.3 (2012): 74–117.

2. François Hallé, *Éloge de la plante: Pour une nouvelle biologie* (Paris: Seuil, 1999), p. 321. Along with Niklas, Hallé is a botanist who has made the great effort to transform the contemplation of the life of plants into a properly metaphysical object of study.

3. Niklas, *Plant Evolution*, p. viii.

4. W. Marshall Darley, "The Essence of Plantness," *American Biology Teacher*, 52.6 (1990): 354–7, here p. 356.

5. Among the most famous examples, see Peter Singer, *Animal Liberation: A New Ethics for Our Treatment of Animals* (New York: HarperCollins, 1975) [reissued several times], and Jonathan Safran Foer, *Eating Animals* (New York: Little, Brown, 2009). But the debate is very old: see the two great works of antiquity, one by Plutarch, *On the Intelligence of Animals* [*De sollertia animalium*], the other by Porphyry, *On Abstinence from Killing Animals* [*De abstinentia*]. On the history of the debate, see Renan

Larue, *Le Végétarisme et ses ennemis: Vingtcinq siècles de débates* (Paris: PUF, 2015). The debate over animals, which is strongly marked by an extremely superficial moralism, seems to forget that heterotrophy presupposes the killing of other living beings as a natural and necessary dimension of life.

6. Giorgio Agamben, *The Open: Man and Animal*, trans. by Kevin Attell (Stanford: Stanford University Press: 2003) [originally published as *L'aperto: L'uomo e l'animale* (Turin: Bollati Boringhieri, 2002)].

7. The debate over the rights of plants exists in a very minor form—at least since the famous chapter 27 in Samuel Butler, *Erewhon, or, Over the Range* (London: Trubner & co., 1872) until the classic article by Christopher D. Stone, "Should Trees Have Standing? Toward Legal Rights for Natural Objects," *Southern California Law Review*, 45 (1972): 450–501. On these questions, see the useful summary of philosophical debates in Marder, *Plant Thinking*, as well as the position expounded in Hall, *Plants as Persons*.

8. Darley, "Essence of Plantness," p. 356. See also J. L. Arbor, "Animal Chauvinism, Plant-Regarding Ethics and the Torture of Trees," *Australian Journal of Philosophy*, 64.3 (1986): 335–69.

9. Hallé, *Éloge de la plante*, p. 325.

10. On the question of the *senses* of plants, see Chamovitz, *What a Plant Knows* and Richard Karban, *Plant Sensing and Communication* (Chicago: University of Chicago Press, 2015). The limitation of these works resides nonetheless in the stubborn attempt to "rediscover" organs "analogous" to those that make perception possible in animals without trying at all to imagine—starting from plants and their morphology—another possible form of the existence of perception, another way of thinking the relation between sensation and body.

11. Darley, "Essence of Plantness," p. 354. The question of the surface and of exposure to the world is central to Fechner, *Nanna* and to Hallé, *Éloge de la plante*. On the matter of the relation to the

world, see Marder, *Plant Thinking*, which represents the most profound philosophical work on the nature of plant life.

2
The Extension of the Domain of Life

They live at astral distances from the human world, like nearly all other living beings. This separation is not simply a cultural illusion; it is of a much deeper nature and its root can be found in metabolism.

The survival of the near totality of living beings presupposes the existence of other living beings: every form of life requires that there be life in the world already. Humans need the life produced by animals and plants. And higher animals would not survive without the life they exchange among themselves, thanks to the process of nourishment. To live is essentially to live the life of another: to live in and through the life that others have been able to construct or invent. There is a sort of parasitism, a universal cannibalism, that belongs to the domain of the living: it feeds off itself, without realizing that it needs other forms and modes of existence. As though life in its most complex and articulated forms is never anything but an immense cosmic tautology: it presupposes itself and produces nothing other than itself. This is why life seems impossible to explain other than starting from itself. As for plants, they represent the only breach in the self-referentiality of the living.

In this sense, higher life seems never to have had immediate relations with the inanimate world: the first environment of any living being is that of the individuals of its own species or of other species. Life seems to *have to be its own environment, its own site*. Plants alone break this topological rule of self-inclusion. They have no need for the mediation of other beings in order to survive. Nor do they desire it. They require nothing but the world, nothing but reality in its most basic components: rocks, water, air, light. They see the world before it gets inhabited by forms of higher life; they see the real in its most ancestral forms. Or rather they find life where no other organism reaches it. They transform everything they touch into life, they make out of matter, air, and sunlight what, for the rest of the living, will be a space of habitation, a world. Autotrophy—the

name given to this Midas-like power of nutrition, the one that allows plants to transform into nourishment everything they touch and everything there is—is not just a radical form of alimentary autonomy; it is above all the capacity that plants have to transform the solar energy dispersed into the universe into a living body, [to transform] the deformed, disparate matter of the world into a coherent, well-ordered, and unified reality.

If it is from plants that we ought to enquire what the world is, this is because they are the ones who "play the world" [*"font le monde"*]. For the vast majority of organisms, the world is the product of plant life, the product of the colonization of the planet by plants, since time immemorial. Not only is it the case that "the animal organism is constructed entirely and simply from the organic substances produced by plants,"[1] but "higher plants represent about 99% of the eukaryotic biomass of the planet."[2] All the objects and tools that surround us come from plants (nourishment, furniture, clothes, fuel, medicine). Most importantly, the entire higher animal life (which has an aerobic nature) feeds off the organic exchange of gases between these beings (oxygen). Our world is a world of plants before it is a world of animals.

It was Aristotelianism that, before any other philosophy, took into account the liminal position of plants, describing them as a universal principle of animation and ensoulment [*psychisme*]. For the Aristotelianism of antiquity and the Middle Ages, vegetative life, *psuchē trophukē* (literally "nursing/feeding/vegetative soul"), was not simply a distinct class of specific forms of life or a taxonomic unity separated from others, but rather a place shared by all living beings, regardless of the distinction between plants, animals, and humans. It was a principle through which "life belongs to all living things."[3]

For plants, life starts by defining itself as *circulation* of living beings and, because of this, constitutes itself in dissemination of forms, in difference between species, realms, and modes of life. They are not always intermediaries, agents of the cosmic threshold between the living and the non-living, spirit and matter. Their arrival on firm ground and their proliferation have made it possible to produce the quantity of matter and organic mass of which higher life is composed

and from which it nourishes itself. But also—and this in the first place—they have transformed for good the face of our planet: it is through photosynthesis that oxygen came to feature so heavily in our atmosphere;[4] it is thanks to our plants and their life that higher animal organisms can produce the energy necessary for survival. It is through them and with their help that our planet produces its atmosphere and makes breath possible for the beings that cover its outer skin. The life of plants is a cosmogony in action, the constant genesis of our cosmos. Botany, in this sense, has to rediscover a Hesiodic register and describe all the forms of life capable of photosynthesis as inhuman and material divinities, domestic titans that do not need violence to found new worlds.

From this point of view, plants challenge one of the pillars of the biological and natural sciences of the past few centuries: the priority of the environment over the living, of the world over life, of space over the subject. Plants, in their history and evolution, demonstrate that living beings produce the space in which they live rather than being forced to adapt to it. They have modified the metaphysical structure of the world for good. We are invited to conceive of the physical world as a collection of all objects, the space that includes the totality of everything there was, is, and will be: the definitive horizon that no longer tolerates any exteriority, the absolute container. In making possible the world of which they are both part and content, plants destroy the topological hierarchy that seems to reign over our cosmos. They demonstrate that life is a rupture in the asymmetry between container and contained. When there is life, the container is located in the contained (and is thus contained by it); and vice versa. The paradigm of this mutual overlap is what the ancients called “breath” (*pneuma*). To blow, to breathe—means in fact to have this experience: what contains us, the air, becomes contained in us; and, conversely, what was contained in us becomes what contains us. To breathe means to be immersed in a medium that penetrates us with the same intensity as we penetrate it. Plants have transformed the world into the reality of breath, and it is starting from this topological structure, which life has given to the cosmos, that I will attempt to describe, in this book, the notion of “world.”

Notes

1. Julius Sachs, *Lectures on the Physiology of Plants* (Oxford: Clarendon, 1887), p. 600.

2. Anthony J. Trewavas, "Aspects of Plant Intelligence," *Annals of Botany*, 92.1 (2003): 1–20, here p. 16. See also his major work *Plant Behaviour and Intelligence* (Oxford: Oxford University Press, 2014).

3. Aristotle, *De anima* 2.4, $415^{a}24–5$.

4. T. M. Lenton, T. W. Dahl, S. J. Daines, B. J. W. Mills, K. Ozaki, M. R. Saltzman, and P. Porada, "Earliest Land Plants Created Modern Levels of Atmospheric Oxygen," *Proceedings of the National Academy of Sciences*, 113.35 (2016): 9704–9.

3
On Plants, or the Life of the Spirit

They don't have hands with which to shape the world, yet it would be hard to find more capable agents when it comes to the construction of forms. Plants are not only the most subtle artisans of our cosmos, they are also the species that have given life to the world of forms—they are the form of life that has made the world itself a site of infinite figuration. It is in and through plants that the Earth has asserted itself as a cosmic laboratory, a space for the invention of forms and the making of matter.[1]

The absence of hands is not a sign of lack, but rather the consequence of a restless immersion in the very matter they ceaselessly model. Plants coincide with the forms they invent: all forms are, for them, inflections of being, and not merely of doing and acting. To create a form means to traverse it with all of one's being, as one traverses ages or stages of one's own existence. To the abstraction of creation and technique—which are able to transform the forms only at the cost of excluding the creator and producer of the process of transformation—the plant opposes the immediacy of metamorphosis: to generate always means to transform oneself. To the paradoxes of consciousness, which does not know how to conceptualize forms without first distinguishing them from itself and from the reality of which they are models, the plant opposes the absolute intimacy between subject, matter, and imagination: to imagine is to become what one imagines.

It is not just a matter of intimacy and immediacy: the genesis of forms achieves, in plants, an intensity inaccessible to any other living being. Unlike higher animals, wherein development stops once the individual has reached his or her sexual maturity, plants never cease to develop and grow, to construct new organs and new parts of their own body (leaves, flowers, parts of the trunk, etc.), which they previously lacked or had gotten rid of. Their body is a morphogenetic industry that knows no interruption. Plant life is nothing but the cosmic alembic of universal metamorphosis, the power that allows

any form to be born (to constitute itself from individuals with different forms), to develop (to modify its form over time), to reproduce, thus differentiating itself (to multiply what exists, provided that it modifies it), and to die (to allow difference to overtake identity). The plant is nothing if not a transducer, one that transforms the biological fact of the living being into an aesthetic problem and makes of these problems a question of life and death.

This is also why, before Cartesian modernity, which has reduced the soul [*l'esprit*] to its anthropomorphic shadow, plants were considered for centuries the paradigmatic form of reason's existence, of a soul *whose exercise is self-fashioning*. The measure of this association resided in the seed. In the seed, vegetative life demonstrates its whole rationality: the production of a certain reality takes place starting from a formal model that is without error.[2] One sees here a rationality analogous to that of praxis or production—but one that is more profound and radical, since it concerns the cosmos in its totality and not exclusively a living individual: it is a form of rationality that engages the world in the becoming of a single living being. In other words, in the seed, rationality is no longer a function of ensouling [*psychisme*] (be it animal or human) or the attribute of a single being, but a cosmic fact. It is the way of being and the material reality of the cosmos. To exist, the plant has to merge with the world, and it cannot do so other than in the form of a seed: the space in which the act of reason coexists with the becoming of matter.

Through the mediations of Plotinus and Augustine, this Stoic idea became one of the pillars of the Renaissance philosophy of nature. As Giordano Bruno wrote, the universal intellect

> is that one and the same thing that fills everything, illuminates the universe and directs nature to produce her various species suitably. It is to the production of natural things what our intellect is to the production of the representation of things. [...] The hermeticists say that it is "most fecund in seeds" or yet that it is the "seed sower," because it impregnates matter with all forms, which, according to their nature and manner of being, succeed in shaping, forming, and weaving matter in ways that are so remarkable and numerous that they cannot be ascribed to chance, nor to any other principle incapable of differentiation and arrangement. [...] Plotinus says it is the "father and progenitor," because it distributes seeds in nature's field and is the proximate dispenser of forms. As for us, we call it the "internal artificer," because it shapes matter, forming it from inside like a seed or root shooting forth and unfolding the trunk, from within the trunk thrusting out the boughs, from inside the boughs the derived branches, and unfurling buds from within these. From therein it forms, fashions, and weaves, as with nerves, the leaves, flowers, and fruits, and it is from the inside that, at certain times, it calls back its sap from the leaves and the fruits to the twigs, from the twigs to the branches, from the branch to the trunk, from the trunk to the root.[3]

It is not enough to recognize, as the Aristotelian tradition did, that reason is the site of forms (*locus formarum*), the warehouse of all the forms the world can host. Reason is also their formal and efficient cause. If a reason exists, it is the one that defines the genesis of each of the forms of which the world is composed. Conversely, a seed is the exact opposite of the simple, virtual existence of a form, with which it is often confused. The seed is the metaphysical space wherein the form no longer defines a pure appearance or the object of vision or the simple accident of a substance, but a destiny: at once the specific—but complete and absolute—horizon of existence for a given individual and what allows one to understand our existence and all the events of which it is made up as *cosmic* facts, not as purely subjective facts. To imagine does not mean to place an inert and immaterial image before one's eyes, but rather to contemplate the force that allows one to transform the world and a portion of its matter into *a singular life*. By imagining, the seed makes a life

necessary, lets its body couple with the course of the world. The seed is only the site in which form is not a content of the world but the being of the world, its form of life. *Reason is a seed because, contrary to what modernity has insisted on believing*, it is not the space of sterile contemplation, not the space of the intentional existence of forms, but the force that makes it possible for an image to exist as the specific destiny of a given individual. Reason is what allows an image to become destiny, a space of total life, a spatiotemporal horizon. It is cosmic necessity, not individual whim.

Notes

1. This is why plants are an important inspiration in design. See Renato Bruni, *Erba volant: Imparare l'innovazione dalle piante* (Turin: Codice Edizioni, 2015). On engineering and plant physics, see the fundamental works by Karl J. Niklas: *Plant Biomechanics: An Engineering Approach to Plant Form and Function* (Chicago: University of Chicago Press, 1992); *Plant Allometry: The Scaling of Form and Process* (Chicago: University of Chicago Press, 1994); and, with Hanns-Christof Spatz, *Plant Physics* (Chicago: University of Chicago Press, 2012).

2. On the notion of the "seed" in the philosophy of nature in the modern period, see the beautiful book by Hiro Hirai, *Le concept de semence dans les théories de la matière à la Renaissance: De Marsile Ficin à Pierre Gassendi* (Turnhout: Brepols, 2005).

3. Giordano Bruno, *Cause, Principle, and Unity*, ed. and trans. by Robert de Lucca; *Essays on Magic*, ed. and trans. by Richard J. Blackwell; introd. by Alfonso Ingegno (Cambridge: Cambridge University Press, 1998), pp. 37–8 [= a passage from the second dialogue of the treatise on cause].

4
Toward a Philosophy of Nature

This book aims to reopen the question of the world by starting with the life of plants. To do this means to revive an ancient tradition. What we, more or less arbitrarily, call "philosophy" was born as—and in the beginning took itself to be—an enquiry into the nature of the world, a discourse on nature (*peri tēs phuseōs*) or on the cosmos (*peri kosmou*). This choice was not by chance: to privilege nature and the cosmos as objects of thought meant to assert, implicitly, that thought does not become philosophy unless and until it confronts its objects. It is in front of the world, in front of nature, that the human being can truly *think*. This identity between world and nature is far from trivial, because *nature* was designating not that which precedes the activity of the human spirit, nor the opposite of culture, but what makes it possible for everything to be born and to become, the principle and the force that are responsible for the genesis and transformation of any object, thing, entity, or idea that exists and will ever exist. To identify nature and cosmos means first of all to make nature not a separate principle, but that which expresses itself in everything that is. Conversely, the world is neither the logical combination of all its objects nor a metaphysical totality of beings, but the physical force that traverses all that comes to be and that transforms itself. There is no separation between material and immaterial, or between history and physics. At a more microscopic level, nature is what allows the world to be; on the other hand, everything that ties a given thing to the world is part of nature.

For several centuries now, with rare exceptions, philosophy stopped contemplating nature: the right to speak of the world of things and of nonhuman living beings befalls, mainly or exclusively, to other disciplines. Plants, animals, atmospheric phenomena, be they common or extraordinary, the elements and their combinations, the constellations, the planets, and the stars—these have all been definitively expelled from the imaginary catalogue of its privileged objects of study.[1] Starting from the nineteenth century, an immense

part of the experience related to each of these entities has been the object of a kind of censure: since the time of German idealism, everything that goes under the name of *human sciences* has been a policing effort, at once desperate and despairing, to force the disappearance of any trace belonging to *the natural* from the domain of knowledge.

This "physiocide"—to use the word coined by Iain Hamilton Grant[2]—has had far more harmful consequences than the simple distribution of [branches of] knowledge between the various learned bodies. At this point, it is completely normal for someone who calls him- or herself a philosopher to know the most insignificant events of his or her nation's historical past, all the while ignoring the names, lives, or histories of the animal and vegetal species that provide his or her daily nourishment.[3] But, apart from this form of illiteracy, the refusal to accord nature and the cosmos their philosophical dignity produces a strange form of bovarism: philosophy seeks at all costs to be human and humanistic, to be included among the human and social sciences, to be a science—even a *normal* science—like all others. By mixing false presuppositions, superficial pipe dreams, and a sickening moralism, philosophers have turned into radical adepts of the Protagorean credo: "Man is the measure of all things."[4] Deprived of its supreme objects, threatened by other forms of knowledge (be they the social or the natural sciences), philosophy has turned into a sort of Don Quixote of contemporary knowledge, engaged in an imaginary struggle against the projections of its own spirit; or into a Narcissus who looks back at the ghosts of its past, now empty souvenirs in a provincial museum. Forced to study not the world, but the more or less arbitrary images that humans have produced in the past, it has become a form of skepticism—and an often moralized and reformist one at that.[5]

The consequences don't stop here. The sciences we call "natural" are the first to have suffered as a result of this banishment. By reducing nature to everything that precedes the soul [*esprit*] (and hence that qualifies as *human*) and that does not participate in any of its properties, these disciplines have taken it upon themselves to transform nature into a purely residual, oppositional object, one incapable of occupying the position of subject. Nature, on this view,

is nothing but the empty, incoherent space of all that precedes the emergence of soul and follows the Big Bang, the lightless, wordless night that prevents any reflection and illumination.

This deadlock is the result of an obstinate repression: a repression of the living, of the fact that all knowledge is already an expression of being and life. It is never the case that we can immediately interrogate and understand the world, for the world is the breath of the living. All cosmic knowledge is nothing but *a point of life* [*vie*] (and not just *a point of view* [*vue*]), all truth is nothing but the world in the mediated space of the living. One will never be able to understand the world such as it is, without passing through the mediation of a living being. On the contrary, meeting it, knowing it, speaking it means always to live according to a certain form, starting from a certain style. To know the world, one must first choose the intensity of life, the height, and the form from which one wants to view it, and hence to live it. We need a mediator, a gaze capable of seeing and living the world where we cannot reach it. Contemporary physics is no exception: its mediators are the machines it erects as supplementary and prosthetic subjects—only to hide them immediately afterward, refusing to recognize them as the projection of its own eyes and therefore as capable of observing the world from one single perspective.[6] Microscopes, telescopes, satellites, and accelerators are precisely that: the inanimate, material eyes that allow physics to observe the world, to get a view on it. But the machines physics uses are mediators that suffer from some kind of long-sightedness, being always late, too far away from the depths of the cosmos: they see nothing of the life that inhabits them, the cosmic eye they themselves embody. Philosophy, after all, has always chosen myopic mediators, capable of concentrating only on the portion of the world that is immediately before them. To ask of humankind what being in the world means—the way Heidegger did, along with the rest of twentieth-century philosophy[7]—is to reproduce a very partial image of the cosmos.

Nor is it enough (as Uexküll taught us)[8] to shift one's gaze toward the most elementary forms of animal life: the tick, the domestic dog, the eagle already have below them an infinite number of other observers of the world. Plants are the real mediators: they are the first eyes that

appeared and opened themselves onto the world, they are the gaze that came to perceive it in all its forms. The world is, above all, everything the plants could make of it. They are the ones who *made* our world, even though the status of this making is quite different from that of any other activity of living beings. It is from plants, then, that this book will ask the question of the nature of the world, its extension, its consistency. What is more, the attempt to rebuild a cosmology—the only form of philosophy that can be considered legitimate—will have to begin with an exploration of vegetal life. I will posit that the world has the consistency of an atmosphere and that the leaves are witnesses to this fact. I will ask the roots to explain the true nature of the Earth. Finally, it is the flower that will teach us what rationality is, when measured not as a universal capacity or power, but as a cosmic force.

Notes

1. One might object that this is not the first time. Tradition tells us that Socrates was the first to impose it on philosophy to "disregard the physical universe" and to "confine" its study to "moral questions" (*peri ta ēthika*; see Aristotle, *Metaphysics* 987^{b}). It was Socrates who "brought down philosophy from the heavens, placed it in cities, introduced it into families, and obliged it to examine into life and morals, and good and evil" (Cicero, *Tusculanae disputationes* 5.4.10, in C. D. Yonge's translation). See also Cicero, *Academica* 1.4.15.

2. See, for example, Iain Hamilton Grant, "Everything Is Primal Germ or Nothing Is: The Deep Field Logic of Nature," *Symposium: Canadian Journal of Continental Philosophy*, 19.1 (2015): 106–24.

3. The rise of specialization in the university system is based on a mechanism of reciprocal ignorance: to be a specialist does not mean to know more about a given subject, but rather to have obeyed a juridical obligation to ignore other disciplines.

4. [Protagoras, fr. 80 B1 Diels–Kranz. The sources of this famous dictum are Plato, *Theaetetus* 152a and Sextus Empiricus,

Adversus mathematicos 7.60.]

5. In this respect, anthropology's admirable attempts, after the fact, to repatriate nature within the human sciences by spying on any movement that may allow us to *humanize* it again, or to *socialize* it, would seem the most naive expression of the *esprit d'escalier*. For in all these attempts nature represents the domain of the *nonhuman* when it has not been specified either what "the human" would designate (how can one have certainty on this matter, after Darwin?) or in what respect the nonhuman would oppose the human (reason? language? soul?). The nonhuman is nothing but a new, more sophisticated name with ancient associations: "beasts," "the irrational," "the insane" (*amens*). Plato had already warned us against this division (*Statesman*, 263d): "This kind of classification might be undertaken by any other creature capable of rational thought—for instance, cranes are reputed to be rational and there may be others. They might invest themselves with a unique and proper dignity and classify the race of cranes as being distinct from all other creatures; the rest they might well lump together, men included, giving them the common appellation of 'the beasts.' So let us try to be on the watch against mistakes of this kind" (J. B. Skemp's translation, revised by Martin Ostwald, Indianapolis: Hackett, 1992, pp. 13–14). The Protagorean presupposition would seem also to inform and inspire the opposite movement of assimilation, which insists on assimilating animals to humans, so that attributes considered to be specifically human would belong to other species of animals. In this case, too, one has established the shape of the human in advance and has considered the natural as its residue, even if this means rushing next to deny this same dialectical partition. How, then, can we "be on the watch against mistakes of this kind"?

6. This is one of the great lessons of Bruno Latour's work, starting from his major works *Science in Action* (Cambridge, MA: Harvard University Press, 1987) and *We Have Never Been Modern* (Cambridge, MA: Harvard University Press, 1991). On the question of technical mediation looked at from a moral point of view as well, see Peter-Paul Verbeek, *Moralizing Technology:*

Understanding and Designing the Morality of Things (Chicago: University of Chicago Press, 2011).

7. On this question, see Walter Biemel's classic *Le Concept de monde chez Heidegger* (Paris: Vrin/ Louvain: Nauwelaerts, 1950). On the notion of "world" in philosophy, see Rémi Brague's major study *La Sagesse du monde: Histoire de l'expérience humaine de l'univers* (Paris: Fayard, 1999) [English version *The Wisdom of the World: The Human Experience of the Universe in Western Thought* (Chicago: University of Chicago Press, 2003)].

8. See Jakob von Uexküll, *A Foray into the Worlds of Animals and Humans, with A Theory of Meaning*, trans. by Joseph D. O'Neil (Minneapolis: University of Minnesota Press, 2010; originally published in 1934).

II
Leaf Theory
The Atmosphere of the World

5
Leaves

Firm, immobile, and exposed to the elements to the point of merging with them. Suspended in the air, effortlessly, without having to contract a single muscle. A bird without flight. The leaf is the first great reaction to the conquest of terra firma, the principal result of the terrestrialization of plants, the expression of their passion for aerial life.

Everything plays a role in its existence, from the anatomical structure of the trunk to the general physiology of the plant, passing through its history, which is the history of all the evolutionary choices that have taken place over the course of millennia. Everything is presupposed and teleologically enclosed in this green surface that opens up to the sky. The plants' arrival into aerial space has pushed them toward an infinite bricolage of forms, structures, and evolutionary solutions. The structure of the trunk is above all the invention of a "mezzanine" that makes it possible to overcome gravitational force without losing all relation to the Sun and to earthly humidity. Constant and direct exposure to air and sun has required the construction of a resistant and permeable structure.

It is on leaves that rests not only the life of the individual to which they belong, but also the life of the kingdom of which they are the most typical expression, that is, the whole biosphere.

> The whole world of living things, be they plants or animals, is supported and rigidly conditioned by the energy that plastids steal from the sun in order to construct the lines that hold the glucose molecule together. Life on earth—the autonomous life of the vegetal world as much as the parasitic life of the animal world—is thus made possible by the existence and the operating capacity of the plastid chlorophylls[1]

present in leaves. Leaves have imposed upon the vast majority of living beings a unique environment: the atmosphere.

We are in the habit of identifying plants with flowers, their most sumptuous expression, or trunks with trees, their most solid formation. But the plant is first and foremost the leaf.[2]

> Leaves are not just the principal part of the plant. Leaves *are* the plant: trunk and root are parts of the leaf, the base of the leaf, the simple extension by which leaves, in staying high up in the air, are supported by and nourish themselves from the soil. [...] The whole plant is identified in the leaf, to which the other organs are just appendages. It is the leaf that produces the plant: leaves form the flower, the sepals, the petals, the stamens, the pistils; and it is also the leaves that form the fruit.[3]

To grasp the mystery of plants means to understand leaves—from all points of view, and not just from the isolated perspectives of genetics and evolution. In them is unveiled the secret of what we call "the climate."

The climate is not the collection of the gases that envelop the terrestrial globe. It is the essence of cosmic fluidity, the deepest face of our world, the one that reveals it as the infinite mixture of all things, present, past, and future. The climate is the name and the metaphysical structure of mixture. In order for a climate to exist, all the elements within a given space must be at once mixed and identifiable—united not through substance, form, or contiguity but through the same "atmosphere." If the world is *one*, this is not because there is only one substance or one universal morphology. At the climatic level, everything that is and has been constitutes *a* world. Climate is the being of cosmic unity. In all climates, the relation between the container and the contained is constantly reversible: what is place becomes content, what is content becomes place. The medium becomes subject and the subject becomes medium. All climate presupposes this constant topological inversion, this oscillation that undoes the border between subject and environment, a role-reversing oscillation. Mixture is not simply the composition of elements but this precise relationship of topological exchange. Mixture is what defines the state of fluidity. A fluid is not a space or a body defined by the absence of resistance. It has nothing to do with the states of aggregation of matter: solids, too, can be fluids, without having to pass from a gaseous state to a liquid one.

The structure of universal circulation is fluid, the place where everything comes into contact with everything else and comes to mix with it without losing its form and its own substance.

The leaf is the paradigmatic form of openness: life capable of being traversed by the world without being destroyed by it. But it is also the climatic laboratory par excellence, the oven that produces oxygen and frees it into space, the element that renders possible the life, the presence, and the mixture of an infinite variety of subjects, bodies, histories, and worldly beings. The little green limbs that populate the planet and capture the energy of the Sun are the cosmic connective tissue that has allowed, for millions of years, the most disparate lives to cross paths and mix without melting reciprocally, one into the other.

The origin of our world does not reside in an event that is infinitely distant from us in time and space, millions of light years away; nor does it reside in a space of which we no longer have a trace. It is here and now. The origin of the world is seasonal, rhythmic, deciduous like everything that exists. Being neither substance nor foundation, it is no more in the ground than in the sky, but rather halfway between the two. Our origin is not in us—*in interiore homine*—but outside, in open air. It is not something stable or ancestral, a star of immeasurable size, a god, a titan. It is not unique. The origin of our world is in leaves: fragile, vulnerable, yet capable of returning, of coming back to life once they have passed through the rough season.

Notes

1. Sergio Stefano Tonzig, *Sull'evoluzione biologica: Ruminazioni e masticature*, unpublished manuscript (owner Giovanni Tonzig), p. 18.

2. This is an idea that goes back to Goethe and his essay *The Metamorphosis of Plants*, first published in 1790: "Whether the plant grows vegetatively, or flowers and bears fruit, the same organs fulfill nature's laws throughout, although with different functions and often under different guises. The organ that expanded on the stem as a leaf, assuming a variety of forms, is the

same organ that now contracts it in the calyx, expands again in the petal, contracts in the reproductive apparatus, only to expand finally as the fruit" (Johann Wolfgang von Goethe, *The Metamorphosis of Plants*, ed. by Gordon L. Miller and trans. by Douglas Miller, Cambridge, MA: MIT Press, 2009, p. 100). See also Lorenz Oken, *Elements of Physiophilosophy*, vol. 10, trans. by Alfred Taulk (London: Ray Society, 1847), section 1133, p. 224: "A leaf is a whole plant with all its tissues and systems; with cells, ducts, tracheae; bar, liber, wood, stalk, and branches." On the history of this debate, see the classic work by Agnes Arber, *The Natural Philosophy of Plant Form* (Cambridge: Cambridge University Press, 1950) and her essays "The Interpretation of Leaf and Root in the Angiosperms," *Biological Review*, 16 (1941): 81–105 and "Goethe's Botany," *Chronica Botanica*, 10.2 (1946): 63–126. See also the text by H. Uittien, "Histoire du problème de la feuille," *Recueil des travaux botaniques néerlandais*, 36.2 (1940): 460–72. For a more modern discussion of the question, see R. Sattler (ed.), *Axioms and Principles of Plant Construction: Proceedings of a Symposium held at the International Botanical Congress, Sydney, Australia, August 1981* (Dordrecht: Springer, 1982); Neelima R. Sinha, "Leaf Development in Angiosperms," *Annual Review Plant Physiology and Molecular Biology*, 50 (1999): 419–46; and Hirokazu Tsukaya, "Comparative Leaf Development in Angiosperms," *Current Opinion in Plant Biology*, 17 (2014): 103–9. For a synthesis of the biology of the leaf, see the wonderful book by Steven Vogel, *The Life of a Leaf* (Chicago: University of Chicago Press, 2012).

3. Tonzig, *Sull'evoluzione biologica*, p. 31.

6
Tiktaalik roseae

In 2004 a group of American paleontologists discovered, in a rock formed out of Devonian sediments on the island of Ellesmere, the remains of a species of boned fish that dated back 380 to 375 million years and looked like a hybrid between a fish and an alligator. Indeed, this animal, whose scientific name is *Tiktaalik roseae*,[1] brings together the anatomical characteristics of a fish and those of a tetrapod. It can be considered one of the pieces of evidence for the marine origins of animal life on Earth. Most, if not all, higher living beings are the result of a process of adaptation from a fluid medium.

Since the famous and controversial Miller–Urey experiment in 1953,[2] the idea that the primordial medium of all forms of life is the sea—or, as common usage has it, a "primordial soup"[3]—seems to have taken hold. Even if the biological and zoological truth of this hypothesis remains to be demonstrated, it is interesting to make it the object of a metaphysical experiment—a short *Gedankenexperiment* [thought experiment] that expands on what, for the time being, is only a simple biological hypothesis of philosophical imagination. The result will be closer, perhaps, to mythographic writing than to a scientific treatise on cosmology. But the physical world cannot be seen, and sometimes understood, except through an imaginative effort of this kind.

Let us take seriously this hypothesis, at least for an instant, for the sake of *radicalizing* it: the aim here is to transform what presents itself as a simple empirical finding on the significant and yet contingent connection between *life* and *fluid medium* into a *necessary cosmological* relation.[4] Let us suppose, then, that life has sprung from a fluid physical environment (the content, be it molecules of water or ammonia, doesn't matter) not simply by chance, but because life becomes a possible phenomenon exclusively through fluid environments. Then the living beings' transition from sea to earth would have to be interpreted not as a radical

transformation, nor as a revolution of the nature of life and its relation to the environment that hosts it, but as a gradual change in the density and state of aggregation of the same fluid medium (matter), which can assume different configurations. In this sense, to make a necessity out of the relation between (plural) forms of life and a fluid medium means to posit two major hypotheses. One concerns the reality of the world and of matter; the other concerns the reality of the living.

One must first recognize that, *from the point of view of what is alive* and regardless of its objective nature, matter, which makes up the inhabited world, is ontologically *unitary and homogeneous* despite the difference between its elements and despite physical discontinuity; and this unity consists in its *fluid* nature. Fluidity is not a state of aggregation of matter: it is the way in which the world constitutes itself in the living and in front of it. Fluid is any matter that, regardless of its solid, liquid, or gaseous state, extends its forms into an image of itself, be it as a perception or as a physical continuity. If all living beings cannot exist other than in a fluid environment, it is because life contributes to the constitution of a world of this sort, perpetually unstable and constantly caught up in a motion of self-multiplication and self-differentiation.

The fish, then, is not only one of the stages in the evolution of living beings, *but the paradigm of any living being*—just like the sea, which need not be considered only as an environment specific to certain beings, but as a metaphor for the world itself. The being in the world of each living being should thus be understood starting from the fish's experience of the world. This being in the world, which in consequence is ours, too, is always a being in the sea of the world; it is a form of *immersion*.

If life always is and cannot but be immersion, then most of the concepts and divisions we apply to the description of anatomy and physiology, as well as the active exercise of the bodily powers that allow us to live—in a nutshell, the phenomenology of the concrete existence of any living being—deserve to be rewritten. For every immersed being, the opposition between motion and stillness no longer exists: stillness is one of the results of motion and motion is, like a soaring eagle, a consequence of stillness.

Any being that can no longer separate between stillness and motion cannot contrast action and contemplation. Contemplation presupposes stillness: it is only by positing a fixed, stable, and solid world, which finds itself facing a *still* object, that one can speak of an *object*, and hence of a thought or of vision. On the contrary, the world for an immersed being—the world in immersion—does not, properly speaking, contain *real objects*. Everything in it is fluid, everything in it is in motion, with, against, or in the subject. It is defined as an element or flux that approaches, distances itself from, or accompanies the living being, which is itself flux or part of a flux. It is, properly speaking, a universe *without things*, an enormous field of events of varying intensity. So, if being in the world is *immersion*, then thinking and acting, working and breathing, moving, creating, feeling would be inseparable, because an immersed being has a relationship with the world that is not modeled on the relationship that a subject has with an object but on that of a jellyfish with the sea, which allows it to be what it is. There is no material distinction between us and the rest of the world.

The world of immersion is an infinite expanse of fluid matter according to varying degrees of quickness and slowness, but especially of resistance or of permeability—because in motion everything aims to penetrate the world and be penetrated by it. Permeability is the keyword: in this world, everything is in everything. The water of which the sea is made is not only in front of the fish subject but *in it*, passing through him, coming out of him. This interpenetration between world and subject gives to this space a complex geometry, which is itself in permanent change.

This approach to the world as immersion seems to be a surreal cosmological model, yet we experience it more often than we imagine. In fact we relive the experience of the fish each time we listen to music. If, instead of drawing the universe that surrounds us starting from the portion of reality to which vision gives us access, we deduced the structure of the world on the basis of our musical experience, we would have to describe the world as something composed not of objects but of fluxes that penetrate us and that we ourselves penetrate, of waves of variable intensity and in permanent movement.

Imagine being made of the same substance as the world that surrounds you; being of the same nature as music—a series of vibrations of the air, like a jellyfish, which is no more than a thickening of water. You will have a very precise image of what immersion is. If listening to music in a space defined exclusively by this activity (say, in a dance club) gives us such pleasure, it is because it allows us to seize the deepest structure of the world, one that the eyes, at times, prevent us from perceiving. Life as immersion is one in which our eyes are ears. To feel is always to touch, both oneself and the universe that surrounds us.

A world in which action and contemplation can no longer be distinguished is also a world in which matter and sensibility—or, if you wish, the eye and the light—are perfectly combined. Bodies and organs of sensibility can no longer be separate. We would no longer feel with a single part of our body, but with the totality of our being. We would be nothing but an immense organ of sense that merges with the object perceived. An ear that is nothing but the sound it hears, an eye that bathes constantly in the light that gives it life.

If life is tied indissolubly to fluid environments, this is because the relation between a living being and the world can never be reduced to one of opposition (or objectification) or to one of incorporation (which we experience in nourishment). The most primal relation between the living being and the world is that of reciprocal projection: a movement through which the living being commissions the world with what it must make of its own body and whereby the world, on the contrary, entrusts the living being with the realization of a movement that should have been external to it. What we call *technique* is a movement of this type. Thanks to it, the soul [*esprit*] lives outside the living being's body and makes itself soul [*âme*] of the world; conversely, a natural movement finds its origin and ultimate form in an idea of the living being. This mutual projection takes place also because the living being identifies itself with the world in which it is immersed. Every household is the fruit of this movement. We project ourselves in the space closest to us, and we make of this portion of space something intimate: a portion of world that has a particular relation to our own body, a kind of ordinary, material extension of our body. Our relation with our digs is exactly one of immersion: we do not stand before them the way we stand

before objects, we live in them as a fish lives in the sea, as primordial organic molecules live in their primordial soup. In effect, we've never ceased being fish. *Tiktaalik roseae* is just one of the forms we have developed in order to transform the universe into a sea in which we immerse ourselves.

Notes

1. The team was composed of Edward B. Daeschler, Farish A. Jenkins, and Neil H. Shubin. See Erik Ahlberg, and Jennifer A. Clack, "Palaeontology: A Firm Step from Water to Land," *Nature*, 440.7085 (2006): 747–9; E. B. Daeschler, N. H. Shubin, and F. A. Jenkins, "A Devonian Tetrapod-like Fish and the Evolution of the Tetrapod Body Plan," *Nature*, 440.7085 (2006): 757–63; N. H. Shubin, E. B. Daeschler, and F. A. Jenkins, "The Pectoral Fin of *Tiktaalik roseae* and the Origin of the Tetrapod Limb," *Nature*, 440.7085 (2006): 764–71; and Neil H. Shubin, *Your Inner Fish: The Amazing Discovery of Our 375-Million-Year-Old Ancestor* (London: Penguin, 2009).

2. Stanley L. Miller and Harold Clayto Urey, "Organic Compound Synthesis on the Primitive Earth," *Science*, 130.3370 (1959): 245–251. The experiment confirms the abiogenetic thesis proposed by Oparin and Haldane.

3. The idea of the primordial soup makes its first appearance in a letter dated February 1, 1871, from Darwin to the botanist Joseph D. Hooker, which speaks of "a small warm pond"; and it reappears in the writings of Oparin and Haldane. The latter speaks of a "hot dilute soup" as the first site of life. See John B. S. Haldane, "The Origin of Life," *Rationalist Annual*, 148 (1929): 3–10 and Alexander I. Oparin, *The Origin of Life* (New York: Macmillan, 1939). On this topic, see also Antonio Lazcano, "Historical Development of Origins Research," *Cold Spring Harbor Perspectives in Biology*, 2.11, doi: 10.1101/cshperspect.a002089 and Iris Fry, *The Emergence of Life on Earth: A Historical and Scientific Overview* (New Brunswick: Rutgers University Press, 2000).

4. This is the authentic philosophical meaning of René Quinton's book *L'Eau de mer en milieu organique: Constance du milieu marin originel comme milieu vital des cellules, à travers la série animale* (Paris: Masson, 1904). At p. v the author writes: "This book will go on to establish the two following points: (1) Animal life, in its cellular stage, first appeared in the seas. (2) Across the zoological spectrum, animal life has always tended to maintain the cells that compose each organism in a marine environment, such that, with a few exceptions that are negligible for present purposes and that seem besides to refer only to inferior and decayed species, every animal organism is a veritable marine aquarium in which there continue to live, in the aquatic condition of their origins, the cells that constituted these origins."

7
In Open Air
Ontology of the Atmosphere

Life has never abandoned fluid space. When, in time immemorial, life left the sea, it found and created around itself a fluid with different characteristics—consistency, composition, nature. With the colonization of the terrestrial world,[1] outside the marine environment, the dry world transformed itself into an enormous fluid body that allows the vast majority of living beings to live in an exchange-based, reciprocal relation between subject and environment. We are not inhabitants of the Earth; we inhabit the atmosphere. Terra firma is just the extreme limit of this cosmic fluid at the heart of which everything communicates, touches, extends. Its conquest was, before anything else, the fabrication of this fluid.[2]

Hundreds of millions of years ago, in a time span encompassed between the end of the Cambrian and the start of the Ordovician, groups of organisms left the sea and deposited the first traces of animal life of which we have evidence: it is likely that these were arthropod homopods,[3] in other words beings equipped with legs and with a pointed caudal appendage—the telson. Their presence on Earth at that point was still ephemeral and experimental: they appeared in the aerial environment in order to look for nourishment or to reproduce.[4] The world that opened up before them had been fashioned by other living beings. The universe we inhabit is the result of a catastrophe of pollution, one that we call, alternatively, the Great Oxygenation Event or the Oxygen Catastrophe.[5] Both geological and biological causes seem to have come together to change the face of the planet definitively. The development of the first organisms capable of photosynthesis—cyanobacteria—and the flux of hydrogen coming from the surface of the Earth prompted an accumulation of oxygen, in a first stage instantly oxidized by the elements present in marine waters or on the terrestrial surface (iron, for example, or limestone formations). With the development and diffusion of

vascular plants, the atmosphere stabilized itself: the quantity of free oxygen passed the threshold of oxygenation and accumulated in free form. In turn, the massive presence of oxygen led to the extinction of many anaerobic organisms that populated earth and sea, to the benefit of aerobic forms of life.[6]

The definitive settling, in sedentary form, of living beings on dry land coincided with the radical transformation of the aerial space that surrounds and envelops the terrestrial crust: what, from the seventeenth century on, we call "atmosphere" altered its internal composition.[7] Thanks to plants, the Earth definitively became the metaphysical space of breath. The first to colonize and make the Earth inhabitable were the organisms capable of photosynthesis: the first living beings that were wholly terrestrial are the greatest transformers of the atmosphere. At the other end, photosynthesis is a great atmospheric laboratory in which solar energy is transformed into *living matter*. From this point of view, plants have never abandoned the sea: rather they have brought it where it did not exist. They have transformed the universe into an immense atmospheric sea and have transmitted their marine habits to all other beings. Photosynthesis is, in this sense, a cosmic process of fluidification of the universe, one of the movements through which the fluid of the world constitutes itself: what allows the world to breathe and keeps it in a state of dynamic tension.

Plants, then, allow us to understand that immersion is not a simple spatial determination: to be immersed is not reducible to finding oneself *in* something that surrounds and penetrates us. Immersion, as we have seen, is first of all an *action* of mutual compenetration between subject and environment, body and space, life and medium. It is impossible to distinguish them physically and spatially: for there to be immersion, subject and environment have to *actively penetrate each other*; otherwise one would speak simply of juxtaposition or contiguity between two bodies touching at their extremities. Subject and environment act on each other and define themselves starting from this reciprocal action. Observed *ex parte subiecti* [from the subject's angle], this simplicity is expressed as the formal identity between passivity and activity: to penetrate the surrounding environment is to be penetrated by it. Thus, in all space of immersion, *to act* and *to be acted upon* are formally

indistinguishable. We experience this, for example, each time we swim.

But the state of immersion is above all the metaphysical site of a more radical identity of being and doing. One cannot *exist* in a fluid space without modifying, by this very fact, the reality and form of the environment that surrounds us. The life of plants constitutes the most surprising proof of this, in light of the *cosmogonic* consequences they have had on our world. The existence of plants is, by itself, a global modification of the cosmic environment, in other words of the world that they penetrate and by which they are penetrated. It is already *by existing* that plants modify the world globally without even moving, without beginning to act. "To be" means, for them, to *make world* [faire monde]; reciprocally, to construct (our) world, to make world is only a synonym of "to be." Plants are not the only living beings to experience this coincidence: organisms display it in an even more obvious manner. One must then generalize this find and conclude that *the existence of every living being is necessarily a cosmogonic act* and that a world is always, simultaneously, a condition of possibility and a product of the life that it hosts. Every organism is the invention of a way of producing the world ("a way of world-making," to put Nelson Goodman's phrase to different use), and the world is always a space of life, a lifeworld.

From this perspective, one can measure the limits of the notions of place or environment—which continue to represent the relation between the living being and the world exclusively under the aspects of *contiguity* and *juxtaposition*—and can begin thinking of them as ontologically and formally autonomous from the living organism that inhabits them. If any living being is a being in the world, every environment is a being within beings. The world and the living are nothing but a halo, an echo of the relation that binds them together.

We will never be able to be materially separated from the matter of the world: every living being constructs itself starting from the same matter that makes up the mountains and the clouds. Immersion is a *material* coincidence, which starts under our skin. This is why organisms do not need to go beyond or outside themselves to reinvent the face of the world; they have no need to act, to rejoin

their “environment,” or to perceive it: through the simple act of being they already fashion the cosmos. To be in the world necessarily means to *make world*: every activity of living beings is an act of design upon the living flesh of the world. On the other hand, in order to construct the world, one need neither fabricate an object different from oneself (spilling matter out of one’s skin) nor perceive, recognize, seize a portion of the world directly and consciously and *want* to change it. Immersion is a more profound relation than action and consciousnes—it is underneath praxis as well as underneath thought: a silent and mute design, an *ontological* design. It is this “plasmability,” which is only the absence of resistance to life; it is this *ease* with which cosmic matter metamorphoses into a living subject and becomes the *actual body* of certain organisms (even below the annexation represented by nutrition). In this respect, plants let us see the most radical form of being in the world: they adhere to it completely and without passivity. Far from being passive, they exercise on the world, which *we all* experience through the simple act of being, the most intense influence with the richest consequences, and this on a global, not a local scale. They change the world, not just their environment or their ecological niche. To think of plants means to think of a being in the world that is *immediately cosmogonic*. Photosynthesis—one of the major cosmogonic phenomena, and one that is indistinguishable from the being itself of plants—is neither of the order of contemplation nor of the order of action (as the construction of a dam by a beaver would be). In this way plants force biology, ecology, and also philosophy to rethink once more the relations between the world and the living.

In fact it is not possible to interpret the relation between plants and the world through the profoundly idealist model conceived of by the German naturalist Jakob von Uexküll. Following Kant’s doctrine and assuming that we should recognize each animal’s status of sovereign subject over its organs, von Uexküll conceived of the world as “a bubble [that] represents the animal’s environment and contains all the features accessible to the subject”:[8]

> We can say, with Kant, that there is no absolute space on which our subject cannot exercise an influence, because the specific matter of space, the signs of place and direction, is a subjective product, just like its form. Without spatial qualities and their synthesis in universal form produced through apperception, there would not be space but only an assortment of sensorial qualities like colors, sounds, smells, and so on, which would have their specific forms and places but would lack a site of encounter.[9]

This is because "[e]very subject spins out, like the spider's threads, its relations to certain qualities of things and weaves them into a solid web, which carries its existence."[10] The environment is thus "a psychical product [*psychoidales Erzeugnis*] and cannot be deduced from physical or physiological factors. Each environment is supported by a spatial and temporal frame that consists of a series of perceptual characters and signs of order."[11] This model is insufficient for at least two reasons. First of all, it conceives of the relationship with the world under the form of cognition and action: access to the world is given only through these two channels, as though "the rest of the life" of an individual were enclosed inside him or her and not thrown into the world, exposed to it, obliged to feed off it, to construct itself out of its elements. Second—but this is a consequence of this main limitation—von Uexküll's model entails that access to the world is of an *organic* nature, in other words takes place in and through an organ (it is irrelevant whether a cognitive or a practical one). Plants not only do not act and do not perceive—at least not in an *organic* way, that is, starting from parts of the body *specifically* built for this purpose—they also do not expose themselves to the world couched in a specific organ. No, it is with the totality of their body and being, without distinctions of form or function, that plants open to the world and merge into it.

Nor is it possible to conceive of the relation of plants to the world through niche construction theory. This theory, which has received its most detailed treatment from John Odling-Smee, Kevin N. Laland, and Marcus W. Feldman,[12] claims that, instead of limiting themselves to suffering environmental pressure, organisms are capable of modifying their own existential niche, or that of others,

through their metabolism and activity.[13] The idea of an action of the living on the surrounding environment[14] goes back to the last book by Charles Darwin published during his life,where he demonstrates, against his own theses on natural selection, that "[w]orms have played a more important part in the history of the world than most persons would at first suppose. [...] Each year [*sc.* in England]," he writes, "a weight of more than ten tons of dry earth annually passes through their bodies and is brought to the surface on each acre of land";[15] their action is thus decisive for the disaggregation of rocks, the erosion of the soil, the conservation of ancient ruins,[16] and the soil's preparation for the growth of plants.[17] Though they "are poorly provided with sense-organs" and thus incapable of learning about the external world, they demonstrate great expertise in the construction of burrows and, in particular, they give clear proof of possessing "some degree of intelligence instead of a mere blind instinctive impulse, in their manner of plugging up the mouths of their burrows."[18] The modifications that these barely organized creatures produce in the higher layers of the globe are not limited to influencing the lives of other living beings (humans and plants alike), but also influence the state of their specific habitats, which are modified to the benefit of future generations. Niche construction theory rehearses Darwin's finds in order to emphasize how living beings, even the simplest ones, are not just the victims of natural selection and how adaptation to the environment is not their only fate:[19] they are equally capable of modifying the space that surrounds them and of handing down the new world to future generations. In this sense, by producing permanent and transmissible modifications from one generation to the next, living beings produce *culture*,[20] which is not a human prerogative but rather a sort of inheritance that is not anatomical but ecological,[21] an exosomatic inheritance.[22] And yet, even though it has made it possible for us to overcome the dualisms that characterize the classical theory of evolution, niche construction theory does not allow us to conceive of the intimacy that characterizes immersion. The concept of niche in fact brings about a double separation. Elaborated in order to express the reality of a principle of competitive exclusion—the principle of Gause,[23] namely the tendency of two populations who share the same space to

eliminate each other in order to enjoy fully the available resources—the concept seems to tackle the relation between the world and the living in exclusive terms: the world is, at least tendentially, the space of a *single* species, the habitat of a specific form of life (as it was also for von Uexküll). Now, to be in the world means finding it impossible not to share the ambient space with other forms of life, not to be exposed to the life of others. As we have seen, the world is by definition the life of others: the ensemble of other living beings. The mystery that needs explaining is therefore the inclusion of all in the same world, and not the exclusion of other beings—which is always unstable, illusory, and ephemeral. What is more, through the concept of niche, one restricts the sphere of influence and of mundane existence to limitrophe space or to the set of factors or resources that are *immediately* related to the living subject. To recognize that the world is a space of immersion means, on the contrary, that there are no real or stable frontiers: the *world* is the space that never lets itself be reduced to a house, to what is one's own, to one's digs, to the immediate. Being in the world means to exercise influence especially outside one's own space, outside one's own habitat, outside one's own niche. It is always the totality of the world one lives in, which is and will always be infested by others.

In conclusion, the influence[24] of any living being on the environment cannot be measured simply by the effects that its existence produces outside itself: its very existence—insofar as it is nothing but a novel fashioning of the anonymous matter of the world—is the foremost influence of a living being on its environment. If the environment does not begin beyond the skin of the living being, this is because the world is already inside it. In this sense, the action of the living being upon the world cannot be considered a form of engineering produced by the ecosystem.[25]

"Plants," wrote Charles Bonnet, "are planted in the air nearly as much as they are in the earth":[26] the atmosphere rather than the soil is their first medium, their world. Photosynthesis is thus the most radical expression of their being in the world. Before being recognized as the principal mechanism of the production of vital energy, photosynthesis was understood as a *natural airconditioning* device. "I flatter myself," Joseph Priestley wrote in 1772, "that I have

accidentally hit upon a method of restoring air which has been injured by the burning, and that I have discovered at least one of the restoratives which nature employes for this purpose. It is vegetation."[27]

Priestley was a unitarian theologian famous for his research on electricity. He placed a mint plant under a bell jar that contained air produced from the combustion of a candle. He remarked that, twenty-seven days later, another candle was still perfectly capable of burning inside the jar.[28] According to Priestley, the explanation lies in the fact that plants feed off of gases produced through animal respiration and putrefaction ("phlogistic matter," in the terminology of his time). They absorb it and incorporate it into their own substance.[29] This discovery led him to formulate the principle of complementarity between the plant world and the animal world: "plants, instead of affecting air in the same manner with animal respiration, reverse the effects of breathing, and tend to keep the atmosphere sweet and wholesome, when it is become noxious, in consequence of animals living and breathing, or dying and putrefying in it."[30] The being in the world of plants resides in their capacity to (re-)create atmosphere. From a certain point of view, the living being itself—regardless of the order and realm to which it belongs—is considered in terms of the type of atmosphere it produces, as though being in the world meant above all "to make atmosphere," and not the other way round.

Some years later, a Dutch doctor, Jan Ingenhousz, extending Priestley's intuition, discovered that the capacity of plants to "correct bad air and to improve good air"[31] was due exclusively to leaves.

> It will, perhaps, appear probable, that one of the great laboratories of nature for cleansing and purifying the air of our atmosphere is placed in the substance of the leaves, and put in action by the influence of the light; and that the air thus purified, but in this state grown useless or noxious to the plant, is thrown out for the greatest part by the excretory ducts, placed chiefly, at least in the most part of plants, on the underside of the leaf.[32]

Ingenhousz indeed discovered photosynthesis (and not only its effects) when he grasped that this work of purification and of air conditioning was intimately tied to the presence of solar light: "the leaves of plants yield dephlogistificated air only in the clear day-light, or in the sunshine, and begin their operation only after they have been in a certain manner prepared, by the influence of the same light, for beginning it."[33] Dipping plants in a pot full of water, Ingenhousz found that the air, having been

> prepared in the leaves by the influence of the light of the sun, appears soon upon the surface of the leaves in different forms, most generally in the form of round bubbles, which, increasing gradually in size, and detaching themselves from the leaves, rise up and settle at the inverted bottom of the jar: they are succeeded by new bubbles, till the leaves, not being in the way of supplying themselves with new atmospheric air, become exhausted.[34]

The fact of being underwater is not against nature, he argues:

> It might, perhaps, be objected that the leaves of the plants are never in a natural state when surrounded by pump water; and that thus there may, perhaps, remain some degree of doubt, whether the same operation of the leaves in their natural situation takes place. I cannot consider the plants kept thus under water to be in a situation so contrary to their nature as to derange their usual operation. Water, even more than they want, is not hurtful to plants, if it is not applied too considerable a time. The water only cuts off the communication with the external air.[35]

The experiences and discoveries of Priestley and Ingenhousz (followed by those of Jean Senebier,[36] Nicolas Théodore de Saussure,[37] Julius Robert von Mayer,[38] and Robin Hill,[39] to cite only some of the great scientists at the origin of the discovery of the true nature of the photosynthetic process) were important not only because they allowed us to make an enormous step forward in our understanding of plant physiology, but because they represented a radical shift in the way we look at the atmosphere. The air we breathe is not a purely geological or mineral reality—it is not just out there, it

is not, as such, an effect of the earth—but rather the breath of other living beings. It is a byproduct of "the lives of others." In breath—the first and the most trivial and unconscious act of life for a huge number of organisms—we depend on the lives of others. But, above all, the life of others and its manifestations are reality itself, the body and the matter of what we call the world or the medium. Breath is already a first form of cannibalism: every day we feed off the gaseous excretions of plants. We could not live but off the life of others. Conversely, every living being is first of all what makes possible the life of others, a product of transitive life, which is capable of circulating everywhere, of being breathed in by others. The living being is not satisfied with giving life to a restricted portion of matter that we call its body; it also gives life especially to the space that surrounds it. That is where immersion lies—the fact that life is always its own environment and that, because of this, it circulates from body to body, from subject to subject, from place to place.

After all, photosynthesis demonstrates that, if one observes it on a global scale, the fundamental relation between life and the world is much more complex than what we imagine through the concept of adaptation.

> Adaptation is a dubious notion, for in the real world the environment, to which the organisms are adapting, is determined by their neighbors' activities rather than by the blind forces of chemistry and physics alone. [...] the air we breathe, the oceans and the rocks are all either the direct products of living organisms or have been greatly modified by their presence.[40]

Instead of revealing itself as a space of competition or mutual exclusion, the world opens in them as the metaphysical space of the most radical form of mixture, the form that makes possible the coexistence of the incompatible, an alchemical laboratory in which everything seems to be able to change its nature, to pass from the organic into the inorganic. Immersion makes both symbiosis and symbiogenesis possible: if organisms come to define their identity thanks to the life of other living beings, this is because each living being lives already, at once, in the life of others.[41]

Plants are the primordial soup of the Earth that allows matter to become life and life to retransform itself into "brute matter." We call "atmosphere" this radical mixture that makes everything coexist in a single place without sacrificing either forms or substances.

More than a part of the world, the atmosphere is a metaphysical space in which everything depends on everything else, the quintessence of the world understood as a space in which each person's life is mixed with the life of others. The space in which we live is not simply a container to which we have to adapt. Its form and its existence are inseparable from the forms of life it hosts and makes possible. The air we breathe, the nature of the soil, the lines of the terrestrial surface, the shapes that form themselves in the sky,[42] the color of everything that surrounds us: these are all immediate effects of life, in the same sense and with the same intensity as they are its principles. The world is not an autonomous entity independent of life, it is the fluid nature of any medium: climate, atmosphere.

It surrounds us and penetrates us but we are barely aware of it. It is not a space: it is a subtle, transparent body, barely perceivable by touch or by sight. But it is from this fluid, which envelops everything, which penetrates and is penetrated by everything, that we have the colors, forms, smells, and tastes of the world. In this same fluid we can encounter things and let ourselves be touched by everything that exists and does not exist. It is this fluid that makes us think; it is this fluid that makes us live and love. The atmosphere is our first world, the medium in which we are wholly immersed: the sphere of breath. It is the absolute medium, that in which and through which the world gives itself, that in which and through which we give ourselves to the world. More than absolute container, it is the stirring of everything, the matter, space, and force of the infinite and universal interpenetration of things. The atmosphere is not just a part of the world that is distinct and separate from others, but the principle through which the world makes itself inhabitable, opening itself to our breath and itself becoming the breath of things. One is always, in the manner of the atmosphere itself, *in* the world, because the world exists as atmosphere.

The term "atmosphere" is modern. It is a neologism coined in the seventeenth century to give a classical allure to the Dutch expression

dampcloot, itself a translation of Latin *vaporum sphaera*, a term by which Galileo was referring to *regio vaporosa*, a "vaporous realm."[43] But before being the aerial region immediately above the terrestrial crust, hot through the reflection of solar light and humid owing to the vapors exhaled by the earth, atmosphere has also been, for centuries, a space of circulation for elements and forms, the metaphysical space of their conjunction, the unity of all things, measured by the coincidence of breath and not by that of substance or form.

The Stoics were the first to have thought of the unity of the world in terms related to the atmosphere. In pondering over the various forms that unity can take and over the form of unity specific to the world in its totality, Stoicism developed its concept of total mixture. One can, in effect, imagine three forms of union produced by the interaction of different substances or objects: simple juxtaposition (*parathesis*), in which different things form a single mass while preserving the limits of their body and without sharing anything, as in the case of a heap of grains; fusion (*sunchusis*), in which the quality of each component is destroyed to produce a new object, which has a different nature and quality from that of the originary elements, as in the case of perfumes; and, lastly, total mixture (*krasis*, or *di'holōn antiparektasis*), in which bodies occupy each other's place, while preserving their quality and individuality.[44] Now, what one calls "world" cannot be thought of as a simple pile of objects with no relation other than superficial contact, or as a complete fusion of bodies that gives rise to a "super-object"[45] distinct in essence and quality from its originary components. Alexander of Aphrodisias wrote, summarizing the doctrine of Chrysippus:

> Certain mixtures occur by juxtaposition through two or more substances being composed into the same mass and juxtaposed with one another "by juncture" as he [*sc*. Chrysippus] says, and with each of them preserving the surface of their own substance and quality in such a juxtaposition, as, one will grant, happens with beans and wheat-grains in their juxtaposition [...] other mixtures occur by total fusion with both the substances and their qualities being destroyed together as he says happens with medical drugs in the joint-destruction of the constituents and the production of other body from them;

and there is another type, wrote Alexander, that

> occurs through certain substances and their qualities being mutually coextended in their entirety and preserving their original substance and qualities in a mixture: this mixture is blending in the strict sense of the term.[46]

To think of the atmosphere as a space of mixture means to overcome the idea of composition and fusion. Between the elements of the same world there is a complicity and an intimacy that go much deeper than those produced by physical contiguity; what is more, this attachment is not identical with an amalgam or with the reduction of the variety of substances, colors, forms, or species to a monolithic unity. If things form a world, it is because they mix without losing their identity.

The unity of mixture, in turn, is not mechanical: "substance is unified because it is entirely pervaded by a pneuma through which the whole is held together, is stable and is sympathetic with itself."[47] To mix without fusion means to share the same breath. One has to give attention to the unity of a living body: organs are not simply juxtaposed, nor are they materially liquefied into one another. If they constitute *a body*, it is because they share the same *breath*. The same goes for the cosmos: to be in the world means always to share not only an identity, but the same *breath* (that is, the same *pneuma*). "There is a breath that moves itself toward itself and of itself":[48] such is the dynamic of the world, its immanent rhythm. Breath is the art of mixture, what allows each object to mix with the rest of the objects, to immerse itself in them. *Atmosphere*, the sphere of breath,

its extreme horizon, is the form of intimacy and unity that defines itself not through homogeneity of substance or form but through the sharing of the same breath, of a family *resemblance* among a collection of elements that is not a simple combination of disparate objects. The atmosphere—the climate—is this unity that has no need to be reduced to a unity of qualities and forms.

What radiates unity also radiates form, visibility, consistency. This same family resemblance is what allows us to recognize the real identity of a collection, and the atmosphere is what makes a place visible to us in its totality, beyond the objects that occupy it. Breath is not only air in motion: it is lightning, unveiling, means of revelation. If the world is unified by a common and universal breath, it is because breath is the originary essence of what the Greeks called *logos*, language, reason. Hence *logos* is what produces the universal mixture, it is what allows everything to mix in the extension of every other living thing without losing its own identity. If breath gives unity to the world, it is because it also constitutes the last root of its visibility and its rationality: breath is the true *logos* of the world, its language, its word, the organ of its revelation.

The world is the matter, the form, the space, and the reality of breath. Plants are the *breath of all living beings, the world as breath*. In turn, any breath is evidence of the fact that being in the world is, fundamentally, an experience of immersion. To breathe means to be plunged into a medium that penetrates us in the same way and with the same intensity as we penetrate it. Any being is a being of the world [*mondain*] if it immersed in what immerses itself in it. The plant, then, is the paradigm of immersion.

Notes

1. The literature on this topic is immense. See Patricia G. Gensel and Dianne Edwards (eds.), *Plants Invade the Land: Evolutionary and Environmental Perspectives* (New York: Columbia University Press, 2001); M. Vecoli, G. Clément, and B. Meyer-Berthaud (eds.), *The Terrestrialization Process: Modeling Complex Interactions at the Biosphere–Geosphere Interface* (London: Geological Society, 2010); and Joseph E. Armstrong, *How the*

Earth Turned Green: A Brief 3.8-Billion-Year History of Plants (Chicago: University of Chicago Press, 2014). See also manuals of the evolutionary history of plants; among others, Kathy J. Willis, *The Evolution of Plants* (Oxford: Oxford University Press, 2002), esp. chs. 2 and 3, and T. N. Taylor, E. L. Taylor, and M. Krings, *Paleobotany: The Biology and Evolution of Fossil Plants* (Burlington: Elsevier, 2009). Among the most recent studies on this topic, see J. A. Raven, "Comparative Physiology of Plant and Arthropod Land Adaptation," *Philosophical Transactions of the Royal Society London*, 309 (1985): 273–88; Paul Kenrick and Peter R. Crane, "The Origin and Early Evolution of Plants on Land," *Nature* 389.6646 (1997): 33–9; and Martin Gibling and Neil Davies, "Paleozoic Landscapes Shaped by Plant Evolution," *Nature Geosciences*, 5 (2012): 99–105.

2. As Karl J. Niklas wrote, the assertion of plant life has constituted an invasion of the air more than one of the earth. See his magisterial *The Evolutionary Biology of Plants* (Chicago: University of Chicago Press, 1997).

3. R. B. MacNaughton, J. M. Cole, R. W. Dalrymple, S. J. Braddy, D. E. G. Briggs, and T. D. Lukie, "First Steps on Land: Arthropod Trackways in Cambrian-Ordovician Eolian Sandstone, Southeastern Ontario, Canada," *Geology*, 30 (2002): 391–4.

4. Simon J. Braddy, "Eurypterid Palaeoecology: Palaeobiological, Ichnological, and Comparative Evidence for a 'Mass-moult-mate' Hypothesis," *Paleogeography, Paleoclimatology, Palaeoecology*, 172 (2001): 115–32.

5. The literature is immense on this issue, too. The fundamental contributions are those of Preston E. Cloud, "Atmospheric and Hydrospheric Evolution on the Primitive Earth," *Science*, 160 (1972): 729–36 and Heinrich D. Holland's articles "Early Proterozoic Atmospheric Change," in Stefan Bengston (ed.), *Early Life on Earth* (New York: Columbia University Press, 1994), pp. 237–44; "The Oxygenation of the Atmosphere and Oceans," *Philosophical Transactions of the Royal Society: Biological Sciences*, 361 (2006): 903–15; and "Why the Atmosphere Became Oxygenated: A Proposal," *Geochimica and Cosmochimica Acta*,

73 (2009): 5241–55. The beautiful book by Donald E. Canfield, *Oxygen: A Four-Billion-Year History* (Princeton: Princeton University Press, 2014), gives one a good orientation. For an explanation of the great oxidative event starting from geological causes, see, among others, M. Wille, J. D. Kramers, T. F. Nagler, N. J. Beukes, S. Schroder, T. Meisel, J. P. Lacassie, and A. R. Voegelin, "Evidence for a Gradual Rise of Oxygen between 2.6 and 2.5 Ga from Mo Isotopes and Re-PGE Signatures in Shales," *Geochimica and Cosmochimica Acta*, 71 (2007): 2417–35. For a biological explanation, see for example T. J. Algeo, R. A. Berner, J. B. Maynard, and S. E. Scheckler, "Late Devonian Oceanic Anoxic Events and Biotic Crises: Rooted in the Evolution of Vascular Land Plants?" *GSA Today*, 5 (1995): 63–6; and Joseph L. Kirschvink and Robert E. Kopp, "Paleoproterozoic Ice Houses and the Evolution of Oxygen-Mediating Enzymes: The Case for a Late Origin of Photosystem II," *Philosophical Transactions of the Royal Society*, 263 (2008): 2755–65.

6. See the literature cited in the previous note.

7. On the history of the concept of atmosphere, see Craig Martin, "The Invention of Atmosphere," *Studies in History and Philosophy of Science*, 52 (2015): 44–54.

8. Jakob von Uexküll, *A Foray into the Worlds of Animals and Humans, with A Theory of Meaning*, trans. by Joseph D. O'Neil (Minneapolis: University of Minnesota Press, 2010), p. 43. See also Jakob von Uexküll, *Theoretische Biologie*, 2nd edn. (Berlin: Springer, 1928), p. 62: "The space around each animal is a soap bubble within which their actions take place."

9. Von Uexküll, *Theoretische Biologie*, p. 42.

10. Von Uexküll, *Foray*, p. 53.

11. Jakob von Uexküll, *Die Lebenslehre* (Potsdam: Müller and Kiepenheuer, 1930), p. 134.

12. F. J. Odling-Smee, K. N. Laland, and M. W. Feldman, *Niche Construction: The Neglected Process in Evolution* (Princeton: Princeton University Press, 2003). The theory of the construction

of niches is indebted to the writings of Richard C. Lewontin: "Organism and Environment," in H. C. Plotkin (ed.), *Learning, Development, and Culture* (New York: Wiley, 1982), pp. 151–70; "The Organism as the Subject and Object of Evolution," *Scientia*, 118 (1983): 65–82; "Adaptation," in Richard Levins and Richard Lewontin (eds.), *The Dialectical Biologist* (Cambridge, MA: Harvard University Press, 1985), pp. 65–84. For a mise au point on this issue, see Sonia E. Sultan, *Organism and Environment: Ecological Development, Niche Construction, and Adaptation* (Oxford: Oxford University Press, 2015).

13. Kevin N. Laland, "Extending the Extended Phenotype," *Biology and Philosophy*, 19 (2004): 313–25; K. N. Laland, J. F. Odling-Smee, and M. W. Feldman, "Evolutionary Consequences of Niche Construction and Their Implications for Ecology," *Proceedings of the National Academy of Sciences*, 96 (1999): 10242–7; K. N. Laland, J. F. Odling-Smee, and S. F. Gilbert, "EvoDevo and Niche Construction: Building Bridges," *Journal of Experimental Zoology*, 310 (2008): 549–66.

14. G. G. Brown, C. Feller, E. Blanchart, P. Deleporte, and S. S. Chernyansky, "With Darwin, Earthworms Turn Intelligent and Become Human Friends," *Pedobiologia*, 47 (2004): 924–33.

15. Charles Darwin, *The Formation of Vegetable Mould, through the Action of Worms, with Observations on Their Habits* (New York: Appleton, 1881), p. 305.

16. Ibid., pp. 308–9.

17. Ibid., pp. 309–10.

18. Ibid., p. 312.

19. Kim Sterenly, "Made by Each Other: Organisms and Their Environment," *Biology and Philosophy*, 20 (2005): 21–36.

20. The literature on animal culture has grown considerably. See, among others, Gavin R. Hunt and Russell D. Gray, "Diversification and Cumulative Evolution in New Caledonian Crow Tool Manufacture," *Proceedings of the Royal Society*, 270

(2003): 867–74; Kevin N. Laland and William Hoppitt, "Do Animals Have Culture?" *Evolutionary Anthropology*, 12 (2003): 150–9; Kevin N. Laland and Bennett G. Galef Jr. (eds.), *The Question of Animal Culture* (Cambridge, MA: Harvard University Press, 2009); Luke Rendeel and Hall Whitehead, "Culture in Whales and Dolphins," *Behaviour and Brain Sciences*, 24 (2001): 309–82; David F. Sherry and Bennett G. Galef Jr., "Social Learning without Imitation," *Animal Behaviour*, 40 (1990): 987–9; and Andrew Whiten and Carol P. Van Schaik, "The Evolution of Animal 'Cultures' and Social Intelligence," *Philosophical Transactions of the Royal Society*, 362 (2007): 603–20. An important and original introduction is that of Dominique Lestel, *Les origines animales de la culture* (Paris: Flammarion, 2001).

21. See Odling-Smee, Laland, and Feldman, *Niche Construction*, p. 13: "We call this second general inheritance system ecological inheritance. It comprises whatever legacies of modified natural selection pressures are bequeathed by niche constructing ancestral organisms to their descendants. Ecological inheritance differs from genetic inheritance in several important respects."

22. Laland, "Extending the Extended Phenotype," p. 316: "Organisms not only acquire genes from their ancestors but also an ecological inheritance, that is, a legacy of natural selection pressures that have been modified by the niche construction of their genetic or ecological ancestors. Ecological inheritance does not depend on the presence of any environmental replicators, but merely on the persistence, between generations, of whatever physical changes are caused by ancestral organisms in the local selective environments of their descendants. Thus ecological inheritance more closely resembles the inheritance of territory or property than it does the inheritance of genes."

23. Georgyi F. Gause, *The Struggle for Existence* (Baltimore: Williams & Wilkins, 1934). On the concept of niche, see Arnaud Pocheville, "The Ecological Niche: History and Recent Controversies," in T. Heams, P. Huneman, G. Lecointre, and M. Silberstein (eds.), *Handbook of Evolutionary Thinking in the Sciences* (New York: Springer, 2015), pp. 547–86.

24. On the notion of influence in ecology, see the classic article by Robert J. Naiman, "Animal Influences on Ecosystem Dynamics," *BioScience*, 38 (1988): 750–2, which recognizes the difficulty of limiting the magnitude of living beings' action on the environment: "As a general phenomenon, this process is complicated and difficult to study because many animal population cycles occur over long periods (i.e., decades); alterations to the ecosystem are apparently subtle over short periods (i.e., increased tree mortality or altered soil formation); and shifts in biogeochemical cycles or sediment and soil characteristics are not detectable over short periods (i.e., years). Nevertheless, these successional pathways often result in a heterogeneous landscape that would not occur under the dominating influence of climate and geology alone; they require the intervention of animal activity."

25. See the famous essay by C. G. Jones, J. H. Lawton, and M. Shachak, "Organisms as Ecosystem Engineers," *Oikos*, 69 (1994): 373–86: "Ecosystem engineers are organisms that directly or indirectly modulate the availability of resources (other than themselves) to other species, by causing physical state changes in biotic and abiotic materials. In so doing, they modify, maintain, and/or create habitats. The direct provision of resources by an organism to other species, in the form of living or dead tissues, is not engineering. Rather, it is the stuff of most contemporary ecological research, for example plant–herbivore and predator–prey interactions, food web studies, and decomposition processes."

26. Charles Bonnet, *Recherches sur l'usage des feuilles dans les plantes: Et sur quelques autres sujets relatifs à l'histoire de la végetation* (Göttingen: Elie Luzac, 1754), p. 47. For what follows, see Leonard Kollender Nash, *Plants and the Atmosphere* (Cambridge, MA: Harvard University Press, 1952); Howard Gest, "Sunbeams, Cucumbers, and Purple Bacteria: Historical Milestones in Early Studies of Photosynthesis Revisited," *Photosynthesis Research*, 19 (1988): 287–308; Howard Gest, "A 'Misplaced Chapter' in the History of Photosynthesis Research: The Second Publication (1796) on Plant Processes by Dr. Jan

Ingenhousz, MD, Discoverer of Photosynthesis," *Photosynthesis Research*, 53 (1997): 65–72; Govindjee and Howard Gest, "Celebrating the Millennium: Historical Highlights of Photosynthesis Research, Part 1," Photosynthesis Research (special issue), 73 (2001): 1–6; Govindjee, J. Thomas Beatty, and Howard Gest, "Celebrating the Millennium: Historical Highlights of Photosynthesis Research, Part 2," *Photosynthesis Research* (special issue), 76 (2003): 1–13; Jane Hill, "Early Pioneers of Photosynthesis Research," in J. Eaton-Rye, B. C. Tripathy, and T. D. Sharkey (eds.), *Photosynthesis: Plastid Biology, Energy Conversion, and Carbon Metabolism* (Dordrecht: Springer, 2012), pp. 771–800. On eighteenth-century botany, see the important study by François Delaporte, *Le second règne de la nature: Essai sur les questions de végétalité au XVIIIe siècle* (Paris: Flammarion, 1979) [English version *Nature's Second Kingdom: Explorations of Vegetality in the Eighteenth Century*, trans. by Arthur Goldhammer, Cambridge, MA: MIT Press, 1982]. See also Claude Lance, *Respiration et photosynthèse: Histoire et secrets d'une équation* (Les Ulis, Paris: EDP Sciences, 2013). See also Jack Farineau and Jean-François Morot-Gaudry, *La photosynthèse: Processus physiques, moléculaires et physiologiques* (Versailles: Éditions QUAE, 2011).

27. Joseph Priestley, "Observations on Different Kinds of Air," *Philosophical Transactions of the Royal Society of London*, 62 (1772): 147–264, here p. 166.

28. Ibid., p. 168.

29. Ibid., p. 232.

30. Ibid., p. 193.

31. Jan Ingenhousz, *Experiments upon Vegetables: Discovering Their Great Power of Purifying the Common Air in the Sun-Shine, and of Injuring It in the Shade and at Night, to Which Is Joined, a New Method of Examining the Accurate Degree of Salubrity of the Atmosphere* (London: Elmsly & Payne, 1779), p. 12. On Ingenhousz, see Geerdt Magiels, *From Sunlight to Insight: Jan Ingenhousz, the Discovery of Photosynthesis and Science in*

the Light of Ecology (Brussels: VUB Press, Academic and Scientific Publishers, 2010).

32. Ingenhousz, *Experiments upon Vegetables*, p. 9.

33. Ibid., pp. 14–16.

34. Ibid., pp. 15–16.

35. Ibid., p. 31.

36. Jean Senebier, *Mémoires physico-chimiques sur l'influence de la lumière solaire pour modifier les êtres des trois règnes de la nature* (Geneva: Barthelemi Chirol, 1782) [English version published in 1805 by T. Cox of London].

37. Nicolas Théodore de Saussure, *Recherches chimiques sur la végétation* (Paris: Chez la veuve Nyon, 1804) [English version *Chemical Research on Plant Growth*, trans. with introd. by Jane F. Hill, New York: Springer, 2013].

38. Julius Robert von Mayer, *Die organische Bewegung im ihrem Zusammenhange mit dem Stoffwechsel: Ein Beitrag zur Naturkunde* (Heilbronn: Drechsel'sche Buchhandlung, 1845).

39. See the pioneering studies by Robin Hill that helped our understanding of the chemical dynamism of photosynthesis: "Oxygen Evolved by Isolated Chloroplasts," *Nature*, 139 (1937): 881–2 and "Oxygen Produced by Isolated Chloroplasts," *Proceedings of the Royal Society Biological Sciences*, 127 (1939): 192–210.

40. Arthur Lovelock, "Geophysiology: The Science of Gaia," *Reviews of Geophysics*, 27 (1989): 215–22, here p. 216.

41. On the history of the notion of symbiosis, see Olivier Perru, "Aux origines des recherches sur la symbiose vers 1868–1883," *Revue d'histoire des sciences*, 59.1 (2006): 5–27. On the history of the concept of symbiogenesis, see Liya Nikolaevna Khakhina, *Concepts of Symbiogenesis: A Historical and Critical Study of the Research of Russian Botanists* (New Haven: Yale University Press, 1992) and works in the tradition of Boris Mikhaylovich

Kozo-Polyansky's classic *Symbiogenesis: A New Principle of Evolution* (Cambridge, MA: Harvard University Press, 2010). For contemporary approaches, see the magisterial studies of Lynn Margulis, *Symbiosis in Cell Evolution: Microbial Communities in the Archean and Proterozoic Eons*, 2nd edn. (New York: W. H. Freeman, 1993) and *Symbiotic Planet: A New Look at Evolution* (New York: Basic Books, 1998).

42. On this last point, see Allison L. Steiner, Sarah D. Brooks, Chunhua Deng, Daniel C. O. Thornton, Michael W. Pendleton, and Vaughn Bryant, "Pollen as Atmospheric Cloud Condensation Nuclei," *Geophysical Research Letters*, 42 (2015): 3596–602.

43. Craig Martin, "The Invention of Atmosphere."

44. See Philo of Alexandria, *De confusione linguarum* 37.184; also Alexander of Aphrodisias, *De mixtione*. On the question of mixture, see the magnificent monograph of Jocelyn Groisard, *Mixis*: *Le problème du mélange dans la philosophie grecque d'Aristote à Simplicius* (Paris: Les Belles Lettres, 2016).

45. This is the presupposition of almost all current debates on speculative realism: sadly, these seem to know only the first concepts of the world and ignore completely the idea of the world as mixture. See, among others, Quentin Meillassoux, *After Finitude*, trans. by Ray Brassier (London: Continuum, 2008) and Markus Gabriel, *Why the World Does Not Exist*, trans. by Gregory S. Moss (Cambridge: Polity, 2015).

46. Robert Todd, *Alexander of Aphrodisias on Stoic Physics: A Study of the De mixtione with Preliminary Essays: Text, Translation and Commentary* (Leiden: Brill, 1976), pp. 53–4.

47. Ibid., p. 115.

48. Ioannes Stobaeus, *Eclogarum physicarum et ethicarum libri duo* 1.12.4 (153.24 Wachsmut = *Stoicorum Veterorum Fragmenta* II 471). When Georges Canguilhem wrote that "to live is to radiate, it is to organize the milieu from and around a starting from a center of reference, which cannot itself be referred to without losing its original meaning," he unconsciously describes the Stoic

concept of *pneuma* (which had vast resonances in the Renaissance). See Georges Canguilhem, *Knowledge of Life*, ed. by Paola Marrati and Todd Meyers, trans. by Stefanos Geroulanos and Daniela Ginsburg (New York: Fordham University Press, 2008), pp. 113–14.

8
The Breath of the World

It is at the heart of all our experiences. It is not a substance: it does not enclose in itself the nature of things. Nor is it a late echo, added once the experience is accomplished. It is a rhythmic movement, regular and tireless, a wave without noise that goes to the limits of the horizon and comes back to us, to brush against our bodies and to explode into our lungs.

Without it, nothing would be possible in our life. Everything that happens to us has to mix with it, to take place within its space. Breath is the first activity of all living beings, the only one that can claim to meld itself with being. It is the only work that does not tire us, the only movement that has no end other than itself. Our life begins with a (first) breath and will end with a (last) breath. To live is to breathe and embrace in one's breath all the matter of the world.

It is not only the most elementary movement of any human body, it is also the first and the simplest of the acts of living beings—its paradigm, its transcendental form. Breath is, quite simply, the first name of being in the world. Intellection is breath: the idea, the concept, and what we, ever since scholasticism, call an intentional species are all portions of the world in the spirit, before the word, design, or action may restore to the cosmos these intensities. Sight is breath: it is to welcome light, the colors of the world, it is to have the force of letting oneself be pierced by its beauty, of choosing a portion and a portion only, of creating a form, of initiating a life starting from what we have extracted from the continuum of the world.

Everything in the realm of the living is the articulation of breath: from perception to digestion, from thought to pleasure, from speech to locomotion. Everything is a repetition, intensification, and variation of what takes place in breath. This is why the most different kinds of knowledge—from medicine to theology, from cosmology to philosophy—have used it as the noun that characterizes life in its most different forms, in the most diverse languages (*spiritus, pneuma, Geist*). To recognize its status, people have made of it a

substance separate from others through form, matter, and being—mind [*esprit*]. But the first, most paradoxical attribute of breath is its very lack of substance, its insubstantiality: it is not an object detached from others, but the vibration through which everything opens up to life and mixes with the rest of the objects, the oscillation that, for an instant, animates the matter of the world.

It is a vibration that touches, simultaneously, the living being and the world that surrounds it. In breath, for the duration of an instant, the animal and the cosmos are reunited; and they seal a different unity from the one marked by being or form. It is, however, with and in the same motion that living being and world consecrate their separation. What we call life is only this gesture, through which a portion of matter distinguishes itself from the world with the same force that it uses to merge with it. To blow is to make the world, to fuse with it and to redesign our form, in a perpetual exercise. To breathe is to know the world, to penetrate and be penetrated by it and its mind [*esprit*]—to traverse it and to become for an instant, with this same impetus, the place in which the world becomes an individual experience. This operation is never final: the world, like the living being, is only the return of breath and of its possibility. Mind [*Esprit*].

Breath does not limit itself to the activity of the living: it defines the consistency of the world, too, and especially that. The space it traces coincides with the world milestones that one experiences. We reach out as far as our breath does. On the other hand, a world without breath would be nothing but a confused mass of objects in the process of decomposition. If it is thanks to breath that we are in the world, it is in and through breath that we have understood and fashioned the world. It is of breath that we have to enquire about the nature of the world: it is in breath that the world reveals itself, it is in breath that the world exists for us.

The innumerable beings that populate the cosmos, the most different and incomparable things, the most faraway moments and spaces, the most incompatible realities draw their unity from the infinite forms of breath. They melt into a world. As a superior unity of everything that is different—a supreme and unsurpassable unity of what is and what is not—it does not exist other than in and through breath.

The metaphysical space of breath is, above all, contradiction: breathing precedes every distinction between soul [*âme*] and body, between mind [*esprit*] and object, between ideality and reality. It is not enough to proclaim the facticity of sense and its primacy over existence. Sense and existence always live as breath and in breath: they are its specific vibrations. The world is breath and all that exists in it exists in this form. The existence of the world is not a fact of the logical order: it is a pneumatological matter. Only breath can touch and feel the world, giving it existence. One can only breathe the world.

The ancients are not the only ones to have made breath into [*sc.* a principle of] the transcendental unity of the world and into the proof that, in this capacity, it is a living reality. In an unpublished fragment, Newton wrote: "Thus this Earth resembles a great animall or rather an inanimate vegetable, draws in aethereall breath for its dayly refreshment & vitall ferment & transpires again with gross exhalation."[1]

But one has to wait for the more recent debate around the Gaia hypothesis to recognize that atmosphere constitutes the living unity of the world, the proof that the planet is determined by life. One of its first formulations, in an article that Lovelock and Margulis published in 1974 in the journal *Icarus*, asserts that the existence itself of atmosphere is proof of a "homeostasis on a planetary scale"[2] and of the fact that "life has modulated the flow of energy and mass at the planetary surface."[3] Atmosphere is the vital breath that animates the Earth in its totality.

The idea is quite old. Lamarck was, without a doubt, the first to define atmospheric and climatic space as the site of a dynamic interconnection between matter and life, between world and subjectivity. The treatise he dedicated to the science of this liminal space—a science he called *hydrogeology*—opens with this question: "What are the general effects of living organisms on the mineral substances which form the earth's crust and external surface?"[4] The possibility of conceiving of the most superficial layer of matter in the terrestrial crust and of the ensemble of gaseous and liquid materials that hang over the planet as an immense fluid for the circulation of being arises from the discovery that "the various *compound mineral*

substances occurring in the earth's external crust in isolated accumulations, veins, and parallel beds, and so on, as plains, hills, valleys, and mountains are exclusively the product of the animals and plants that lived in these areas."[5] According to Lamarck, this unity is engendered by the state of aggregation; and the forms of any matter at surface level have the organic faculties of living beings as direct and indirect causes of the existence of that matter. As he had already written in his *Mémoires*,

> all the compounds one observes on the globe are due, be it directly or indirectly, to the organic faculties of living beings endowed with life. In effect, these beings form all materials, having the faculty of composing their own substance, and, to compose it, a part between them (plants) having the faculty of forming first combinations that they assimilate to their substance.[6]

This is not simply a matter of influence on the chemical composition. The presence of living beings does not limit itself to determining the aggregation of matter; it also defines its status. The world exists only in those places where there are living beings—while the presence of life, for its part, transforms the very nature of space.

What we see here is a movement that operates contrary to the one described by Lamarck in his *Philosophie zoologique*: it is no longer the living being's responsibility to adapt to environmental circumstances—the *circumfusa* of neo-Hippocratic medicine;[7] rather the environment in its entirety has to become echo, halo, aureole for the mass of living beings—in other words, their atmosphere.

The opposite is also true. If we are atmospherically connected to what surrounds us, this is also because the atmosphere is what constantly engenders the living. This is the conclusion reached by one of the first analyses of the chemical relations between living beings and the environment: the *Essai de statique chimique* by Dumas and Boussingault, published in 1844. The authors start from the assertion that plants function "in every particular, inversely or in opposition to animals": "If the animal kingdom constitutes an immense apparatus of combustion, the vegetable kingdom, in its turn, constitutes an immense apparatus of reduction." Their perfect

integration is not just the simple supernumerary effect of a preestablished harmony, nor is it just the result of divine government expressing itself in the natural economy, but the consequence of the fact that the life of plants and animals depends entirely on the atmosphere:

> What the one gives to the atmosphere, that the other takes from it; so that, surveying these facts from the loftiest point of view, and in connection with the physics of the globe, it would be imperative on us to say that, in so far as their truly organic elements are concerned, plants and animals are the offspring of the air, that they are but condensed or consolidated air [...] Vegetables and animals, therefore, come from the atmosphere, and return to it again; they are true dependents of the air. Vegetables, then, assume from the atmosphere the elements which animals exhale into it.[8]

We do not inhabit the Earth, we inhabit the air through the atmosphere. We are immersed in it exactly as the fish is immersed in the sea. And what we call breathing is nothing but the agriculture of atmosphere.

To try and join the two movements—the one that goes from living beings to the environment and the one that goes from the environment to living beings—means to think of the atmosphere as a system or a space for the circulation of life, matter, and energy. This is the radical approach of the Russian naturalist Vladimir Vernadsky. He recognized that "atmosphere is not an independent region of life"[9] but is also an expression of life. In effect, green plants have created a new, transparent medium for life—atmosphere:[10] "Life creates both the free oxygen in the Earth's crust, and also the ozone that protects the biosphere from the harmful short-wavelength radiation of celestial bodies."[11] At the other end, life constitutes itself starting from atmosphere: "Living matter builds bodies of organisms out of atmospheric gases such as oxygen, carbon dioxide, and water, together with compounds of nitrogen and sulfur, converting these gases into liquid and solid combustibles that collect the cosmic energy of the sun."[12] Vernadsky calls the biosphere "the exterior crust of the Earth," considering it not only as a material region but especially as "a place of transformation of the planet by external

cosmic forces. These forces mold and transform the faces of the earth and, as a result, the history of the biosphere is sharply distinguished from that of the rest of the planet."[13]

The principal source of this region is what Vernadsky calls living matter: the collection of organisms and living bodies that are responsible for the creation of new compounds[14] and that "exert a powerful permanent and continuous disturbing effect on the chemical stability of the surface of our planet." It is living matter that

> creates the colors and forms of nature, the associations of animals and plants, and the creative labor of civilized humanity, and also becomes a part of the diverse chemical processes of the Earth's crust. There is no substantial chemical equilibrium on the crust in which the influence of life is not evident and in which chemistry does not display life's work. *Life is therefore not an external or accidental phenomenon of the Earth's crust*. It is closely bound to the structure of the crust, forms part of its mechanism, and fulfills functions of prime importance to the existence of this mechanism. Without life, the crustal mechanism of the Earth would not exist.[15]

In this living mass, plants play a major role: "All living matter can be regarded as a single entity in the mechanism of the biosphere, but only one part of life, *green vegetation*, the carrier of chlorophyll, makes direct use of solar radiation. [...] The whole living world is connected to this green part of life by a direct and unbreakable link."

The atmosphere is not something that is added to the world: it is the world as reality of mixture within which everything breathes. If the natural sciences have trouble conceiving of immersion and mixture as the authentic nature of the cosmos, the human sciences stubbornly keep trying to understand this nature, for instance the climate, on the one hand as a *purely natural fact, and thus excluded from their domain*, and on the other hand as a purely human reality or as an exclusively aesthetic fact, which thus no longer relates to anything that comes from the nonhuman world. Thus, starting from the famous Hippocratic treatise *De aere, aquis et locis*,[16] a vast tradition began to develop that runs from Aristotle to Montesquieu[17] and from Vetruvius to Herder[18] and was to nourish the political

geography of Ratzel as much as the metaphysical geography of Watsuji Tetsurô.[19] Throughout the extraordinary diversity of approaches, doctrines, and historical contexts, this tradition concentrates on two ideas. First of all, it is important to recognize, as Abbé Jean-Baptiste Dubos would write, that "the human machine is not much less dependent on the qualities of the air, on the changes to which these qualities are liable, and, in short, on all the variations which may obstruct or favor what we call the operations of nature, than the very fruits themselves."[20] Climate is here synonymous with the nonhuman. The human sphere—culture, history, the life of the mind—is not autonomous, it has a foundation in what is not human; the apparently nonspiritual elements—air, water, light, winds—do not engender mind but can influence the human being, his or her behaviors, attitudes, and ideas. Climates engender and set up the majority of humans in their physical aspect and, even more, in their social mores. As Edme Guyot wrote, "the nature of the earth, the quality of its fruits, and the difference between climates have contributed to the variety of colors and to the diversity of figures and temperaments among all humans."[21] The nonhuman is the cause of the multiplicity of life forms—not only in space but also in time and history.

In radicalizing the Herderian approach, which makes of history, as Kant would say, a kind of "climatology of intellectual and sensory powers of man,"[22] Simmel's sociology made of the concept of atmosphere an absolute medium of social perception: "the atmosphere of someone is the most intimate perception of him."[23] The idea of atmosphere as the originary dynamism of all sociability would have great success. For example, Peter Sloterdijk conceived of atmosphere at once as an original product of human coexistence and as the paradigm of all cultural life qua cultural life. "The symbolic airconditioning of the shared space is the primal product of every society. Indeed humans create their own climate; not according to free choice, however, but under preexisting, given and handed-down conditions."[24] This shared environment is what Sloterdijk calls "sphere," the geometrical figure of absolute interiority.

> Spheres are by definition also morpho-immunological constructs. Only in immune structures that form interiors can humans continue their generational processes and advance their individuations. Humans have never lived in a direct relationship with "nature," and their cultures have certainly never set foot in the realm of what we call the bare facts; their existence has always been exclusively in the breathed, divided, torn-open and restored space.[25]

Humans thus "flourish only in the greenhouse of their autogenous atmosphere." To live in society means to participate in the construction of these atmospheres; at the other end, the atmosphere is always a cultural fact. What is more, it embodies the impossibility of a state of nature: for Sloterdijk, climatization means the impossibility of getting access to the natural world. But plants demonstrate, on the contrary, that climatization—air-designing—is the living being's simplest act of existence, its most elementary nature.

Cultural reductionism is proper to a long tradition that makes of atmosphere "the fundamental concept of a new aesthetics." The atmosphere would be "the shared reality of the perceiver and the perceived. It is the reality of the perceived as the sphere of its presence and the reality of the perceiver insofar as he or she, in sensing the atmosphere, is bodily present in a particular way."[26] This interpretation, which goes back to Léon Daudet, makes of atmosphere "knowledge of the skin, which is as tangential as knowledge of the mind [*esprit*] is and uses epithelial cells in the same way in which knowledge of the mind uses the roots of words."[27] This faculty of synthetic knowledge

> envelops space and time; it emanates at once from the universe and from us; and it is in us—consciousnesses, persons, populations—as an inclusion of the universal, as that something that connects after having specified, which is neither quantitative nor qualitative but participates in both at the same time and has, in life, a life of its own, dissimulated yet capable of being exposed, analogous to that of radium or the waves at the cryptoid heart of inanimate nature.[28]

This emanation, “at once moral and organic—under its moral aspect tied to the whole of being; under its organic aspect tied to epithelial and endothelial tissues”[29]—is based on a cosmic accord. “The entire cutaneous surface makes us participants in a universal equilibrium, us, the adapted of outer and inner (*adaequatio rei et sensus* [‘the conformity between thing and sense’]).”[30]

This psychological and gnoseological reduction of atmosphere seems to forget that atmosphere is fundamentally an *ontological* fact that concerns the status and mode of being of things, and not the manner in which they are perceived. If every act of knowledge is, by itself, a fact of atmosphere because it is an act of mixing between subject and object, the extension of the atmosphere’s domain goes well beyond any act of knowledge.

Notes

1. Manuscript from the Dibner Collection, MS 1031 B, Dibner Library of the History of Science and Technology, Smithsonian Institution Libraries, *c*.3v.

2. James E. Lovelock and Lynn Margulis, “Biological Modulation of the Earth’s Atmosphere,” *Icarus*, 21 (1974): 471–89, here p. 471; see also their “Atmospheric Homeostasis by and for the Biosphere: The Gaia Hypothesis,” *Telus*, 26 (1974): 2–10. On the history of the Gaia thesis, see the detailed work by Michael Ruse, *Gaia: Science on a Pagan Planet* (Chicago: University of Chicago Press, 2013).

3. Lovelock and Margulis, “Biological Modulation,” p. 495.

4. Jean-Baptiste de Lamarck, *Hydrogeology*, trans. by Albert V. Carozzi (Urbana: University of Illinois Press, 1964), p. 4.

5. Ibid., pp. 122–3: “the remains of living organisms and of their products continuously undergo decomposition, are deeply modified, and eventually are no longer recognizable. From these organic remains, moreover, rain water removes various integrant molecules which it further degrades, transports, and eventually deposits in their new state.”

6. Jean-Baptiste de Lamarck, *Mémoires de physique et d'histoire naturelle, établis sur les bases de raisonnement indépendantes de toute théorie; avec l'explication de nouvelles considérations sur la cause générale des dissolutions; sur la matière de feu; sur la couleur des corps; sur la formation des composés; sur l'origine des minéraux, et sur l'organisation des corps vivans, lus à la première classe de l'Institut national dans ses séances ordinaires, suivis de Discours prononcé à la Société Philomatique le 23 floréal an V* (Paris, 1797), p. 386.

7. See the quite beautiful text by Jean-Baptiste Fressoz, "Circonvenir les *circumfusa*: La chimie, l'hygiénisme et la libéralisation des choses environnantes (1750–1850)," *Revue d'histoire moderne et contemporaine*, 56.4 (2009): 39–76.

8. Jean-Baptiste Boussingault and Jean-Baptiste Dumas, *Essai de statique chimique des êtres organisés* (Paris: Fortin Masson, 1842), pp. 5–6 [English version *The Chemical and Physiological Balance of Organic Nature: An Essay*, ed. by D. P. Gardner (New York: Saxton & Miles/Boston: Saxton, Peirce & Co., 1844), pp. 19–20].

9. Vladimir I. Vernadsky, *The Biosphere* (New York: Copernicus, 1998), p. 122. On Vernadsky's position in the history of ecological thought, see Jean-Paul Deléage, *Une histoire de l'écologie* (Paris: La Découverte, 1991), ch. 9.

10. Vernadsky, *The Biosphere*, p. 76.

11. Ibid., p. 120.

12. Ibid., p. 87.

13. Ibid., p. 44. See also p. 47: "The biosphere may be regarded as a region of transformers that convert cosmic radiations into active energy in electrical, chemical, mechanical, thermal, and other forms. Radiations from all stars enter the biosphere, but we catch and perceive only an insignificant part of the total; this comes almost exclusively from the Sun."

14. Ibid., p. 50.

15. Ibid., pp. 57–8 and 58 [for this and the next quotation].

16. See *Airs, Waters, Places* in volume 1 of the Loeb edition of the Hippocratic corpus (Cambridge, MA: Harvard University Press, 1984), in W. H. S. Jones's translation.

17. See Charles de Montesquieu, *The Spirit of Laws*, ed. by Anne M. Cohler, Basia C. Miller, and Harold S. Stone (Cambridge: Cambridge University Press, 1989), Part III, Book 14, ch. 10: "The different needs of differing climates have formed differing ways of living, and these differing ways of living have formed the various sorts of laws." On the history of the doctrine, see Roger Mercier, "La théorie des climats des *Réflexions critiques* à *L'Esprit des lois*," *Revue d'histoire littéraire de la France*, 58 (1953): 17–37 and 159–75.

18. Johann G. Herder, *Ideen zur Philosophie der Geschichte der Menschheit*, in idem, *Werke*, vol. 6 (Frankfurt: Deutsche Klassiker, 1989).

19. Watsuji Tetsurô, *Climate and Culture: A Philosophical Study*, trans. by. Geoffrey Bownas (Westport: Greenwood Press, 1961). See Robert N. Bellah, "Japan's Cultural Identity: Some Reflections on the Work of Watsuji Tetsurô," *Journal of Asian Studies*, 24 (1965): 573–94; Augustin Berque, "Milieu et logique du lieu chez Watsuji," *Revue philosophique de Louvain*, 92 (1994): 495–507; Graham Mayeda, *Time, Space, and Ethics in the Philosophy of Watsuji Tetsurô, Kuki Shuzo, and Martin Heidegger* (New York: Routledge, 2006).

20. Jean-Baptiste Dubos, *Critical Reflections on Poetry and Painting*, trans. by Thomas Nugent (London: Nourse, 1788), pp. 176–7.

21. Edme Guyot (nom de plume Sieur de Tymogue), *Nouveau système du Microcosme ou Traité de la nature de l'homme* (La Haye: M. G. de Merville, 1727), p. 246.

22. Immanuel Kant, *Political Writings*, 2nd edn., ed. by Hans Reiss, trans. by H. B. Nisbet (Cambridge: Cambridge University Press, 1991), p. 214.

23. Georg Simmel, *The Sociology of Georg Simmel*, ed. and trans. by Kurt H. Wolff (New York: Free Press, 1950). On Simmel, see Barbara Carnevali, "*Aisthesis* et estime sociale: Simmel et la dimension esthétique de la reconnaissance," *Terrains/Théories*, 4 (2016), available at http://teth.revues.org/686.

24. Peter Sloterdijk, *Bubbles: Spheres I*, trans. by Wieland Hoban (Pasadena: Semiotexte, 2011), pp. 47–8.

25. Ibid., p. 46 [for this and the next quotation].

26. Gernot Böhme, "Atmosphere as the Fundamental Concept of a New Aesthetics," *Thesis Eleven*, 36 (1993): 113–26, here 113. See, by the same author, the classic work *Atmosphäre: Essays zur Neuen Äesthetik* (Frankfurt: Suhrkamp, 1995). For a panoramic view on this concept, see Tonino Griffero, *Atmospheres: Aesthetics of Emotional Spaces* (Farnham: Ashgate, 2014). For a radical reading of the concept of atmosphere from the point of view of law, see the important work by Andreas Philippopoulos-Mihalopoulos, *Spatial Justice: Body, Lawscape, Atmosphere* (London: Routledge, 2015).

27. Léon Daudet, *Mélancholia* (Paris: Grasset, 1928), p. 32. On Daudet, see Barbara Carnevali, "'Aura' e 'ambiance': Léon Daudet tra Proust e Benjamin," *Rivista di Estetica*, 46 (2006): 117–41.

28. Daudet, *Mélancholia*, p. 16.

29. Ibid., p. 86.

30. Ibid., p. 25.

9
Everything Is in Everything

If living is breathing, it is because our relation to the world is not one of being thrown or being in the world, and not even one of mastery—that of a subject over an object that lies before it: no, being in the world means experiencing transcendental immersion. Immersion—and breath is only its originary dynamic—defines itself as inherence or reciprocal imbrication. We are in something with the same intensity and same force as that something is in us. It is the reciprocity of inherence that makes breath an inescapable condition: it is impossible to liberate oneself from the environment in which one is immersed, and it is impossible to purify this environment of our presence.

To inhale is to allow the world to come into us—the world is in us—and to exhale is to project ourselves into the world that we are. To be in the world is not simply to find oneself *in* a final horizon containing everything that we are and will be able to perceive, live, or dream. From the moment we start to live, think, perceive, dream, breathe, the world in its infinite details is in us, materially and spiritually penetrating our body and our soul [*âme*], giving form, consistency, and reality to everything that we are. The world is not a place; it is a state of immersion of each thing in all other things, the mixture that instantaneously reverses the relation of topological inherence.

Anaxagoras was the first to give a rigorous definition of mixture as the form that characterizes the world: everything is in everything (*pan en panti*). Immersion is not the temporary condition of a body in another body. Nor is it a relation between two bodies. In order for immersion to be possible, *everything needs to be in everything*. On the one hand, as we have seen, to be immersed in something is to experience being in something that is, in turn, in us. On the other hand, according to Anaxagoras, this absolute, reciprocal mixture that seems to make everything the site of everything else is not a condition limited in space and time, but the form of the world and of all being in the world. For there to be a world, the particular and the

universal, the singular and the whole have to interpenetrate, mutually and completely: the world is the space of a universal mixture in which each thing contains and is contained by *all* other things. On the other hand, interiority (being in something, *inesse*) is the relation that ties each thing to *all* other things, the relation that defines the being of *worldly* things.[1]

To say that everything is in everything, and thus that immersion is the eternal form and the condition of possibility of the world, means first of all to assert that every physical event is produced as immersion and from the starting point of immersion. In this way, the light that allows me to see the page I write is the sea in which I bathe. It is, in turn, in the switch, in the cable that ties it to the fixture, and —embryonically—in my hand, which activates it. And the hand that flicks the switch is contained in the light that now illuminates it. Everything is in everything. This mixture makes the world and space into the reality of a universal transmissibility and translatability of forms. But what we call transmission is only the echo of this reciprocal inherence of all things in all other things: the world is a perpetual contagion.

If everything is in everything, it is because, in the world, everything must be able to circulate, transmit itself, translate itself. The impenetrability we have often imagined as the paradigmatic form of space is an illusion: wherever there is an obstacle to transmission and interpenetration, a new plane is produced that allows bodies to reverse the inherence from one to the other, in a reciprocal interpenetration. Everything in the world both produces mixture and is produced by mixture. Everything enters and exits from everywhere: the world is an opening, an absolute freedom of circulation—not side by side with, but *through* bodies and others. To live, to experience, or to be in the world also means to let oneself be traversed by all things. To get out of oneself always means to enter into something else, into its forms and its aura; to return to oneself always means to prepare oneself to encounter all sorts of forms, objects, images—the very ones that Augustine was surprised to find in his memory, generator of mixture and splendid evidence of this total compenetration.[2]

Science and philosophy have made every effort to classify and define the essence of things and of the living, their forms and their activity; but they remain blind when it comes to their *worldliness*, that is, to their *nature*, which consists in their capacity to enter into any other thing and be traversed by it.

The same goes for matter: it is not what separates and distinguishes things, but rather what makes possible their encounter and mixture. It is not simply reducible to the space of a form's inherence in the world. It is rather the case that, through it, everything is in everything, nothing can separate itself from the fate of the rest, and everything lets itself be traversed by the world and therefore can traverse it.

To make of the world the reality of this perpetual reversal of the inherence of everything in everything means to make space not only the name of a generalized exteriority, but that of a universal interiority: to have within itself everything that contains us. Extension—corporeality—is not the space in which being is external to all other things (*partes extra partes*), with an intensity that coincides with its *conatus sese conservandi* [impulse toward self-preservation]; space is, on the contrary, an experience in which everything exposes itself to being traversed by all other things and strives to traverse the world in all its forms, consistencies, colors, and smells. Hence space and extension are forces that allow all things to breathe, to expand, and to intermingle within breath: to breathe is to let oneself be penetrated by the world in order to make, from the world, something that is *also* made from our breath. Everything breathes and everything is breath because all things interpenetrate.

Therefore a new geometry must be thought out; for the cosmos does not draw either a sphere or a plan. Cosmos as nature is not a horizon that contains in itself all other beings (the sphere), nor is it the totality of things (*ta panta*) or a totality that transcends its elements (the One, or God). But denying its transcendence in order to make it into an originary power, a *foundation*, or a *root* (ground, *Grund*), as imagined by a tradition that culminated in German idealism, is not enough—just as it is not enough to think of this foundation as *collapsed* [effondré] (an *Ungrund* ["unground"]).[3] To affirm that *everything is in everything* (*pan en panti*) does not mean simply to

imagine the existence of everything in a single substrate. The cosmos —that is, *nature*—is not the foundation of things, it is their mixture, their breathing, the movement that animates their interpenetration. Put otherwise, the concept of immanence is not enough for us either to think of the existence of the world or to radicalize this existence by making God coincide with world—as pantheism did—by imagining the inherence of all things in God (and by thinking of their coincidence only through God). True immanence is what makes anything exist inside anything else: that everything is in everything means that everything is immanent in everything. Immanence is no longer the relation between one thing and the world, it is the relation that ties things to one another. It is this relation itself that constitutes the world.

In this manner, the totality defines a relationship of radical and absolute interiority, which nullifies any distinction between container and contained. Because, if everything is everything, not only does each thing contain all other things, but a thing has to find itself within no matter what other thing—what is more, in the things it contains. The fact of *being contained in something* coexists with the fact of containing this same thing. The container is also the content of what it contains. This identity is not logical, it is topological and dynamic. Every object is a site for every other object and, conversely, to be a place is to find one's world in every other thing. In a certain sense, any thing is a world—where the world is no longer the ultimate, unreachable horizon given only at the end of time and at the farthest extension of space, but the intensional identity with any of its objects. Being in the world no longer means finding oneself in an infinite space that contains everything else; it means being no longer able to experience being in a place without finding this place in yourself, and thus becoming the place of your place. The world is the force that reverses any inherence into its opposite, transforms any ingredient into a place, and any place into an element of the same compound.

Thus the cosmology of mixture is founded on a different ontology from the one traditionally taught. For all action is interaction, or rather interpenetration and reciprocal influence. Physics—the science of nature—should then be completely rewritten. If the world is in all its beings, this means that every being is capable of radically

transforming the world. Universal mixture embodies the fact that the world is constantly exposed to the transformation brought about by its components. One need not wait for the Anthropocene to encounter this paradox: it was the plants that, millions of years ago, transformed the world by producing the conditions of possibility of animal life. The "phytocene"[4] is the clearest proof that the world is mixture and that every being of the world [*mondain*] is in the world with the same intensity with which the world is in it. In this universal mixture, the effect is always capable of modifying its cause, which always resides in the effect. In this sense, immersion is the destruction of the one-way process that puts totality before the individual, the "before" before the "after." Causality in mixture is always bidirectional: mixture is always a hysteron proteron. Retroaction, which we have considered a property of life, is only the rhythm specific to breathing, the breath of mixture. It is for this reason, too, that the notions of environment and ambient world should be rejected: the living being is an environment for the world in the same way in which the remaining things of the world are the environment of the living individual. Influence always goes in both directions. Retroaction is an effect of immersion, and immersion is a cosmic fact: it constitutes the form and the condition of possibility of the cosmos, not the effect of some *human* actions. The notion of Anthropocene transforms what defines the very existence of the world into a single action, historical and negative: it makes nature a cultural exception[5] and makes the human being an extranatural cause. Above all, it neglects the fact that the world is always the reality of the living beings' breath.

From this angle, cosmology is a pneumatology—or, better, it is its higher form. To know the world is to breathe it, because each breath is a production of the world: what appears to be separate comes together in a dynamic unity. To breathe is to taste the world. And, for each living being and each object, the world is that which is given through and thanks to breath. The world has the taste of breath. If every mind [*esprit*] makes the world, this is because each act of breath is not just the simple survival of the animal in us, but the form and consistency of the world of which we are the pulse.

There is nothing metaphorical or arbitrary about this coincidence between pneumatology and cosmology. To interrogate the world—its

form, its limits, and its consistency with the breath that allows us to know it and to adhere to it—permits us to find evidence that classical cosmology will never be able to obtain. In the immanence of breath, the world appears to be something closer and extremely different from what we imagined. It is the unseen face that plants allow us to contemplate.

Notes

1. In *Bubbles: Spheres I*, Peter Sloterdijk uses the image of mutual imbrication (which he acknowledges as belonging in the lineage of Stoic philosophers of bodily mixture) but prefers to concentrate on the theological version—provided by Ioannes Damascenus—of the *perichōrēsis* of the three persons of the Trinity. This choice is heavy with consequences. First of all, in spite of what Sloterdijk writes, divine mixture is not "a repression-free, nonhierarchical interweaving of substances in the same section of space" (p. 591): on the contrary, first the whole Neoplatonic tradition, then the Christian one, too, will try to introduce hierarchical order into the concept of mixture (God the Father is not and can never be on the same plane as the spirit). What is more, both traditions are about limiting the possibility of mixture with spiritual substances, of making mixture into a property that is primarily related to souls and not to bodies qua bodies: Sloterdijk's mixture is thus a purely anthropological (or theological) space, the symbol of a spiritual relationship between acosmic subjects and not the ordinary physiology of any worldly being. This is also why he seems to overlook or neglect the importance of the reference to Anaxagoras. On the reception of the concept of mixture in Neoplatonism and in Christian theology, see the important pages devoted to the topic by Jocelyn Groisard, *Mixis*: *Le problème du mélange dans la philosophie grecque d'Aristote à Simplicius* (Paris: Belles Lettres, 2016), pp. 225–92.

2. St. Augustine, *Confessions*, Book 10.

3. In this sense, Schelling's approach is insufficient, too. On the philosophy of nature in Schelling and in German idealism, see the

excellent volume by Iain Hamilton Grant, *Philosophy of Nature after Schelling* (London: Bloomsbury, 2006).

4. Natasha Myers, "Photosynthesis," in *Theorizing the Contemporary*, special issue of *Cultural Anthropology*, 2016 available at http://culanth.org/fieldsights/790-photosynthesis.

5. This is also the thesis of Christophe Bonneuil and Jean-Baptiste Fressoz's excellent study *The Shock of the Anthropocene: The Earth, History, and Us*, trans. by David Fernbach (New York: Verso, 2016).

III
Theory of the Root
The Life of the Stars

10
Roots

In Sneffels Yoculis craterem kem delibat
umbra Scartaris Julii intra calendas descende,
audas viator, et terrestre centrum attinges.
Kod feci. Arne Saknussemm.

[Descend into the crater of Yocul of Sneffels,
which the shade of Scartaris caresses, before the kalends of July,
audacious traveler, and you will reach the center of the earth.
I did it. Arne Saknussemm.]

Jules Verne

They are hidden and invisible to the vast majority of animal organisms, who compete for attention on the platforms of terra firma. Sunk as they are in a cryptic, cloistered world, they pass their lives without the slightest idea about the explosion of forms and events that swarm between Earth and sky. Roots are the most enigmatic forms of the plant world. Their body is often infinitely large and infinitely more complex than its aerial twin, the one that plants let appear in the light of day: the total surface of the root system of a rye plant can reach 400 square meters, that is, a surface 130 times larger than that of the plant's aerial body.[1]

In the history of plant life, they arrived relatively late: for millions of years, plants could do without roots—in the sea as on earth.[2] *Primum vegetari deinde radicare* [first be animated, then grow roots]: plant life would seem not to need roots in order to define itself, exist, or at least survive. The origin of roots is obscure, and it is not easy to distinguish their forms. The first fossil evidence dates back to 390 million years ago. As in all forms of life destined to last for millions of years, their origin is due to fortuitous invention and bricolage more than to methodical, conscious elaboration: the first kinds of roots were functional modifications of the trunk or horizontal rhizomes deprived of leaves.[3]

Their morphology as well as their physiology is extremely variable: their functions have changed over time and cannot be univocally attributed to them; sometimes—as is the case with mycorrhizae—they are delegated to other organisms, which enter into a symbiotic relationship with the plant.

They seem to live cut off from the multiplicity of living beings, and yet it is thanks to them that plants come to be aware of what goes on around them. Plato had already compared our head, and hence reason, to a "root": the human being, he said, is "a plant of the sky [*phuton ouranion*] and not of the earth," with the roots going up—a sort of inverted plant.[4] But the version that was to become canonical was given by Aristotle in the treatise *De anima*: "up and down are not for all things what they are for the whole world: if we are to distinguish and identify organs according to their functions, the roots of plants are analogous to the head in animals."[5] "The action of the two," Averroes would gloss, "is identical."[6] The analogy between the head and the root sets up the one between human being and plant, which was to have an extraordinary success in the philosophical and theological tradition from the Middle Ages and up to the modern period (Francis Bacon would still use it). Likewise, in his philosophical treatise, when he expands over the parallelism between these two, Guillaume de Conches explains that "trees push their root, which has their head, toward the bottom, in the earth from which they derive their nutrition. Man, on the contrary, exhibits his head, which is like his root, in the air, because he lives by his spirit."[7] Linnaeus[8] would reverse the direction of the analogy, speaking of the plant as an upside-down animal. But the dictum *quemadmodum caput est animalibus ita radices plantis* ("the root is for plants what the head is for animals") seems never to have lost its efficacy. Thus, in the conclusion to his book on the motor faculty of plants, Darwin wrote:

> It is hardly an exaggeration to say that the tip of the radicle thus endowed, and having the power of directing the movements of the adjoining parts, acts like the brain of one of the lower animals; the brain being seated within the anterior end of the body, receiving impressions from the sense-organs, and directing the several movements.[9]

Likewise, František Baluška, Stefano Mancuso, and Anthony Trewavas[10] extended this intuition through research on the concept of plant intelligence and attempted to demonstrate that the root corresponds perfectly to the animal brain, since they have the same capacities. It is through the root system, in effect, that a plant acquires the vast majority of information on its own state and that of the environment in which it is immersed; it is also through the roots that it comes into contact with other, limitrophic individuals and manages, collectively, the risks and difficulties of underground life.[11] The roots make the soil and the subterranean world a space of spiritual communication. Thanks to them, then, the most solid part of the Earth is transformed into an enormous planetary brain[12] through which matter circulates, along with information on the identity and state of the organisms that populate the surrounding environment. It is as if the eternal night, in which one imagines the depths of the Earth to be plunged, were anything but a long and deaf sleep. In the immense and silent horn of the underground, night is a perception without organs, without eyes and without ears, a perception that takes place through the whole body. Intelligence, thanks to roots, exists in mineral form, in a world without sun and without movement.

In ordinary speech as in literature and art, roots are often the emblem and the allegory of what is most *fundamental* and *originary*, what is most obstinately solid and stable, what is necessary. They are the plant organ par excellence. And yet it would be hard to find a more ambiguous form among those that life has created and adopted over the course of its history. They are not any more necessary to the survival of the individual than the other parts of the organism; from a strictly evolutionary point of view, they are not at the origin of the plant result—as is the photosynthetic function, for example. The advantages they bring are those of networking, and not those of isolation or distinction. But, even so, it would be naive to consider them a secondary and “decorative” appendage. Roots are not what we thought they were, but they express and embody, all the same, one of the most significant traits of plant existence: ambiguity, hybridity, their amphibious and double character.

We are dealing here in the first place with ecological hybridity. Thanks to roots, the vascular plant, alone among all living organisms, inhabits *simultaneously* two environments that are radically different in their texture, structure, and organization and in the nature of the life that inhabits them: earth and air, sun and sky. Plants are not content to touch them lightly, they push into each one of them with the same stubbornness, the same capacity to imagine and to fashion their bodies in the most unexpected forms. Cosmic mediators, plants are *ontologically amphibious* beings:[13] *they connect environments and spaces*, showing that the relation between the living being and the environment cannot be conceived of in *exclusive* terms (say, those of niche theory, or Uexküll's); they always have to be inclusive. Life is always cosmic, and not a matter of niches; it is never cloistered in a *single* environment, but it radiates through all environments; it makes of those environments a *world*, a cosmos whose unity is atmospheric.

This ecological duplicity is accompanied and as if redoubled by a dynamic, structural duplicity. Although in communication and in mutual interpenetration (much like in the whole cosmos), the two environments not only are juxtaposed against each other but structure themselves as reversed mirror images. It is as though plants lived two lives at the same time: one aerial, bathed and immersed in light, made of visibility and of an intense interspecific interaction with other plants and with other animals of all kinds; the other chthonic, mineral, latent, *ontologically* nocturnal, chiseled in the stony flesh of the planet, in synergistic communion with all the forms of life that populate it. These two lives do not alternate and do not exclude each other: they are the being of the same individual, the only one who succeeds in reuniting, in its body and in its experience, the earth and the sky, the stone and the light, the water and the sun, and to be the image of the world in its totality. Already in the body of the plant, everything is in everything: the sky is in the Earth, the Earth is pushed toward the sky, the air makes itself body and extension, and extension is nothing but an atmospheric laboratory.

Plants are beings that are ecologically and structurally double: but their bodies are the ones that are *anatomically geminated* first. The root is like a second body, secret, esoteric, hidden; an antibody, an anatomical antimatter that reverses as in a mirror, point by point,

everything the other body does, and that pushes the plant in a direction exactly opposite to that of all the efforts it makes above the surface. Imagine that, for each movement of your body, there is another one that goes the opposite way; imagine that your arms, your mouth, your eyes have an antithetical correspondent in a matter that mirrors perfectly the one that defines the texture of your world: you would then have an idea, albeit a vague one, of what it means to have roots. This is what Julius Sachs calls the anisotropy of the plant body—in other words, the antitropy specific to its extremities.[14] As if the body of plants were divided into two, each one of its parts structures itself according to a force and a texture radically opposed to each other. The root is an apparatus of meticulous deconstruction of forms and geometries from the terrestrial surface, starting with the force that seems to determine entirely our life, the life of mobile animals: gravity.[15]

Augustin Pyramus de Candolle wrote in the nineteenth century:

> We give a more exact idea of this organ in saying that the Root (*radix*; *racine*) is that part of the plant which, at its origin, tends to descend towards the centre of the earth with more or less energy. It is to this prevailing character of roots that some naturalists have made allusion when they have designated the root, in a general manner, under the name of *Descensus*.[16]

They are the essence of descent: the way toward the bottom, the geological plunge of life. Their existence—as though they were Otto Lidenbrocks or, better still, nonhuman Arne Saknussemms—is a perpetual voyage to the center of the Earth, an attempt to meld with it. Thomas Andrew Knight had already observed, at the start of the nineteenth century, that "it cannot elude any observer, even the most inattentive, [that,] regardless of the position one puts it in, the seed to bring about the root will invariably make the effort to descend toward the center of the Earth, whereas the elongated germ will take the exact opposite direction."[17] Extending Julius Sachs's research,[18] Charles Darwin, with his son Francis, located the origin of this force in the extremities of roots:

> Sensitiveness to gravitation resides in the tip; and it is the tip which transmits some influence to the adjoining parts, causing them to bend. [...] Different parts of the same plant and different species are affected by gravitation in widely different degrees and manners. Some plants and organs exhibit hardly a trace of its action. [...] In the case of the radicles of several, probably of all seedling plants, sensitiveness to gravitation is confined to the tip, which transmits an influence to the adjoining upper part, causing it to bend towards the centre of the earth.[19]

One would be wrong to see in this love for the Earth a simple effect of gravity: the root does not limit itself to perceiving and passively submitting to the gravitational force, as does any body situated on the surface of the Earth. Of course, gravity is "the most constant and most permanent force among all the environmental forces that act on plants,"[20] but the reaction to gravity is not the same as the reactions that other bodies—animal bodies—display. It is not simply the effect of weight; it is a different attraction, a force of growth that is directed toward the center of the planet. Darwin had noticed it:

> Geotropism [...] excites the primary radicle to bend downwards with very little force, quite insufficient to penetrate the ground. Such penetration is effected by the pointed apex (protected by the root-cap) being pressed down by the longitudinal expansion or growth of the terminal rigid portion, aided by its transverse expansion, both of which forces act powerfully.[21]

It is as if the root doubled the weak force of gravity that pushes it toward the bottom. As if the plant, in its totality, used all its means to overcome the resistance against its descent—with an intensity equal to that which the stem uses to elevate itself.

One is tempted to see the root as the most perfect accomplishment of the Nietzschean program of *amor fati*: "I entreat you, my brothers, *remain true to the earth*, and do not believe those who speak to you of superterrestrial hopes!"[22] The root is not simply a base on which the superior body of the trunk is based, it is the simultaneous inversion of the push toward the upward direction and the sun that animates the plant: it incarnates "the sense of the earth," a form of love for the soil that is intrinsic in any vegetal being. In the pseudo-

Aristotelian treatise *De plantis*, the connection with the earth was already understood as one of the essential elements of the nature of plants: one reads there that "the plant *lives on earth*, as though tied to it"; and this is the reason why "it has no need of sleep."[23] But this is only a part of the truth, and it misconstrues what the root brings to each plant: its hybrid, amphibious character. The root is only a half of the seeded body of the plant—the relation with the earth is just one of the two lives of all plant organisms. And it cannot be understood except in relation to its other half: geotropism is one of the directions of an impulse [*élan*] that has no purpose besides being faithful to the Earth. It is an effect and a result of heliocentrism, which defines the very essence of plant life. If it needs to bury itself in the mineral body of the Earth, this is in order to bind it better to the fire that determines, part by part, its forms and movements.

Notes

1. Howard J. Dittmer, "A Quantitative Study of the Roots and Root Hairs of a Winter Rye Plant (Secale cereale)," *American Journal of Botanics*, 24 (1937): 417–20.

2. At least until the end of the Devonian era, vascular plants seemed to have lived without developed radical axes. See J. A. Raven and Diane Edwards, "Roots: Evolutionary Origins and Biogeochemical Significance," *Journal of Experimental Botany*, 52 (2001): 381–401; P. G. Gensel, M. Kotyk, and J. F. Basinger, "Morphology of Above- and Below-Ground Structures in Early Devonian (Pragian-Emsian) plants," in P. G. Gensel and D. Edwards (eds.), *Plants Invade the Land: Evolutionary and Environmental Perspectives* (New York: Columbia University Press, 2001), pp. 83–102; Nuno D. Pires and Liam Dolan, "Morphological Evolution in Land Plants: New Designs with Old Genes," *Philosophical Transactions of the Royal Society*, 367 (2012): 508–18, particularly 511–12; Paul Kenrick and Christine Strullu-Derrien, "The Origin and Early Evolution of Roots," *Plant Physiology*, 166 (2014): 570–80; Paul Kenrick, "The Origin of Roots," in A. Eshel and T. Beeckman (eds.), *Plant Roots; The Hidden Half*, 4th edn. (London: Taylor &

Francis, 2013), pp. 1–13 (the volume is essential and includes a vast bibliography).

3. Gar W. Rothwell and Diane M. Erwin, "The Rhizomorph of Paurodendron: Implications for Homologies among the Rooting Organs of the Lycopsida," *American Journal of Botany*, 72 (1985): 86–98; Liam Dolan, "Body Building on Land: Morphological Evolution of Land Plants," *Current Opinion in Plant Biology*, 12 (2009): 4–8.

4. [Plato, *Timaeus* 90a, in Benjamin Jowett's translation in Edith Hamilton and Huntington Cairns (eds.), *The Collected Dialogues of Plato*, Princeton: Princeton University Press, 1987, p. 1209.] The origin of this image is quite ancient. On this topic, see Cari-Martin Edsman, "Arbor inverse: Heiland, Welt und Mensch als Himmelspflanzen," in *Festschrift Walter Baetke dargebracht zu seinem 80. Geburtstag am 28 Marz 1964* (Weimar: Böhlaus, 1966), pp. 85–109 and Luciana Repici, *Uomini capovolti: Le piante nel pensiero dei greci* (Bari: Laterza, 2000).

5. Aristotle, *De anima* 2.4, $416^{a}2$ ff [translation from Jonathan Barnes (ed.), *The Complete Works of Aristotle*, vol. 1, Princeton: Princeton University Press, 1984, p. 662].

6. Averroes, *Commentarium magnum in Aristotelis De anima libros*, ed. by F. Stuart Crawford. Corpus commentariorum Averrois in Aristotelem [CCAA] versio Latina VI.1 (Cambridge, MA: Medieval Academy of America, 1953), p. 190.

7. Guillaume de Conches, *Dragmaticon philosophiae* 6.23.4, in idem, *Opera omnia*, vol. 1, ed. by Italo Ronca. Corpus Christianorum, Continuatio mediaevalis [CCCM] 152 (Turnhout: Brepols, 1997), p. 259; Alain de Lille, *Liber in distinctionibus dictionum theologicalium*, in volume 210 of Migne's Patrologia latina [MPL], cols. 707–8; Alexander Neckham, *De naturis rerum* 2.152 (p. 232 Wright); Hugo Ripelin, *Compendium theologicae veritatis* 2.57 (= vol. 34, col. 78a of Albertus Magnus, *Opera omnia*, ed. by Auguste Borgnet and Émile Borgnet, Paris: Louis Vivès, 1895). We are dealing here with a commonplace found in all forms of knowledge and writing; see, for example, Cornelius a

Lapide, *Commentaria in Danielem Prophetam* ch. 4, section 7–8, in idem, *Commentaria in quatuor prophetas maiores* (Antwerp: Apud Henricum et Cornelium Verdussen, 1703), p. 1298; and Cornelius a Lapide, *Commentaria in Marcum*, ch. 8, in idem, *Commentarius in quatuor evangelia*, 2nd edn. (Venice: Ex typis Hieronymi Albritii, 1710–17), p. 461. See also Francis Bacon, *The New Organon*, ed. by Lisa Jardine and Michael Silverthorne (Cambridge: Cambridge University Press, 2000), pp. 107–8 (= Book 2, section 7).

8. Carl von Linné, *Philosophia botanica in qua explicantur fundamenta botanica* (Vienna: Ioannis Thomae Trattner, 1763), p. 97: *planta animal inversum veteribus dictum fuit* ("the ancients said that the plant is an animal upside down").

9. Charles Darwin, *The Power of Movement in Plants* (London: John Murray, 1880), p. 573. See also F. Baluška, S. Mancuso, D. Volkmann, and P. W. Barlow, "The 'Root-Brain' Hypothesis of Charles and Francis Darwin: Revival after More than 125 Years," *Plant Signaling & Behavior*, 12 (2009): 1121–7.

10. See Anthony J. Trewavas, *Plant Behaviour and Intelligence* (Oxford: Oxford University Press, 2014) and Stefano Mancuso and Alessandra Viola, *Brilliant Green: The Surprising History and Science of Plant Intelligence*, trans. by Joan Benham (Washington: Island Press, 2015).

11. F. Baluška, S. Lev-Yadun, and S. Mancuso, "Swarm Intelligence in Plant Roots," *Trends in Ecology and Evolution*, 25 (2010): 682–3; M. Ciszak, D. Comparini, B. Mazzolai, F. Baluška, F. T. Arecchi, T. Vicsek, et al., "Swarming Behavior in Plant Roots," *PloS ONE* 7 (1): e29759, doi: 10.1371/journal.pone.0029759, 2012. The literature on this subject has become massive; see especially F. Baluška, S. Mancuso, D. Volkmann, and P. W. Barlow, "Root Apices as Plant Command Centres: The Unique "Brain-like" Status of the Root Apex Transition Zone," *Biologia*, 59 (2004): 9–17; E. Brenner, R. Stahlberg, S. Mancuso, J. Vivanco, F. Baluška, and E. van Volkenburgh, "Plant Neurobiology: An Integrated View of Plant Signaling," *Trends of Plant Science,* 11 (2006): 413–19; F. Baluška and S. Mancuso, "Plant Neurobiology from Stimulus

Perception to Adaptive Behavior of Plants, via Integrated Chemical and Electrical Signaling," *Plant Signaling & Behavior*, 6 (2009): 475–6; A. Alpi, N. Amrhein, A. Bertl, M. R. Blatt, E. Blumwald, F. Cervone, et al., "Plant Neurobiology: No Brain, No Gain?" *Trends in Plant Science*, 12 (2007): 135–6; E. D. Brenner, R. Stahlberg, S. Mancuso, F. Baluška, and E. van Volkenburgh, "Plant Neurobiology: The Gain Is More Than the Name," *Trends in Plant Sciences*, 12 (2007): 285–6; P. W. Barlow, "Reflections on 'Plant Neurobiology,'" *BioSystems*, 92 (2008): 132–47; F. Baluška (ed.), *Plant-Environment Interactions: From Sensory Plant Biology to Active Plant Behavior* (Berlin: Springer, 2009); and F. Baluška and S. Mancuso (eds.), *Signalling in Plants* (Berlin: Springer, 2009). See also the recent manifesto by P. Calvo, "The Philosophy of Plant Neurobiology: A Manifesto," *Synthese*, 193 (2016): 1323–43.

12. Anthony J. Trewavas tries to define a noncerebral concept of intelligence, in opposition to what Vertosick had called cerebral chauvinism. See his *Plant Behaviour and Intelligence*, p. 201. See also Anthony J. Trewavas, "Aspects of Plant Intelligence," *Annals of Botany*, 92.1 (2003): 1–20 and Frank T. Vertosick, *The Genius Within: Discovering the Intelligence of Every Living Thing* (New York: Harcourt, 2002). For some criticism of Trewavas (rather weak, in fact), see for example Richard Firn, "Plant Intelligence: An Alternative Viewpoint," *Annals of Botany*, 93 (2003): 475–81 and F. Cvrcková, H. Lipavská, and V. Zarsky, "Plant Intelligence: Why, Why Not, or Where?" *Plant Signal Behaviour*, 4–5 (2009): 394–9. The idea of *Earth* as brain is an extremely frequent refrain in the last texts of Marshall McLuhan: see "The Brain and the Media: The 'Western' Hemisphere," *Journal of Communication*, 28 (1978): 54–60.

13. It was Dov Koller (*The Restless Plant*, ed. by Elizabeth van Volkenburgh, Durham: Duke University Press, 2015, p. 1) who observed this most clearly: "In this respect, all but very few plants are obligate amphibians, with part of their body permanently in the aerial environment and the remaining part within the soil. This structural differentiation in plants is based on function." On the notion of an ontological amphibian in anthropology, see the

excellent book by Eben Kirksey, *Emergent Ecologies* (Durham: Duke University Press, 2015); and also René ten Bos, "Towards an Amphibious Anthropology: Water and Peter Sloterdijk," *Society and Space*, 27 (2009): 73–86. But, in this case as in the orthodox use of the concept in biology, one assumes a successive habitation of two or more environments.

14. Julius Sachs, "Über Orthotrope und Plagiotrope Pflanzenteile," *Arbeiten des Botanischen Instituts in Würzburg*, 2 (1882): 226–84.

15. On gravitropism, apart from the monographs by Chamovitz and Karban [cited in ch. 1, nn. 1 and 10 respectively] and Koller's *Restless Plant*, see the classic by Theophil Ciesielski, *Untersuchungen über die Abwärtskrümmung der Wurzel: Beiträte zur Biologie der Pflanzen*, 1 (1872): 1–30; also Peter W. Barlow, "Gravity Perception in Plants: A Multiplicity of Systems Derived by Evolution?" *Plant, Cell, and Environment*, 18 (1995): 951–62; R. Chen, E. Rosen, and P. H. Masson, "Gravitropism in Higher Plants," *Plant Physiology*, 120 (1999): 343–50; C. Wolverton, H. Ishikawa, and M. L. Evans, "The Kinetics of Root Gravitropism: Dual Motors and Sensors," *Journal of Plant Growth Regulation*, 21 (2002): 102–12; R. M. Perrin, L.-S. Young, N. Murthy, B. R. Harrison, Y. Wang, J. L. Will, and P. H. Masson, "Gravity Signal Transduction in Primary Roots," *Annals of Botany*, 96 (2005): 737–43; and Miyo Terao Morita, "Directional Gravity Sensing in Gravitropism," *Annual Review of Plant Biology*, 61 (2010): 705–20.

16. Augustin Pyramus de Candolle, *Vegetable Organography, or, an Analytical Description of the Organs of Plants*, trans. by Boughton Kingdon (London: Houlston & Stonesman, 1839), p. 209. The motif is Aristotelian. See Aristotle, *De anima* 2.4, 416[a]: "Empedocles is wrong in adding that growth in plants is to be explained, the downward rooting by the natural tendency of earth to travel downwards, and the upward branching by the similar natural tendency of fire to travel upwards" [translation from Jonathan Barnes (ed.), *The Complete Works of Aristotle*, vol. 1, Princeton: Princeton University Press, 1984), pp. 661–2].

17. Thomas Andrew Knight, “On the Direction of the Radicle and Germen during the Vegetation of Seeds,” *Philosophical Transactions of the Royal Society*, 99 (1806): 108–20, here p. 108. Before Knight, Henri-Louis Duhamel de Monceau (from whose text Knight quotes) had already tried to furnish an explanation of the fact that “glands placed in a cup in a humid place germinate, and one constantly sees that situation that chance has created for these glands, all the radicules tend toward the sun” (Henri-Louis Duhamel de Monceau, *La Physique des arbres, où il est traité de l’anatomie des plantes et de l’économie végétale* (Paris: Guérin and Delatour, 1758), p. 137.

18. Julius Sachs, “Über Orthotrope und Plagiotrope Pflanzenteile.”

19. Darwin, *Power of Movement in Plants*, pp. 196–7, 548, and 567–8.

20. Koller, *Restless Plant*, p. 46.

21. Darwin, *Power of Movement in Plants*, p. 197.

22. Friedrich Nietzsche, *Thus Spoke Zarathustra*, trans. by Robert J. Hollingdale (New York: Penguin, 1969), p. 42 (= Prologue, section 3).

23. [Aristotle], *De plantis*, $817^{b}20–2$.

11
The Deepest Are the Stars

We struggle to imagine their environment. Light barely reaches them. Here the sounds and noise of our higher world are a deaf, continuous tremor. On Earth, almost everything that goes on up there exists as, and is translated into, quakes and shudders. Water percolates, like any liquid that comes from the world above and, like everything down here, makes efforts to go down toward the center. Everything is in contact with everything, and a slow circulation of materials and juices allows all to live well beyond the limits of their body. Everything breathes, but in a different way from the aerial world. Besides, the breath of bodies has no need to pass through lungs—or through organs, for that matter: any body is defined by its breath, any body is a port, open to the circulation of matter—within and outside itself. The organism is nothing but the invention of a new way of mixing with the world and of allowing the world to mix with what is inside it. Down here, to breathe means to give oneself a tentacular body, capable of clearing for itself a path blocked by stone, and to multiply one's arms and appendages so as to embrace as much Earth as possible, so as to expose oneself to it like the leaf to the sky.

But if roots are active organs of cosmic mixture, this is not only because they put into communication the different elements of the pedological biosphere—the underground world they inhabit—or the other organisms of plants. Their function is, on the contrary, of a cosmic order: their breath involves not only the colloidal substances to which they adhere and the fauna that lives there, but the relations between Earth and Sun. One of the great botanists of the last century wrote:

> The plant plays the role of a mediator between the Sun and the animal world. The plant, or rather its most typical organ, the chloroplast, is the connection that brings together the activity of all the organic world—everything we call life—to the center of energy of our solar system: such is the cosmic function of the plant.[1]

The root is what allows plants to implicate in this cosmic mediation the Earth, in its *planetary dimension*. If the Earth rotates physically around the Sun, it is *in* plants and *thanks to* them that this connection produces life and matter, which always exists in new forms. Plants are the metaphysical transfiguration of the rotation of the planet around the Sun, the step that transforms a purely mechanical phenomenon into a metaphysical event. What is more, they make the Sun live on the Earth: they transform the Sun's breath —its energy, its light, its rays—into the very bodies that inhabit the planet, they make of the living flesh of all terrestrial organs a solar matter. Thanks to plants, the Sun becomes the skin of the Earth, its most superficial layer, and the Earth becomes a star that feeds off the Sun and constructs itself from its light. They metamorphose light into an organic substance and make life a primarily solar fact. Around the mid-nineteenth century, Julius Mayer wrote this:

> Nature has given itself the task of catching in flight the light that overflows on Earth and of guarding this most mobile of forces after having frozen it into a solid form. To reach this goal, it has covered the terrestrial surface with organisms that take solar light in themselves and, as they use this force, produce a continuous sum of chemical differences. These organisms are the plants. The plant world constitutes a reservoir in which the volatile solar rays are skillfully frozen and made available for use.[2]

Thanks to plants to a certain extent, heliocentrism changes from an erudite and speculative problem into a question of life: through them, life is—and is nothing but—the form par excellence of heliocentrism. This is not a matter of truth or opinion: every living being is only the effect and the expression of heliocentrism, on account of the fact that everything on Earth exists thanks to the Sun. The root makes it possible for the Sun—and for life itself—to

penetrate down to the marrow of the planet, to bring the Sun's influence to its deepest resting places, to infiltrate down to the center of the Earth the metamorphosed body of the star that generates us.

"Once blasphemy against God was the greatest blasphemy, but God died, and thereupon these blasphemers died too. To blaspheme the Earth is now the most dreadful offence, and to esteem the bowels of the Inscrutable more highly than the meaning of the Earth."[3] It would be difficult to find words that can summarize with greater precision the spirit of the new religion that defines the contemporary world. Attachment to the Earth—in its planetary, environmental dimension—is the foundation not only of most practices and theories of deep ecology: it is also the spirit that animates the new global politics that has come into view in the past several decades. The Earth is the *only* supreme instance in whose name it becomes possible again to affirm *universal* decisions, which concern not only a specific nation or a specific people but the human species in its totality—in the present as in the future. This cult, as well as the fidelity to the Earth invoked by Nietzsche, is far less novel than one can imagine: to replace the personal divinity of ancient Mediterranean religions with the planet Earth means, once again, to forget what is literally more evident, clear, luminous: the Sun. Heliocentrism has for a long time defined the self-consciousness displayed by the natural sciences, and yet it is far from having left its mark on common consciousness.

Despite the numerous celebrations and the innumerable declarations of conversion, philosophy, just like our common sense, seems never to have let go of its faith in geocentrism. We've never truly been heliocentrists: geocentrism is the deepest soul [*âme*] of western forms of knowledge.[4] Proof of this is in the exclusion that astrology has suffered since the Renaissance: the modern period has identified with the call of the Earth and oblivion of the stars, with the even deeper affirmation of the Earth as the definitive horizon of our existence and of our knowledge. First of all, *being in the world* means being on Earth, measuring everything that is and that happens starting from the forms and figures specific to the planet that is supposed to host us. The Earth, then, is the *definitive* metrical space: the science of place and space is called geometry, measure of the Earth. The Earth is the ultimate place in which everything has to

figure. Only what takes the form of the elements present on this planet exists.

This geometrical obsession becomes explicit in Husserl's phenomenology. In a famous fragment where he tries to overturn Copernicus's results, Husserl shows how the Earth is not and cannot be an object of experience, because it is its fundamental structure: each body "is nonetheless directly referred to the ground of all relative ground-bodies, to the earth-ground."[5] Before being a body, the Earth is the fact itself that there is a ground, a base, that from which one *can* represent to oneself the world, the bodies, their movement and their stillness: "in the primordial shape of its representation, the Earth itself does not move and does not rest; only in relation to it are movement and rest given as having their sense of movement and rest."[6] And western geocentrism would seem to relate to a strange nostalgia for the world of the root. The Earth is not and cannot be a star, it has first of all to be the *ground* [sol]: "For all of us, however, the earth is ground and not a body in the complete sense."[7] Besides, it is *thanks to* the possibility of considering the Earth as soil [*sol*], as *root, origin, universal base*, that it is possible to affirm the unity of humanity. Every object of experience cannot but be "relative to the earth-ground ark and the 'earthly sphere' and to us, earthly human beings, and the objectivity is related to universal humanity."[8] This is exclusively because, as he writes, "the earth is for everyone the same earth—the same bodies rule over it, in it, above it"; thus "the totality of the We, of human beings, of 'animals,' is in this sense earthly."[9] "There is only one humanity and one earth—all the fragments which are or have been separated from it belong to it."[10]

We continue to conceive of ourselves through the prism of a falsely *radical* model, we continue to think the living being and its culture from a false image of roots (because they are isolated from the rest)—as if, by dint of conceiving of the root as reason, we have transformed reason itself and thought into a blind force of rooting, into the faculty of constructing a cosmic connection with the Earth. From this perspective, the replacement of the classical root-based model with that of the rhizome does not represent a real paradigm shift: thought continues to be what allows us to think of the Earth, and only of the

Earth, as *ground*, to affirm that "[t]he earth is not one element among others but rather brings together all the elements within a single embrace while using one or another of them to deterritorialize territory."[11] Fidelity to the Earth—the extreme geotropism of our culture, its will, and its insistence on "radicalness"— has an enormous price: it means devoting oneself to the night, choosing to think without the Sun. Philosophy seems to have chosen, several centuries ago, the way of darkness.

Geocentrism is the delusion of false immanence: there is no autonomous Earth. The Earth is inseparable from the Sun. To go toward the Earth, to dig into its breast means always to raise toward the Sun. This double tropism is the breath itself of our world and its primary dynamism. It is this same tropism that animates and structures the life of plants and the existence of stars: there is no Earth that is not intrinsically tied to the Sun, there is no Sun that is not in the course of making possible the superficial and profound animation of the Earth. To the lunar and nocturnal realism of modern and postmodern philosophy, one should oppose a new form of heliocentrism, or rather an extremization of astrology. This is not, or not only, to make the simple assertion that the stars influence us, that they govern our life, but to accept all this and to add that we also influence the stars, because the Earth itself is a celestial body among others, and everything that lives on it (as well as in it) is of an *astral* nature. There is nothing but sky, everywhere, and the Earth is one of its portions, a state of partial aggregation.

> At rest, however, in the middle of everything, is the sun. For in this most beautiful temple, who would place this lamp in another or better position than that from which it can light up the whole thing at the same time? For, the sun is not inappropriately called by some people the lantern of the universe, its mind by others, and its rulers by still others. [Hermes] the Thrice Greatest labels it a visible god, and Sophocles' Electra, the all-seeing. Thus indeed, as though seated on a royal throne, the sun governs the family of plans revolving around it. [...] Meanwhile the earth has intercourse with the sun, and is impregnated for its yearly parturition.
>
> In this arrangement, therefore, we discover a marvelous symmetry of the universe, and an established harmonious linkage between the motion of the spheres and their size, such as can be found in no other way.[12]

These are the words by which Copernicus tried to revolutionize the way in which we relate to the world. The stake, for him, was not simply the affirmation of the centrality of the Sun. To place the Sun *in the middle of everything* amounted to several cognitive and metaphysical displacements.

To posit that the Sun lies at the center of the universe means, first of all, to *universalize movement*. The Earth *needs to turn* around the Sun in order to exist: all its reality has to be comprised of and observed starting from this infinite source of light and energy. The core of our world is not a stable point, forever frozen; it is something in the nature of a continual bubbling of energy and something to which we have access only through movement, of which the Sun itself is the cause. Everything exists thanks to this source. On the other hand, our bodies, the rocks, the animals are the extreme point of the sky. Our constant, daily heart is the Sun—a cosmic gulf that produces and emanates that of which our bodies are at once captors, archives, and mirrors. To eat is already to recognize the centrality of the Sun and its energy along with its acts, to find on Earth an indirect relation to it: *every* organic compound is, directly or indirectly, the result of the influence of solar energy captured by plants and transformed into an organic mass, into living matter. Each time we eat, we try to make up for our incapacity to absorb immediately this

energy of which plants make use. Our body is the archive of what the Sun offers the Earth.

To assert that the Earth turns around the Sun means, then, to deny the ontological separation between human, terrestrial space and celestial, inhuman space—and thus to transform the very idea of *sky*. The sky is no longer an accidental atmosphere that envelops the Sun; it is the only substance of the universe, the nature of everything that exists. The sky is not what is above. The sky is everywhere: it is the space and the reality of mixture and movement, the definitive horizon starting from which everything has to draw itself. There is nothing but sky, everywhere; and everything, even our planet and what it hosts, is but a condensed portion of this celestial, infinite, and universal matter. Everything that happens is a celestial event, everything that occurs is a divine fact. God is no longer elsewhere, he coincides with the reality of forms and accidents. Plants have made life a perpetual devotion to the sky, to what takes place in the sky, and all this while being firmly rooted in the Earth. This means that, thanks to the plants, life is no longer a purely *chemical* fact but especially an *astrological* one.

To assert a *material* continuity between the Earth and the rest of the universe means to change the idea itself of the Earth. The Earth is a celestial body, and everything in it is sky.[13] The human world is not the exception in a nonhuman universe; our existence, our gestures, our culture, our language, our appearances are *celestial*. To recognize the *astral* nature of the Earth is to make astrology—the science of the stars—not just into a local science, but also into *the global and universal science*: the task is no longer to understand the dominion of the stars over us—their governance—but to understand the sky as the space of flux and of influences. It is not just that biology, geology, and theology are no more than branches of astrology; on this model, astrology becomes a science of contingency, unpredictability, irregularity. The sky is not the site of the return of the same.

Thus astrological universalism involves the destruction of the very idea of absolute immanence, the assertion of something like an infinite floating where no body and no being lets itself be anchored anywhere any more, where in fact there is no longer any soil, any stable base, any ground. The ultimate source of our existence is the

sky. The Earth and its extension are not the base or the universal substrate of our existence but rather its extreme surface, the ultimate and least substantial screen of the universe of the real: depth is represented by the stars, the Earth and sky are the infinite extension of our skin. This destruction of the traditional idea of ground also allows us to go beyond the ordinary horizon of ecology. From its very beginning, ecology always considers the environment exclusively in terms of habitat, of a soil that hosts and welcomes: it makes the world a universalization of the idea of inhabitability. It reduces the great space, the universe of the sky, to an inhabitable Earth. And it is because of this conception of the world as ground, welcoming space, and inhabitability that ecology can consider the cohabitation of living beings in an *ordered* and *standardized* collective. To recognize or to become aware that the Earth is an astral space, that it is only a condensed portion of the sky, is to recognize that there is such a thing as the uninhabitable, that space can never be, and will never be, definitively inhabited.[14] One crosses and penetrates space, one mixes with the world, but one will never be able to establish oneself in it. Every dwelling tends to become uninhabitable, to be *sky* and not a house. This is what the root demonstrates—what ordinary language considers to be the most successful example of habitation: it is but the extremity of a device of conjunction between Earth and sky, the ruse that allows us to transform the Earth into a celestial body down to its core.

To make the Earth into a celestial body is, once again, to render contingent the fact that it represents our habitat. Like the vast majority of stars, the Earth is not by definition inhabitable. The cosmos is not the inhabitable in itself—it is not an *oikos* [a home], it is an *ouranos* [a sky]: ecology is no more than the refusal of *uranology*.

Notes

1. Kliment Timiryazen, *The Life of the Plants: Ten Popular Lectures* (Moscow: Foreign Languages Publishing House, 1953), p. 341. See also p. 188: “It is not the leaf as a whole, but the chloroplast that

colours it green, which serves as a connecting link between the Sun and all things living upon the Earth."

2. Julius Mayer, *Die organische Bewegung im Zusammenhang mit dem Stoffwechsel: Ein Beitrag zur Naturkunde* (Heilbronn: Drechsler'sche Buchhandlung, 1845), pp. 36–7.

3. Friedrich Nietzsche, *Thus Spoke Zarathustra*, trans. by Robert J. Hollingdale (New York: Penguin, 1969), p. 42 (= Prologue, section 3).

4. Since Deleuze and Guattari's proposal for a "geophilosophy," this geocentrism has become explicit. See Gilles Deleuze and Félix Guattari, *What Is Philosophy?*, trans. by Hugh Tomlinson and Graham Burchell (New York: Columbia University Press, 1994); Ray Brassier, *Nihil Unbound: Enlightenment and Extinction* (London: Palgrave, 2007); Eugene Thacker, *In the Dust of This Planet: Horror of Philosophy*, vol. 1 (Winchester: Zero Books, 2011); Ben Woodard, *On an Ungrounded Earth: Towards a New Geophilosophy* (New York: Punctum Books, 2013). A work that goes against this tendency is the splendid book by Peter Szendy, *Kant in the Land of Extraterrestrials*, trans. by Will Bishop (New York: Fordham University Press, 2013).

5. Edmund Husserl, "Foundational Investigations of the Phenomenological Origin of the Spatiality of Nature: The Originary Ark, the Earth, Does Not Move," trans. by Fred Kersten, in Maurice Mearleau-Ponty, *The Limits of Phenomenology: Including Texts by Edmund Husserl*, ed. by Leonard Lawlor and Bettina Bergo (Evanston: Northwestern University Press, 2002), pp. 117–31, here p. 121.

6. Ibid., p. 118.

7. Ibid., pp. 123–4.

8. Ibid., p. 127.

9. Ibid., pp. 123, 126.

10. Ibid., p. 130.

11. Deleuze and Guattari, *What Is Philosophy?*, p. 85.

12. Copernicus, *De revolutionibus* 1.10 [translation from Nicolaus Copernicus, *On the Revolutions* [1543], trans. by Edward Rosen (Baltimore: Johns Hopkins University Press, 1992), p. 22]. On the significance of the Copernican revolution, the literature is enormous. See, among others, Michel-Pierre Lerner, *Le monde des sphères*, vol. 2: *La fin du cosmos classique* (Paris: Les Belles Lettres, 2008); Alexandre Koyré, *The Astronomical Revolution: Copernicus–Kepler–Borelli* [1961], trans. by R. E. W. Maddison (London: Routledge, 2009); and Thomas S. Kuhn, *The Copernican Revolution: Planetary Astronomy in the Development of Western Thought* (Cambridge, MA: Harvard University Press, 1977).

13. This is the conclusion that Giordano Bruno had drawn from the works of Copernicus: *Astrorum igitur unum terra est, que non minus digno altoque caelo comprehenditur quia quodcunque ex aliis aliud* ("In conclusion the Earth is one of the planets, and it is surrounded by the sky no less properly and deeply because anything else [is surrounded] from different directions": Giordano Bruno, *Camoeracensis Acrotismus* art. 65, in idem, *Opera latine conscripta*, Naples: F. Fiorentino, 1971). On Bruno and Copernicus, see the splendid books by Miguel A. Granada, *El debate cosmologico en 1588: Bruno, Brahe, Rothann, Ursus, Röslin* (Naples: Bibliopolis, 1996) and *Sfere solide e cielo fluido: Momenti del dibattito cosmologico nella seconda metà del Cinquecento* (Milan: Guerini e associati, 2002).

14. For a quite different, but equally radical and original cosmocentric perspective, see the masterpiece by Fabian Ludueña, *Más allá del principio antrôpico: Hacia una filosofia del Outside* (Buenos Aires: Prometeo Libros, 2012). Ludueña's whole oeuvre can be considered a speculation on the cosmos as an abiotic space.

IV
Theory of the Flower
The Reason of Forms

12
Flowers

To cling to the surface of the Earth to better penetrate the air and the ground. To moor at random and then to expose and open oneself to anything in the surrounding world, regardless of its form or nature. Never to move, in order to allow for the world to be swallowed up in one's breast all the more. Never to tire of building canals, of opening holes for the world to fall, slip, or seep into oneself. For sessile beings, the encounter with the other—regardless of the qualification of this other—will never be a simple question of waiting and chance. Where no movement, no action, no choice are possible, meeting someone or something is possible exclusively through a metamorphosis of the self. It is only within itself that a being without motion can encounter the world. There is no geography, no intermediary space that might welcome the body of the one and that of the other and that might make this encounter possible. Every sessile being has to make itself world for the world, has to construct within itself the paradoxical site of an environment for the world itself. What is more, faced with another sessile being, the world does not offer itself to experience as a multiplicity of substances separated by contours that one may touch or may observe with one's eyes; it is a single substance of variable intensity and density. To distinguish means to filter, to distill this continuous flux of the essence of things, to concentrate it into an image. *To perceive* the world in depth means to be touched and penetrated by it to the point of being changed and modified by it. For a sessile being, knowing the world coincides with a variation of its own form—a metamorphosis provoked by the outside. This is what one calls sex: the supreme form of sensibility, that which allows us to conceive of the other at the very moment when the other modifies our way of being and obliges us to go, to change, to *become other*. The flower is the appendage that makes it possible for plants—or, more precisely, for their most evolved component, angiosperms—to accomplish the process of absorption and capture of the world. The flower is a *cosmic attractor*, an ephemeral, unstable body that allows one to

perceive—that is, to absorb—the world and to filter its more precious forms in order to be modified by it, to prolong one's being there, in the place where its form would not know how to lead it.[1]

It is, first and foremost, an *attractor*: instead of going toward the world, it attracts the world to it. Thanks to flowers, plant life becomes the site of an explosion of colors and forms and of a conquest of the domain of appearances. Sex, forms, and appearances all merge in the flower. Also, forms and appearances are freed from any expressive or identitarian logic: they do not have to express an individual truth, or define a nature, or communicate an essence: "The mode of the structure of the plant also has something purely demonstrative [and] has no relation with its use."[2] Forms and appearances do not have to communicate meaning or content; they have to establish communication between different beings—different not only in number (the male and female of the same species), but in species, in realm, in ontological domain (plants and insects, dogs, humans…). In the flower, the form is the laboratory of conjunction, the space of the mixture of what is disparate.

Among the modes of self-multiplication, sexual reproduction is the one that transforms a process of division and multiplication of a single individual into a collective process of invention and variation of forms. In the flower, reproduction ceases to be the instrument of individual or specific narcissism to become an ecology of condensation and mixture, because the individual *makes* the world and the whole world is in labor with the new individual. The relation between individuals of the same species has to pass through the relation with other individuals from other realms. Not only is there nothing private or occult in the sexual act (this is what gets expressed in the concept of *phanerogam*), but, to accomplish a sexual act, one must pass through the world: sex is the most worldly and cosmic thing. The encounter with the other is always, by necessity, a union with the world in its diversity of forms, status, substance. It is impossible to enclose oneself in an identity, be it of genre, of species, or of realm. Besides, sex is the originary practice of identity relaxation.

In this sense, the biological and ecological presence and importance of flowers renders impossible any discourse that would limit the

cosmic function of plants to a simple question of energy production or mass transformation of energy. The evolutionary choice of the floral way is the choice of the primacy of form and its variations over everything else.[3] Cosmology is always a cosmetics, and cannot constitute itself other than through a plurality of forms:[4] balance and the flows of energy are not enough to constitute a cosmos. Mixture—whose most universal form for the living is perhaps sex—is always a force of multiplication and of variation of forms, and not a mechanism for their reduction.

It is the active instrument of mixture: every encounter and every union with other individuals occur through it. But a flower is not, properly speaking, an organ: it is an aggregate of different organs, modified to make reproduction possible. There is a deep connection between the ephemeral and unstable aspect of this formation and that of overtaking a properly "organic" horizon. As a space of elaboration, production, and engendering of new identities, individual and specific, the flower is a device that overturns the logic of the individual organism: it is the last threshold where the individual and the species open up to the possibilities of mutation, of change, of death. At the heart of the flower, the totality of the organism as well as that of the species is decomposed and recomposed through the process of meiosis. Flowers are in this respect a place beyond totality, beyond the "one for all." This is what is expressed in their number, too: if higher animals have stable and unique reproductive organs at their service, the plant builds its reproductive appendages *in huge amounts*, to free itself from them rapidly. Because of this excess—which in turn causes another excess, that of the legions of pollinators (animate or inanimate)—it would be difficult, anyway, to reduce the sex of plants to a simple strategy of self-replication. But there are also other elements that make it hard to treat the main instrument of plant reproduction simply as a subjective emanation. The Stoics imagined that, immediately after birth, every living being perceives itself and, on the basis of this perception, appropriates itself and grows accustomed to itself. They called this process of selfappropriation and self-familiarization *oikeiōsis*—the living being's becoming one's own, oneself. "One must know," wrote Hierocles, "that an animal immediately, as soon as it is born, perceives itself"[5] and that, "when it has received the first

perception of itself, [it] immediately becomes its own and familiar to itself and to its constitution."[6] The flower quite often demonstrates the opposite mechanism: that of the disappropriation of the self, of becoming a stranger to oneself. This is what happens in fertilization: the majority of hermaphroditic flowers develop a system of self-immunization to avoid self-fertilization, a defense against themselves that allows them to open up to the world more.[7]

If a flower cannot be considered a simple organ, this is mainly because it is the site of the production of the future organism, and hence the totality of the organs of which a body is composed. In repeating ad nauseam that living beings are *organic* beings, one often forgets that every organism also participates in a metaorganic horizon, the one that permits the construction of all the organs of which it is composed. The flower (alone with the seed) is, from this point of view, the organ of all organs, not only because it puts into place the originary worksite from which the organic construction is both conceived and realized, but because, in order to do this, it has to reduce the actual identity of the organism to a simple code, an abridged, revised sketch, diminished by half, an active image that contains the ensemble of technical and material procedures necessary to produce other individuals. It is in itself the perfect expression of the absolute coincidence of life and technique, matter and imagination, spirit and extension.

Notes

1. For an initiation to the biology of flowering plants, which is extremely complex, see the popular works by Peter Bernardt, *The Rose's Kiss: A Natural History of Flowers* (Washington: Island Press, 1999); Sharman A. Russel, *Anatomy of a Rose: Exploring the Secret Life of Flowers* (New York: Perseus, 2001); William C. Burger, *Flower: How They Changed the World* (New York: Prometheus Books, 2006); Stephen L. Buchmann, *Reason for Flowers: Their History, Culture, Biology, and How They Change Our Lives* (New York: Scribner, 2015).

2. Hans André, "La différence de nature entre les plantes et les animaux," in H. André, F. J. J. Buytendijk, G. Dwelshauvers, and

Maurice Manquat, *Vues sur la psychologie animale*. Cahiers de philosophie de la nature 4 (Paris: Vrin, 1930), pp. 15–30, here p. 26.

3. It is around this aspect that we can measure the insufficiency of Oliver Morton's *Eating the Sun: How Plants Power the Planet* (New York: HarperCollins, 2008), an otherwise well-documented book.

4. On this question, see Edgar Dacqué's work on idealist morphology: Edgar Dacqueé, *Natur und Seele: Ein Beitrag zur magischen Weltlehre* (Munich: Oldenburg, 1926). For a more modern perspective, see Michele Spanò, "Funghi del capitale," *Politica & società*, 3 (2016): 443–8, available at https://www.rivisteweb.it/doi/10.4476/85518.

5. Hierocles the Stoic, *Elements of Ethics, Fragments, and Excerpts*, ed. by Ilaria Ramelli and trans. by David Konstan (Atlanta: Society of Biblical Literature, 2009), p. 5, l. 39 (facing Greek text at p. 4).

6. Ibid., p. 19. On Stoic *oikeiōsis*, see Franz Dirlmeier, *Die Oikeiosis-Lehre Theophrasts* (Leipzig: Dieterich, 1937); Roberto Radice, *Oikeiosis: Ricerche sul fondamento del pensiero stoico e sulla sua genesi* (Milan: Vita e pensiero, 2000); Chang-Uh Lee, *Oikeiosis: Stoische Ethik in naturphilosophischer Perspektive* (Freiburg: Alber Verlag, 2002); Robert Bees, *Die Oikeiosislehre der Stoa*, vol. 1: *Rekonstruktion ihres Inhaltes* (Wurtzbourg: Königshausen und Neumann, 2004).

7. On self-incompatibility, see Simon J. Hiscock and Stephanie M. McInnis, "The Diversity of Self-Incompatibility Systems in Flowering Plants," *Plant Biology*, 5 (2003): 23–32, as well as D. Charlesworth, X. Vekemans, V. Castric, and S. Glémin, "Plant Self-Incompatibility Systems: A Molecular Evolutionary Perspective," *New Physiologist*, 168 (2005): 61–9.

13
Reason Is Sex

Over the centuries, plants have been considered the place where matter is animated by a kind of transcendental imagination: more than a personal faculty, capable of fashioning the intangible reality of psychism, this is an elastic power that models immediately the matter of the world. The "plant soul" is not thought of as a life devoid of the faculty of imagination, but as a life where the imagination produces effects on the whole body of the organism—to the point of giving it form—and where matter is a dream without consciousness, a fantasy that has no need of organs or subjects to realize itself.

Every plant seems to invent and open a cosmic plane where there is no opposition between matter and fantasy, between imagination and self-development. The idea of a sphere of absolute coincidence between body and knowledge, between image and matter, has never been alien to biology. In fact the notion of the gene is its modern formulation.[1] This idea was quite widespread in Renaissance philosophy and medicine. In its most radical form, it has inspired the reflections of William Harvey on the generation of the living, as well as those of Johannes Marcus Marci (= Jan Marek Marci) of Kronland[2] or Petrus Severinus (= Peder Soerensen)[3] on *semina* [seeds] and those of Francis Glisson on natural perception.[4] To use a relatively common analogy, one has to think of the process of engendering living beings (the conception of the living that takes place in the uterus, *conceptio uteri*) as being perfectly isomorphic with the manner in which the brain operates (*conceptio cerebri*): in the plant (or in the vegetative life of all living beings), the matter of the world becomes a brain, where it operates in this capacity.[5] Put otherwise, there is a material and non-nervous brain, a mind [*esprit*] immanent in organic matter qua organic matter. Throughout life, matter can become mind—by starting to live. The most evident manifestation of this elementary form of "cerebrality" is embodied by the seed. The operations of which the seed is capable cannot be explained unless we assume it to be equipped with a form of

knowledge, a know-how, a program of action, a pattern that does not exist in the way of consciousness but allows it to accomplish without error everything it engages in.[6] If, in humans and animals, knowledge is an accidental or ephemeral fact, in the seed (and one might say in the genetic code), knowledge coincides with the essence, life, power, and action itself.[7] Genes are the brains of matter, its mind [*esprit*]. If a grain can be considered to be like a brain, this is because the latter has the form of a seed. The interest of these analogical speculations resides in the possibility of reaching a nonanatomical definition of the brain: the brain is not a human organ, it is not an organ at all, but a feature of matter that holds knowledge and know-how. It is, after all, a matter of enlarging one's sense of the notions of knowledge and thought in a direction contrary to Aristotelianism. We do not want to make the intellect a separate organ, but to make it coincide with matter.

It was Francis Glisson who first formulated this hypothesis in the most radical way, to the point of positing the animation of the whole universe. According to Glisson, matter itself has to be defined from the starting point of some natural affectivity (*perceptio naturalis*), original, separate, and different from sensation or experience, because incapable of error. This radical affectivity is "the immediate action of substantial life" (*immediatam actionem vitae substantialis*). What matter perceives is thus the form of the living being itself. The example of this elementary sensibility is that of a grain of wheat capable of perceiving the form of the plant that would develop from it.[8] It is as if, thanks to the seed, the living being would come to perceive itself. In this sense, imagination does not define a space of sovereignty: it is not possible to distract oneself from the object one contemplates, natural perception is affectivity without sovereignty.[9] The form of the organism that is the object of perception does not present itself with the indifference of choice or of judgment: natural perception does not choose its objects, it does not deliberate. In the seed's immanence, no form is an aesthetic or material fact any longer, but the testimony of a subterranean psychism, an unconscious material psychology. Wherever there is form, there is a mind that structures the matter, which means that matter exists and lives qua mind. Plant life is never a purely biological fact: it is the site of a lack of difference [*indifférence*]

between the biological and the cultural, the material and the cultural, logos and extension.

In his monumental *Manuel de philosophie naturelle*, Lorenz Oken wrote:

> If one wishes to compare the flower—beyond sexual relation—to an animal organ, one can only compare it with the most important nerve organ. The flower is the brain of plants, that which corresponds to the light, which remains on the plane of sex. One can say that what is sex in the plant is brain for the animal, or that the brain is the sex of the animal.[10]

This statement of Oken, brilliant student of Schelling and Goethe, is far from paradoxical; one could say that it represents only the generalization and radicalization of the ancient Stoic thesis according to which reason (*logos*) has the form of the seed. To think of reason as seed allows one to detach it from the human silhouette in order to transform it into a *cosmic* and *natural* faculty (which exists in the physical world, not in the human body, and coincides with the natural course of things) of the fashioning of matter: reason is what gives form to everything that exists. Following preestablished rules, it is what governs the world and its future *from within*. To think of reason as a flower—or rather to think of the flower as the paradigmatic form of existence of reason—leads one to conceive it as the cosmic faculty of the variation of forms. In this way thought is no longer the force that gives the real an identity, determining destiny once and for all; on the contrary, it is the point of encounter with the rest of the cosmos, the metaphysical space in which it mixes with the world and lets itself be affected by mixture, the force of deviation that transforms the deepest identity of a being. Reason—the flower of the cosmos—is a force of multiplication of the world. It never gives the existent back to itself, to its numerical unity, to its history, to its genealogy; instead it multiplies bodies, renews the possible, sets the past back to zero, opens up the space to an inconceivable future. The reason-flower, at last, does not compress the plurality of experience into a unique "I," does not reduce the difference of opinion to the uniqueness of a subject; it multiplies and differentiates subjects, it makes experiences incomparable and incompatible. Reason is no longer the reality of the identical, the unchangeable, the same; it is

the force and structure that constrains each thing to mix with its similars by means of the dissimilar in order to change its face; it is the force that leaves in the care of the world, leaves up to chance encounters, the task of redesigning from within the face of its components.

Reason is a flower: there was no need to wait for humans or higher animals for the technical force of fashioning the matter to become an individual faculty. Plants are the ones that tamed this force in order to make it vibrate to the very rhythm of life and of its generations. It is thanks to plants that life has become the space of reason par excellence; it is thanks to plants that life and world coincide without rest.

Reason is a flower: one could express this equivalence by saying that everything that is rational is sexual and everything that is sexual is rational. Rationality is a matter of forms, but form is always the result of the movement of a mixture that produces variation, change. At the other end, sexuality is no longer the morbid sphere of the infrarational, the site of murky and nebulous affects. It is the structure and ensemble of the encounters with the world that allow everything to let itself be touched by the other, to progress in its evolution, to reinvent itself, to become other in the body of resemblance. Sexuality is not a purely biological fact, an outburst [*élan*] of life qua life, but a *movement of the cosmos* in its totality: it is not an improved technique of the reproduction of the living but the proof that life is just the process through which the world can prolong and renew its existence exclusively by renewing and inventing new formulae of mixture. In sexuality, living beings make themselves agents of cosmic brewing, and mixture becomes a way of renewing beings and identities.

Reason is a flower: reason is not and can never be an organ with well-defined and stable forms. It is a corporation of organs, a structure of appendages that calls into question the entire organism and its logic. It is principally an ephemeral, seasonal structure whose existence depends on the climate and atmosphere of the world in which it finds itself. It is risk, invention, experimentation.

The flower is the paradigmatic form of rationality: to think is always to invest oneself in the sphere of appearances—not in order to

express its hidden interiority, nor in order to speak, to say something, but in order to put different beings in touch with one another. Reason is only this plurality of cosmic structures of attraction that allow beings to perceive and absorb the world and allow the world to exist wholly in all the organisms that inhabit it.

Notes

1. On the history of the gene, see André Pichot, *Histoire de la notion de gène* (Paris: Flammarion, 1999).

2. Johannes Marcus Marci of Kronland, *Idearum operatricium idea sive hypotyposis et detectio illius occultae virtutis, quae semina faecundat et ex iisdem corpora organica producit* (Prague, 1635).

3. Petrus Severinus, *Idea medicinae philosophicae, fundamenta continens totius doctrinae Paracelsinae Hippocraticae et Galienicae* (Basel: Ex officina Sixti Henrici Petri, 1571).

4. On these problems, see Walter Pagel's *Paracelsus: An Introduction to Philosophical Medicine in the Era of Renaissance* (New York: Karger, 1958) and *William Harvey's Biological Ideas: Selected Aspects and Historical Background* (New York: Karger, 1967); also Guido Giglioni's "Il 'Tractatus de natura substantiae energetica' di F. Glisson," *Annali della Facoltà di Lettere e Filosofia dell'Università di Macerata*, 24 (1991): 137–79; "La teoria dell'immaginazione nell'Idealismo biologico di Johannes Baptista Van Helmont," *La Cultura*, 29 (1991): 110–45; "Conceptus uteri/Conceptus cerebri: Note sull'analogia del concepimento nella teoria della generazione di William Harvey," *Rivista di storia della filosofia*, 48.1 (1993): 7–22; "Panpsychism versus Hylozoism: An Interpretation of Some Seventeenth-Century Doctrines of Universal Animation," *Acta comeniana*, 11.35 (1995): 25–45; and *Immaginazione e malattia: Saggio su Jan-Baptista van Helmont* (Milan: FrancoAngeli, 2000).

5. In the words of Charles Drelincourt, *adeo conceptio fit in utero naturalis sicut in cerebro fit conceptus animalis* ("natural conception occurs in the uterus inasmuch as the idea of animal

occurs in the brain"): *De conceptione adversaria* (Leiden: Apud Cornelium Boutesteyn, 1685), pp. 3–4. The foundation of this analogy can take place in both senses.

6. This is the idea of Petrus Severinus, who on the subject of these semina [seeds] wrote: *nec laboriosam sortem obtinuerunt: sine sollicitudine defatigatione, ratiocinatione, dubitatione, pensum absolvunt, scientia ingenita vitali, ipsa denique essentia. Talis scientiae qui cognitionis consensum et conscientiam non habent, dicuntur non scire ea quae faciunt, et tamen videntur scire: operibus enim documenta ponunt divinae scientae* ("Nor have they gotten a laborious lot in life: without anxiety, exhaustion, ratiocination, or doubt, they make up their minds, with a knowledge of their life that is inborn and in the end becomes itself essence/being. Those who have no common feeling or awareness of this kind of knowledge are said not to know what they are doing, even though they seem to know: for in fact they use in their works proofs of a divinely revealed knowledge"). Petrus Severinus, *Idea medicinae philosophicae*, p. 91.

7. *Aequivoce enim nostra scientia cum illa confertur. Nos sensibus memoriis rationum deductionibus et multa sollicitudine praecepta ordinatae* [sc. *ordinate*] *coniungentes scientias acquirimus, illis innata est, non veluti accidentia subjectis innascuntur; sed est ipsa earum essentia, vita potestas ideoque validius agere potest. Nostra mortua est, si cum hac conferatur* ("For our knowledge compares to that one in an ambiguous way. We acquire our forms of knowledge by adding principles, in an organized fashion [*ordinate*], to sense impressions, memories, causal inferences—and with great effort, too; in them, on the other hand, it is inborn—and not in the way accidents are inborn in subjects, but is their very essence, life and power, and hence it can act more soundly. Our knowledge is dead, if you compare it with that). Ibid.

8. *Ex dictis autem elucescit, dari perceptionem priorem, generaliorem et simpliciorem ea sensuum et consequenter dari perceptionem naturalem. Dices, etiamsi haec perceptio non veniat ab anima sensitiva, posse tamen ab anima vegetativa commode deduci. Aristoteles enim videtur insinuare, animal*

primo vivere vitam plantae dein animalis. Respondeo ut se habet forma triticei ad formam plantae ex se formandae ita se habere formam ovi ad formama pulli inde oriundi; sed in utrisque formam inchoatam a perfecta solis gradibus perfectionis differre. [...] *Si ergo formam ovi animam sensitivam inchoatam (quamvis sit praeter usum loquendi) vocari placuerit, per me licet: sed res eodem redit. Ejus enim perceptio non fuerit sensitiva, sed tantum naturalis. Res aperta est in grano tritici in quo similiter inest perceptio naturalis, qua se satum in planta sui generis format, sed ad sensum nunquam aspirat. Atque adeo haec perceptio res clare distincta est a sensu* ("But, from what has been said, it becomes clear that there is a perception that is prior to, more general, and simpler than that of the senses—and consequently that there is a perception of nature [= a natural perception]. You will say: even if this perception may not come from the sensing soul, it may nevertheless proceed naturally from the vegetative soul. Aristotle, for instance, seems to suggest that the animal lives the life of a plant to begin with, and only afterwards an animal life. I reply that the form of a wheat grain stands to the form of the plant that will arise from it in just the same way as the form of the egg stands to the form of the chick that will arise from it. But, in both, the incipient form differs from the complete form only in degrees of completeness. [...] If, therefore, one decides to call the form of the egg an incipient sensing soul (even if this is way beyond the conventional way of speaking), fine by me: but it all comes down to the same thing. For its perception will not have been a matter of sensation, but only of natural power. The issue is obvious in the case of the grain of wheat, where, similarly, there inheres a perception of its nature in conformity with which, once sown, it forms itself into a plant of its own accord; but that perception comes nowhere near sensation. And, so far this perception is something clearly distinct from sensation"). Francis Glisson, *Tractatus de natura substantiae energetica* (London: Typis E. Flesher, 1672): "Ad lectorem," ch. 16.

9. *Dico perceptionem naturalem nullo modo posse actionem suam suspendere aut se ab obiecto oblato avertere; sed perpetuo ad excitandum appetitum naturalem et facultatem motivam recta*

pergere (“In my view there is no way natural perception can suspend its action or turn away from the object that it has been presented with, but always moves straight to exercising natural desire and the faculty of motion”). Glisson, *Tractatus*: “Ad lectorem,” ch. 14.

10. Lorenz Oken, *Lehrbuch der Naturphilosophie*, 3rd edn. (Zurich: Friedrich Schultheiss, 1843), p. 218. On Oken and the Romantic tradition, see the splendid book by Sibille Mischer, *Der verschlungene Zug der Seele: Natur, Organismus und Entwicklung bei Schelling, Steffens und Oken* (Wurtzbourg: Königshausen & Neumann, 1997).

V
Epilogue

14
On Speculative Autotrophy

For some time now, a rather severe protocol reigns supreme in the republic of the sciences: this unwritten golden rule stipulates that one and only one discipline be appropriate for any object of knowledge and asserts, on the other hand, that all disciplines have a *definite* and *limited* number of objects and matters that it is suitable for them to know. Like all forms of discipline, this protocol, too, has a nature and especially an end, which are typically *moral* and not gnoseological: the protocol serves to limit the will to know, to hold back its excesses, to bridle it not from the outside, but from within. What we call *specialization* involves a *work on oneself*, a cognitive and sentimental education that is hidden or, in most cases, forgotten and suppressed. This cognitive asceticism has nothing natural about it—it is, on the contrary, the unstable and uncertain result of long and lamentable efforts, the poisoned fruit of a spiritual exercise practiced on oneself, of a prolonged castration of one's own curiosity. Specialization does not define an excess of knowledge but a conscious and voluntary renunciation of the knowledge of "others." It is not the expression of an immoderate curiosity for an object, but fearful and scrupulous respect for a cognitive taboo. And all invitation to consider different human knowledge as *ontologically* and *formally* separated into disciplines is the expression of an absolute cognitive kashrut: "You will regard as impure all knowledge that does not take up the same object and the same method as yours."

There is nothing new or specifically modern about these taboos.[1] They imposed themselves centuries ago, with the foundation of the university in the Middle Ages. Indeed, they represent the very essence of the institution of the university. Against the ideal of a global, multidisciplinary, encyclopedic culture (the *enkuklos paideia* of the ancients),[2] the university was born to affirm the need to support the liberal arts—techniques of freedom inherited from the ancients and deemed insufficient—with other forms of knowledge—

most notably law, medicine, and especially theology. These forms of knowledge no longer aim at the whole and no longer form a harmonious and unitary structure. They separate the disciplines into different and incompatible existential paths: the jurist cannot be a theologian and the theologian is forbidden to be a jurist. For a long time, the sovereign gesture—par excellence—of the learned person was to bring together in him- or herself the most disparate forms of knowledge and to measure their unity in the breath of his or her awareness: the subject of knowledge—the one who says "I" in the *cogito*—always went beyond the limits of the disciplines, being always capable of seeing much farther than any one of them. With the university, the subject of knowledge and thought (the "I" of the *cogito*) is invited to make his or her cognitive subjectivity—his or her intellectual being and *res cogitans* [thinking capacity]—coincide with the limits of a discipline or an object.

This epistemological limitation corresponds to a limitation that has a *social*, or rather a sociological nature. The birth of the university does not correspond to the birth of new forms of knowledge or to the birth of a new organization of knowledge, but to the formalization of a new *organization of learned people* [savants]. With medieval universities, the production and the transmission of forms of knowledge are for the first time the result of a corporation: after all, *universitas* is the technical term that names a *corporation*. Also for the first time, a corporation is no longer an association tied to a professional skill, a political aim, or an ethnic origin, but rather to a form of knowledge [*un savoir*]: it brings people together around the same form of knowledge, hence we are dealing here with an epistemological corporation. To know is to belong to a corporation. In this way the cognitive act is legitimized by a juridical connection and a political affiliation; the ideal of the *bios theōorētikos* [contemplative life] is immediately and necessarily shared with one's fellows, *socii*. The relationship between the various objects of knowledge is thus defined on the basis of the juridical and social relation between various corporations of learned people. The cognitive limits of a discipline are those of the self-awareness of the corporation: the identity, the reality, the unity, and the epistemological autonomy of the discipline in question are no more than secondary effects of the distinction, unity, and power of the

collegium [association] of the learned persons who govern it. Specialization is the epistemological translation of a corporate ideal of knowledge—of instituting the learned as a juridically closed community. The things we call disciplines or sciences (in the plural) are just the shadows of university corporations.[3] And epistemology is just the effort—inevitably doomed to failure—to translate into scientific language a system of interdictions whose origin is purely social and of a moral nature.

Things and ideas are much less disciplined than people: they mix among themselves without worrying about taboos or etiquette; they circulate freely without waiting for permission; they structure themselves according to forms and forces that never correspond to those that fashion the social body. It would be pointless to expect the contrary. Besides, it is this autonomy that makes possible what has been called, for centuries, philosophy: a relationship with ideas and forms of knowledge [*connaissances*] that is not mediated by any discipline and by any norm and that has no other base than a blind, disorganized, undiscerning desire. If philosophy can lay claim to a privileged relation to truth, if it is a desire of this kind and not a method, a discipline, a protocol, a procedure that could bring us closer to reality, this is because the world is a space in which things and ideas are mixed in a heterogeneous, disparate, unpredictable way. A synaptic exchange resides in the same event space of a poem in the course of being written, of a breeze, of an ant that looks for its way home, of a war that gets started; and everything is tied to everything without there being a unity superior to that of mixture, without causes and effects being ordered according to the criterion of formal homogeneity or according to that of isomorphism. It is not by connecting those phenomena that have the same nature or form (physical phenomena with other physical phenomena, social phenomena with other social phenomena, etc.) *exclusively* among themselves that we will be able to come to understand the world. It is not by suppressing the dissimilar nature of its elements that we will be able to grasp what makes the life of all possible. The world is not a space defined by the order of causation, but rather by the climate of influences, the meteorology of atmospheres. Life and world are no more than names for the universal mixture, for the climate, for the unity that does not involve fusion between substance and form.

To understand a climate is to grasp an atmosphere.

And so it is that the plant and its structure can be explained by cosmology much better than by botany. Moreover, anthropology has much more to learn from the structure of a flower than from the linguistic self-awareness of human subjects if it is to understand the nature of what is called rationality. This is because every truth is connected to every other truth, in the same way in which every thing is connected to every other thing. Besides, this connection—this universal conspiracy of ideas, of truths, *and* of things—is what we call world: what we cross and what crosses us each moment, each time we breathe. If the kinds of knowledge wish to remain *worldly*, be *kinds of knowledge and know-how* [connaissances et savoirs] *of this world*, they will have to respect its structure. In the world, everything is mixed with everything and nothing is ontologically separated from the rest. It is the same with forms of knowledge and ideas. In the sea of thought, everything communicates with everything and every kind of knowledge is penetrated by all the others. Any object can be known by any discipline, any form of knowledge can give access to any object.

All things considered, true knowledge of the world can only be a form of speculative autotrophy: instead of always living exclusively on ideas and truths already sanctioned by this or that discipline in its history (and this includes philosophy), instead of aiming to build itself out of cognitive elements already structured, ordered, and dressed up, it would have to transform any subject, object, or event into an idea, just as plants are capable of transforming any scrap of earth, air, and light into life. This would be the most radical form of speculative activity, a protean and liminal cosmology, indifferent to the places, forms, and ways in which it is practiced.

Notes

1. The literature on disciplinary division is immense. See, among others, Jean-Louis Fabiani, “À quoi sert la notion de discipline,” in J. Boutier, J.-C. Passeron, and J. Revel (eds.), *Qu’est-ce qu’une discipline?* (Paris: EHESS/Enquête, 2006), pp. 11–34; Dan Sperber, “Why Rethink Interdisciplinarity?” (2003), available at

https://www.dan.sperber.fr/?p=101; Thomas S. Kuhn, "The Essential Tension," in idem, *The Essential Tension* (Chicago: University of Chicago Press, 1977), pp. 320–39; John Horgan, *The End of Science: Facing the Limits of Knowledge in the Twilight of the Scientific Age* (Reading: Addison-Wesley, 1996).

2. See Ilsetraut Hadot, *Arts libéraux et philosophie dans la pensée antique: Contribution à l'histoire de l'éducation et de la culture dans l'antiquité* (Paris: Vrin, 2006).

3. In this sense, the strange overlap between the social and the epistemological that the anthropology of science believes it can explain through modernity and its constitution is, more modestly, the effect of an institution—better, the institution par excellence that has run the administration of knowledge throughout the centuries. See Bruno Latour and Steve Woolgar, *Laboratory Life: The Social Construction of Scientific Facts* (Beverly Hills: Sage, 1979) and Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987).

15
Like an Atmosphere

The emergence of philosophy need not be considered an historical event that took place once and for all. More than a discipline that can be identified by its object, by its method, and by questions and aims universally shared across space and time, philosophy is a sort of atmospheric condition that can emerge suddenly—in any place and at any moment. It can reign over human knowledge for a while; but it can also disappear abruptly, for reasons that are often mysterious, exactly as the sweetness of a spring day or a storm can suddenly vanish. In this sense, the idea of a progressive, or even a nonlinear history of thought is an illusion, much like the idea of the existence of an archive, a canon, or a patrimony of works or philosophical texts: there is only a meteorology of thought in the original, Aristotelian sense of the word "meteorology": a science dedicated to the long list of natural phenomena that are often produced by natural laws, but to conditions that are less regular than those of the first element of bodies—conditions such as winds and tremors of the earth, lightning bolts, hurricanes, and storms. "Philosophical" ideas and concepts are not specific kinds of knowledge superimposed on other forms of knowledge or ideas, but a sort of movement that interests the specific element of reason and knowledge, a certain climate, an unstable yet powerful configuration of current knowledge—just as the wind, the clouds, and the rain are not elements that add themselves to those that exist in the world but are simply their contingent modification or the manifestation of their power and influence on us. Just as a certain temperature, a certain light, and any new layout of natural elements can change the face of a place and determine its inhabitability, in the same way any philosophical event modifies the layout of the forms of knowledge and know-how of a given historical context so as to change radically its mode of existence. This is in first place a matter of epistemological proof: philosophy is atmosphere-like because truth always exists in the form of an atmosphere. It is only through its mixture with the other elements that any thing finds its identity: the atmosphere is truer than the essence. At the other

end, if philosophy prefers the atmosphere to the essence, this is because it is the extreme form of the totality of elements. In this respect, the *atmosphere-like* nature of philosophical knowledge manifests itself in its form and in the impossibility of its being reduced to a knowledge defined by an object, a method, or a specific style, to the exclusion of others.

So, if it is impossible to reduce philosophy to a specific object, to an "homogeneous" and univocal field of investigation, this is because philosophy is everywhere. Far from opposing itself to the other forms of knowledge—physics, literature, computer science, art—it coincides with the limits of the knowable and nameable. Nothing is *originally* philosophical; anything whatsoever—even things that do not and will never exist—can and must become an object of philosophical inquiry.

In the same way, it is strictly impossible to recognize any stylistic continuity between one philosophical book and another. Throughout its history, philosophy has practiced all the available literary styles, from the novel to poem, from treatise to aphorism, from fairytale to mathematical formula. According to custom, all symbolic form is *ipso facto* philosophical, and none has the right to claim any higher capacity for achieving truth; no one style of writing is more appropriate to philosophy than another. The contemporary academic fetish for the uncertain Volapük of the essay with footnotes has no raison d'être from this point of view. A film, a sculpture, a pop song, but also a pebble, a cloud, or a mushroom can be *philosophical* with the very same intensity as a treatise of geology, *The Critique of Pure Reason*, or a dictum pronounced with the affected nonchalance of a dandy.

Ultimately, it is impossible to distill a single method; the only method is an extremely intense love for knowledge, a wild, brute, indocile passion for knowledge in all its forms and in all its subjects. Philosophy is knowledge under the empire of Eros, the most undisciplined and rugged of all gods. It can never be a discipline: it is, on the contrary, what human knowledge becomes once it has recognized the fact that no discipline is possible, either moral or epistemological. To affirm the contrary, to bind philosophy to a series of pre-frozen questions, to problems specific to it, means to confuse it with some scholastic doctrine.[1] This is why an idea can

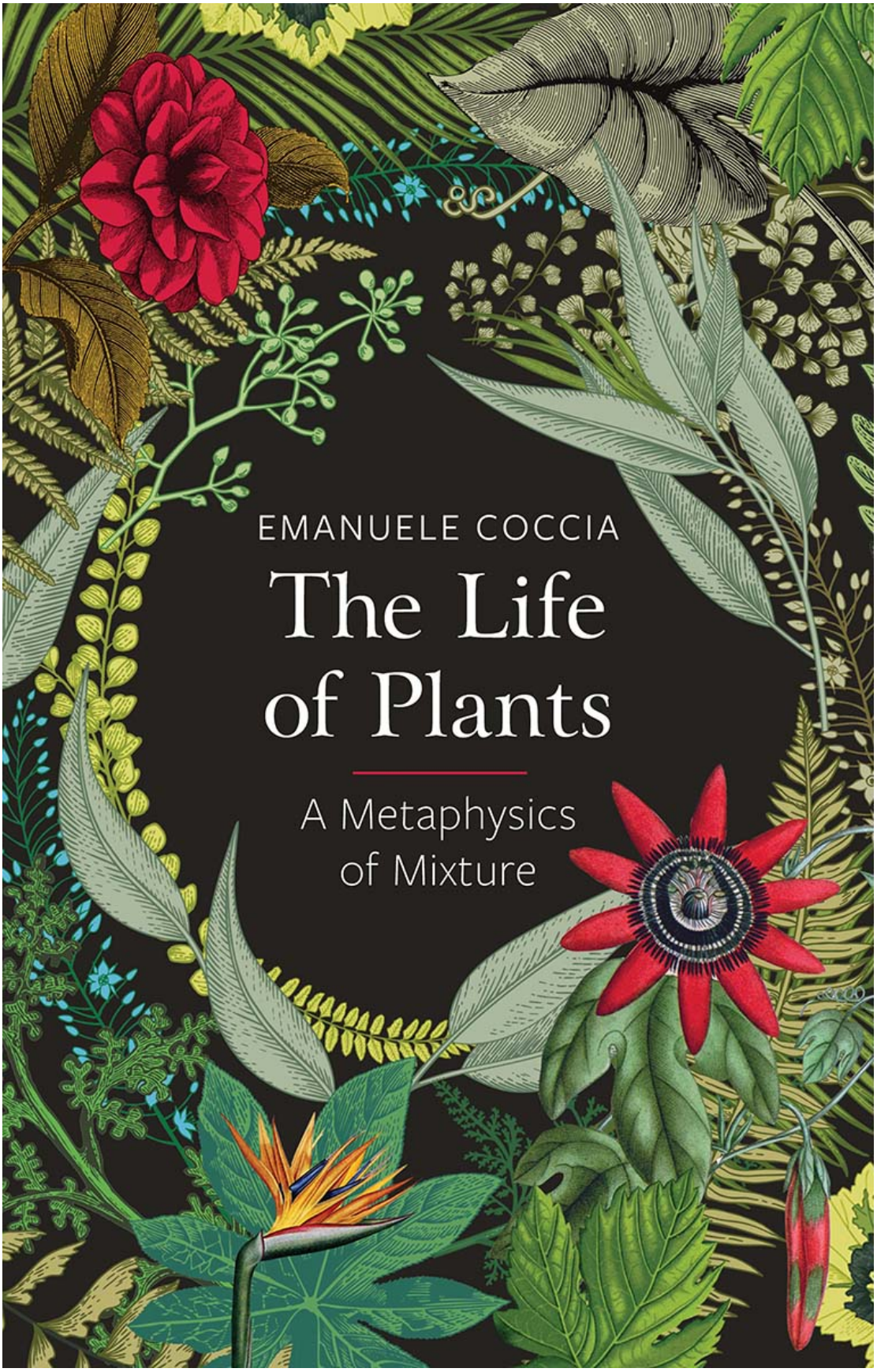
never be found in the archives: it embodies the point of cleavage of all tradition, the *clinamen* within each discipline that allows a specific form of knowledge to become paradigm, example. It is an ideal opposite to Socratic atopy: philosophical thought is nowhere and everywhere. Like atmosphere.

Note

1. This is the paradox of speculative realism, which, trying all along to reaffirm the existence of the real in all its amplitude, has nonetheless purged philosophy of any *real* knowledge of the world, to seek refuge, once again, in the enclosed courtyard of traditional books, subjects, and arguments, all sanctioned as "properly philosophical" by an arbitrary and culturally quite limited canon.

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