

# Organisms and Environments as Combined Systems

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## Abstract

The present paper aims at exploring the relation between organisms (Life) and environments (Earth), and at showing that nowadays we need new conceptual categories to account for such a relation. Over the last thirty years, indeed, the boundaries of what is meant by “environment” and “organisms” have been transformed, and, more precisely, “Earth” and “Life” must be grasped as a “combined system”. But this dynamic, which does not keep separate the organisms from their life-worlds, it is widely present also at the political and cultural level. So, what is well-known on a scientific level, i.e. that it is the life itself which produces the environment and, at the same time, is subjected to the effects of its modifications on the environment, has to be investigated also at the practical level. Here, a sample of such an investigation will be offered through the analysis of the common mediator of the relationship between Life and Earth, i.e. that metabolic exchange between external and internal bodies that consists of “Food”. Then, some reflections on the current forms of the relationship between environment and “Crime” will be provided and some open questions on the recent concept of “environmental crime” will be raised.

**Keywords:** environment; eco-evolution; cohabiting guests; food; environmental crime.

Is there any trait linking the four items of the *Nuova Accademia* meeting, “Terra Vita Cibo Criminalità”, held at the University of Milano-Bicocca two years ago? Can there be a sort of map for the present and, perhaps, a vision on the future? In other words, can there be a useful design to reflect about the ways to cross the boundaries of a variety of knowledges that imply each other? And, if any, how should we understand such a design?

## Earth

Let us try. Since, at least, the last two centuries, Earth is no longer just geology or geography. Since the beginning of the 19th century, Earth has become the “environment”, i.e. the *milieu* of the organisms which surrounds them<sup>1</sup>. The environment is what is

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<sup>1</sup> This concept has been coined by Jean-Baptiste Lamarck. It appeared in his most famous work, *Philosophie zoologique*, which was published in 1809, and became the engine of his “transformism”. Moreover, it was closely related to another important concept, i.e. the concept of “organism”: environment and organism began to be mutually implicated since then. See Lamarck 1809; see also Barsanti 2005.

around an organism, is essential to its survival, is shaped, degraded and plundered by the very existence of it. At the end of the 20th century, this integration between environments and organisms has led to the extension of the theory of evolution through the concept of “eco-evolution”, and thus has produced new methodological criteria. But this dynamic, which does not keep separate the organisms from their life-worlds any longer, first, has been acknowledged in research and, now, it is widely present also at the political and cultural level. In other words, what is known on a scientific level, i.e. that it is the life itself which produces the environment and, at the same time, is subjected to the effects of its modifications, has been translated to a practical level.

This attention has been gained through the acquisition of a critical mass of *expiring effects*. Those effects have been accumulated over a long period of time and have become exponential during the last two centuries of industrial and agricultural revolution. Since the end of the 20th century, the burden of the environmental transformations, dysfunctional to life, alongside of the constructive ones, has become manifest. This is the negative trait of the *anthropic impact* on the planet, or, as it has been said, the emergence of a “planetary crisis caused by a cultural animal”<sup>2</sup>. As a consequence, it has begun a wide critical reflection which ranges from the science of the living world to geopolitics, and is focused on the consequences of the introduction of synthetic substances, of the combustion of hydrocarbons, of the climate and soil changes in the last two centuries. These modifications are largely due to the productive innovations that have unfolded between the industrial and agricultural revolution and, finally, between technoscience and technocapitalism<sup>3</sup>. Such a reflection includes the synergies that take place between those innovations both in the ecosystems and within the living matter itself, i.e. within the bodies. Moreover, it has to be noted that these synergies were initially unpredictable.

## Life

The terrestrial environment is therefore a dual reality: it is the *place* and, at the same time, the *product* of the Life that it hosts (and this is the second influential concept of the Conference). Life, indeed, in all of its forms, starting from the world of archaeobacteria – which resulted from long phases of successful macromolecular combinations in the prebiotic era – to our species and all of those that are contemporary to us, was and is the most powerful *agent of modification* of the planet’s surface.

In 1926, the Russian biogeochemist Vladimir I. Vernadsky introduced the concept of “Biosphere” to indicate that layer where there can be life, thanks to the functions of the synthesis of matter and the energy produced also by solar irradiation. The

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<sup>2</sup> Galassi, Modonesi 2017.

<sup>3</sup> Tocci 2015.

Biosphere sinks for about 3km of depth below the surface of the Earth and extends up to the limit of the stratosphere. The Biosphere is thus a combined system of chemical exchanges between solar energy and substances that pass-through the living bodies. And from these, in different ways ranging from metabolism to behaviours, to techniques, it crosses and modulates this “sphere produced by life”<sup>4</sup>. Vernadsky’s vision of life on the planet was a unitary one, based on the circulation of elements, from the atmosphere, to the plants, the animals, the ground, and then back to the atmosphere and the water, and so on.

In 1947, the paleontologist George G. Simpson stated that the “combined systems” constituted by adapted organisms and the environments modified by their living inhabitants, had to be depicted as the right “units of evolution”<sup>5</sup>.

Nevertheless, Earth and Life, environments and organisms, are usually understood as separate entities. This happens in a double way. On the one hand, it happens in morphological, functional or molecular biology, and in those philosophies that focus on the entity, on the substance and its functions, and are not so much sensitive to the environment; on the other hand, it happens in the earth sciences, where the living beings, i.e. the “inhabitants” of the Earth, are understood as almost extraneous. These sciences keep separate their fields of study: geology, geography, meteorology, pedology, oceanography.

Biology, *Bios-logìa*, deals precisely with the “bios”, the living beings and their forms, functions, physiologies, metabolisms, pathologies, and with their reproduction or their molecular bases. Ecology, *Oikos-logìa*, a young science that has born a little more than a century ago, deals with places and environments that are populated by living beings; for a long time, however, they have been understood only on the basis of their *carrying capacity* and its quantification, thus reducing the study of trophic systems to their dynamic laws. Although ecology can today overlap with landscaping, urban planning, and all those land sciences and various other subsectors that are linked to human activity, the awareness of a recursive integration between organisms and environments comes late.

Between *bios* and *òikos* there is a series of academic fields that are increasingly sectorialized and specialized. Over the last thirty years, the boundaries of what is meant by “environment” have been transformed, and, as a consequence of that transformation, even the boundaries of what is meant by “organism” have been transformed.

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<sup>4</sup> Vernadskji 1929 and 1994.

<sup>5</sup> See Simpson 1944 and 1951. The debate on the evolutionary unit is still going on: Is it the individual, the genome, or the species? Are the populations? Simpson’s intuition had no particular resonance until his direct student, Steven J. Gould, made it a starting point of what today we call the “expansion” of Darwinian evolutionism: Gould 2002.

Consider this example. In intensive farming systems, antibiotics are used not only in the presence of infections, but continuously and even for preventive purposes. This modification of the organic internal context of livestock, alters the entire ecosystem of bacteria and viruses and thus it selects new species through the simplest Darwinian mechanism, i.e. the intensification of widespread mutations and the consequent selection of those strains able to survive within the new “antibiotic environment”<sup>6</sup>. So, depending on the subject that has been taken into account, the environment is not only what surrounds the organisms from the *outside* world, it is not just the landscape, the geography, the niches or the habitat of the planet. As in this case, for the cohabiting guests (i.e. pathogens but also beneficial symbionts) the “environment” is the *inside* of the bodies in which they lodge. An organic interior – that of the host species – populated by prokaryotes, bacteria, viruses, plasmids, is therefore a real internal microcosm: an “internal micro-environment”, or, as the symbiontologists call this additional level in combined system, a “*microbiome*”, in direct analogy with the ecological, macroscopic *biome*, that is that of the inhabited habitats on Earth<sup>7</sup>.

But why should we emphasize these details? Because they are not as merely technical as they might appear and, above all, because the growth of scientific knowledge slowly modifies our perspective on our staying in the world – and we know it well, in analogous way to the loss of that mantle of stars that was the sky in the Ptolemaic system.

Although contemporary ecology through eco-evolution and ecosystem science goes far beyond the geochemical and energy-based studies of its first phase. Although biology increasingly considers the role of the living environments on the living forms and processes, and the two thematic fields of ecology and biology intertwine, we can still acknowledge that the boundaries between the *internal* and the *external* of the bodies and of the related environments (both external and internal) are ever increasingly “transit areas”. In order to grasp the new environment in which we are immersed, in order to critically elaborate it, we need a transformation of the categorial relationship between environment and life.

In other words, we need to take an intermediate position to gain a new perspective on environmental contexts and living ones, in order to capture them in a unitary way: it is important to grasp both the bodies in co-construction with their environments, both external and internal, and the environments in constant dependence on the organic action. There are bodies saturated with environment and environments created and degraded by life. Environmental organisms and organic environments, in which the

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<sup>6</sup> They are new species that microbiologists and clinicians have called *Methicillin-resistant Staphylococcus aureus* (MRSA): see European Food Safety Authority 2009.

<sup>7</sup> Gagliasso 2015.

very same categories “external” and “internal”, dynamically and recursively, shift between figures and ground.

Changing the categorical relationship between environment and organism (“Earth” and “Life”) involves both using data from many disciplines that are now working on the complex ecosystemic field and using disciplines as “tools”. Tools to be used, “handcrafted” and combined with each other as needed (*bricoler*).

This is, I think, a point that roots us in the present also at the epistemic level, and that goes beyond a merely apparent and ecumenical “interdisciplinarity”. A necessary style of reasoning must be able to calibrate the research – and the policies – of an environmental reparation on the basis of the future survival of the living beings. Such a style of reasoning has to orient the utility of technoscientific innovations in ways compatible with them and, at the same time, to counteract obscurantist luddisms. It is a matter of going towards ways of thinking that depart from the ones that we inherited from a Modernity that we have just left behind us, ways of thinking “that we do not know except in a small way”, as emphasized by the founders of the European Research Council (ERC), Helga Novotny<sup>8</sup>. Today, however, they can open new scenarios in which the precautionary criteria can be part of the complex life-environment cluster.

## Food

There is a significant change which is, in some respects, urgent in terms of geopolitical decision-making, and, in other respects, slow and in need of a thoughtful reflection. This change is related to the *common mediator* of the relationship between Life and Earth, i.e. that metabolic exchange between external and internal bodies that consists of Food (the third key theme of the Conference). It is an essential theme in relation to *organisms* and to the producing cycles of the living matter-energy in relation to the *environment* (the Earth). With air, water and other so-called “common goods” essential to the survival of life (today partially and locally compromised), the passage of matter-energy from life contexts to bodies has become a crossroads between scientific issues (metabolism, trophic chains, etc.) and geopolitical questions (hunger and its multiple consequences among the people of the North and the South of the world, i.e. human migrations). This is therefore an integrated question that links together several fields of research and political choices. Food is represented by the trophic chains that bind together all living forms, from protozoa, to fungi, to plants, to animals, and that creates what we call the “food pyramid”. That is precisely the connected Earth-life system, caught in its dynamic interaction and mutual co-construction.

All these transformations are also the basis, as we know well, of the entire human history, from the beginnings to the present, and, as the paleoanthropology shows

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<sup>8</sup> Nowotny 2008.

today, of our own anthropogenesis emerging from ancestors which are common to the rest of the primates<sup>9</sup>. Indeed, one of the main passages between primates and early hominids forms occurs precisely through the very close relationship, in some anthropic species closer to us, between dietary changes and changes in the organic structure, especially encephalic and cortical and therefore psychic<sup>10</sup>.

All these dynamics are interactive and lead to a common denominator, from the use of the Earth, to the eco-evolutionary transformations of its inhabitant organisms and in this the feeding is at the base of artefacts, technologies, forms of production, entire proto-social organizations of hominids, role distributions between classes and genres, conflicts, migrations and explorations on the planet.

At the crossroads between several research fields that are hybridized, according to the new emerging scenarios, even the traditional forms of policies are contaminated.

The incompatibilities between the hyperliberalist economy and the ecological data on the risk of a consumption and exploitation no longer sustainable for the future life that inhabits the planet, are revealed. The themes of the environment, of the living beings and of one of their main connectors, i.e. the food, modify our perception of the present and the future. A perception that modifies us on the anthropological level as well.

Any scientific analysis on ecosystems, on the loss of biodiversity, on the *global climate change*, on the anthropic diffusion impact, including the data of a new discipline, i.e. the environmental epidemiology, that are applied to entire territories subjected to the most serious forms of pollution, is a form of science that links observation with political-social responsibilities. The same new disciplines involved in redefining the internal environment of organisms, are not free from tensions related to ethics when a series of new products introduced into the environment goes through the bodies: the so-called “endocrine disruptors” whose characteristics and organic consequences are explored. There is an environmental ethics that presents problems that, when compared to the past, are partly new, for example the elaboration of criteria of responsible relationship with the future living beings. So, we are dealing with fields that remained strictly separate until the mid-twentieth century: there was the world of scientific validation and that of ethical or political evaluations. Any discourse that treats the environment and the living and their connections (as in this most basic case, for example, the Food) must be able to self-analyse in its very foundations, since it has to be a historical, theoretical, and planning process, and above all it has to embrace multiple discursive levels.

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<sup>9</sup> Manzi 2007.

<sup>10</sup> Biondi, Rickards 2017; Manzi 2007.

Over the past 30 years, the human self-perception in the world has been modified, even if it has not been either anthropologically or philosophically analysed. It can however be grasped in the shift of influential denoting concepts of environmental reality, and of the human role in it. For example, the position of the referent, the location of the speaking subject, is very different if one speaks of “properties of natural *resources*” or of “sharing of *living conditions*”. These terminologies are full of world views that mark the passage between the triumph of the nineteenth century and the current awareness: on the one hand, the appropriation and, on the other, the belonging to natural contexts.

## Crime

As epistemologist, I would not be entitled to speak of the fourth point of the Conference, i.e. the Crime. However, there are concepts on the relationship between *crime* and *environment* that did not exist 50 years ago: “environmental crime”, “precautionary principle” in the management of the environment, the existence of “eco-mafia”. In this case of jurisprudential relevance, there are new way of thinking, new languages and new displacements of the subjects. They seem to point out new emergencies. And, they do so in a double way according to the meanings of the term itself of “emergency” and depending on the discursive context: something new that is being formed or a state of alert in the face of unpredictable events.

Even in this case we find indicators of that “anthropological” change, which is usually slower than the historical one, but sometimes seems to contrast political delays. The attention on human causes in environmental damage develops the theme of *responsibility* towards future vulnerable beings of our species or of other ones in the recent field of environmental ethics<sup>11</sup>. However, between the various philosophies of an environmental ethics, from the ethics of responsibility to the ethics of care<sup>12</sup>, and the idea of “environmental crime” there is still a gap. The sharp jurisprudential identification of crime, the “environmental crime”, goes beyond ethics and results in the possibility of being subject to sanctions. This is a further space which has still to be explored.

## So, I just advance some questions.

Does it perhaps make sense to cross-cut the problem based on the prosecution or non-prosecution (still) of “crimes” in which the relationship between actors and victims is very complex and - for example - displaced over a period of several generations?

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<sup>11</sup> Lecalldano 2010.

<sup>12</sup> Pulcini 2009; Donatelli 2012.

On one hand, there is a well-defined and objectively prosecutable subject, as the case of the eco-mafias. On the other hand, there is a nameless plurality of agents which are remote and intertwined with each other, as the case of industrial pollutions or of pesticide that came from afar. Moreover, there is the global set of a financial system that has become criminogenic, or, in other terms, managed by “predatory formations”<sup>13</sup>. Can these three cases be part of the same method of investigation or do they require different categorical elaborations and research methods which are still unknown?

What criteria, that have not been fully developed yet, can be employed to handle these issues and to create a jurisprudential right? These questions cannot have any answer from an epistemological point of view. Nevertheless, the examples that require new forms of thinking are growing and make these questions cogent and not abstract at all.

Massive systemic effects have revealed the lethal implication of synthetic substances in less than a century, as well as the consequences of the consumption of non-renewable energies on the planet show their global effects. These realities were accepted in the past as useful achievements of the progress, from plastic, to synthetic nitrates for the Green Revolution, to hydrocarbons for transport. Therefore, are the serious consequences of them intentional?

Today, other substances are instead at the centre of a war between profit policies and the health of people and ecosystems. I think of what the remote epidemiologists of tomorrow will computerize in their statistics and of what responsibilities they will impute to our present. In this case the plural mega-subject, but certainly not impersonal, that acts would be prosecutable? Or would the political system that establishes the thresholds and the values on the basis of which something is, for instance, “probably carcinogenic”, be prosecutable?

In conclusion, the four thematic items of the Conference seem to integrate each other. They are “dense” points, *hotspots*, to be kept in mind.

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<sup>13</sup> On this, see Sassen 2015.

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