PHYSIS AS NATURE IN MOTION: AN INQUIRY OF THE EPISTEMOLOGICAL FRAMEWORKS OF NATURAL PHILOSOPHY

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ABSTRACT: The subject of sustainability subsumed by the environmental agenda has been widely approached without taking into account a rigorous examination of the concept of nature, and still being guided by a modern or even Christian epistemological matrix supported by an essentialist, anthropocentric and metaphysical sight. This paper seeks to expose some non-metaphysical theoretical alternatives, especially those derived from evolutionism, quantum mechanics, and chaos theory in which nature appears as a complex, moving, and unstable system that acts through creative and irreversible processes. Methodologically, it is intended to make a philosophical inquiry in order to criticize Christian and modern epistemologies, as well as the concept of nature that follows them, which contains both a creationist and an instrumental bias, to then propose some epistemological alternatives more in tune with the current stage of natural philosophy. As a result, it will be possible to observe that these more current theoretical conceptions require new terminology and conceptual structure to account for the experiences observed in this field which, ironically, come close to the ancient Greek concept of *physis*.

KEYWORDS: Arrow of time; Metaphysics; Essentialism; Evolutionism; Ambivalence; Sustainability; Philosophy of biology; Chaos theory; Quantum mechanics; Anthropocentrism

THE PHILOSOPHICAL FOUNDATIONS OF MODERN EPISTEMOLOGY CONCERNING NATURE

It is not necessary to go very far or do great rhetorical exercises to affirm that, despite the environmental agenda[1], our concept of nature is still dominated by the Christian matrix that modern philosophy tried to rationally legitimize –

[1] By "environmental agenda", I mean not only the global guidelines on the environment promoted by the UN, but also all sorts of literature of wide scope that cover areas such as deep ecology, political ecology, economics, and sustainable development.

either for believing in creationism or fear of inquisition. In 1966, Lynn White (1967) correlated the ecological crisis with the Judeo-Christian dogma of creation[2]. However, this crisis can be placed much earlier in authors who criticized the rationalism of the capitalist mode of production from different angles, such as Weber (1978; 2005), Freud (1962), and Horkheimer (2002; 2004). Mainly in the latter, the concept of *instrumental rationality* [*instrumentalized reason*] is emblematic for describing how rationality would have become not only an ability to understand and criticize reality but also to dominate nature by technological means. It is no longer necessary to say that such use of scientific rationality entails ethical and political consequences that compromise neutrality and disinterested character of science, also making it a weapon of social domination. Anyway, we understand that Judeo-Christian morality is at the origin of the epistemological problem that takes nature as an object of domination[3].

Genesis is quite categorical, leaving no doubt about the anthropocentric and utilitarian view of nature:

> And God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. So God created man in his own image, in the image of God created he him; male and female created he them. And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth (Bible, 1996, 1:26-28).

The question is: how did what should have remained in the realm of myth become a matter for modern science? Where did Christianity get so much strength to become the epistemological backdrop of technoscientific thought if not by taking advantage of the prestige and authority of Greek philosophy? Although it had no explicit religious connotation, or quite the contrary, because

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[2] A different approach can be observed, for example, in Peacocke (2004) when he discusses a theological repositioning of science and the contribution of religion concerning a more collaborative (and not individual) ethics also with regard to the environment.

[3] Unlike what Shkliarevsky (2021) discusses in his article, my concern is not to search for the source of anthropocentrism and, therefore, to prove how much it depends on this or that culture, but to show how much the Judeo-Christian tradition shaped medieval and modern epistemology and, consequently, modern science, defining a form of discourse that crosses all social fields, such as economic, aesthetic, ethical and political, reaching all cultures to the extent that it is intended – if it is not – hegemonic.

it was precisely associated with the search for rational truth[4], Plato's theory of Forms (Plato, 1997; see also Burnet, 1920, 1928; Ross, 2000; Zeller, 1876, 1889), supporting a metaphysical view of reality[5], provided the raw material that Christian theology needed to argue that the physical world is nothing but an imperfect copy of *ideas* (perfect forms). Such theory may be considered the first way of solving the ancient problem of motion which, to a large extent, would have corresponded to the very origin of philosophical and rational thought. After all, while Heraclitus, affirming becoming, that is, full motion, defended that the stability of being was illusory and that the abstraction of thought [logos] could correct it; Parmenides, on the other hand, argued that non-being cannot be, insofar as being can only be conceived in its permanence, that is, motionless (see Burnet, 1920, 1928; Kahn, 1960, 2004; Vernant, 2006; Zeller, 1876, 1889).

Time denial is accurate in Parmenides: "*Since it is not in time, the One in no sense 'is', and it cannot even be named or in any way known*" (Cornford, 1939, 141D-142A). However, as the movement cannot be denied once it is perceived, Plato "solved the problem", splitting the world in two: the ideal world of ideas: perfect, perennial, and immutable; and the material world: corruptible, therefore imperfect. Undoubtedly, the solution to the question of motion that would later be given by Aristotle (1991) in his theory of potency and actuality ["Actual and Possible"; "Form and Matter"] is more plausible to the demands of scientific thought; however, it will feed Christian theology as much as Platonic philosophy

[4] Although there are controversies about the religious character of Platonism, mainly due to its Pythagorean influence, I assume that the emergence of Greek philosophy only makes sense as a project to build scientific rationality. See also references in footnotes 17 and 19.

[5] Metaphysics takes three fundamental forms: theological, ontological and gnoseological. As a theological science, there is the assumption of something divine or even "eternal and immobile", constituting the *first philosophy* according to Aristotle, unlike physics which deals with things in motion. As an ontology, I must highlight at least one of its characteristics, which is the idea of a "necessary essence to being". Regarding gnoseology, there is the claim, expressed in Kant, to be a "science of pure concepts", which presupposes knowledge independent of experience (see the entry "metaphysics" in Abbagnano, 2007; Preus, 2007). Thus, I understand that metaphysics encompasses terms such as immobility, essentialism, teleology, which are incoherent for the understanding of nature based on evolutionism, so it would be fairer to bring it closer to the ancient Greek concept of *physis* rather than the Judeo-Christian or even modern notion.

due to its teleological character[6].

Although Greek metaphysics contributed with conceptual elements to feed Christian theology and then modern philosophy, its epistemology was still far from the dual subject-object model that will foster the machine of instrumental reason. The machine of legitimation of domination called *instrumental rationality* could be only activated from a view of nature that would find its legitimacy in Christian mythology. Thus, it is important to remember that if modern philosophers put into action the logic of the domain of nature, it is Christian theology that provides the moral justification for this rationality. Such is one of our hypotheses[7].

Take, for example, John Locke as a reference. Although an empiricist and defender of the rational bases of natural law and property, Locke (2003) structures all his property defense reasoning in the Bible, in addition to treating nature (non-human creatures) as something bestial and an object destined for our use. Even in different philosophical records, ranging from Bacon (2003) to Descartes (2006), from Kant (1998) to Hegel (1977) or Marx[8], it is possible to observe that reasoning can even abandon the explicit reference to Christianity, but the emerging humanism that places the centrality of the human being in the process of knowledge is also the same that will also legitimize nature as an object of domination in the sense of providing a state of social well-being through its progressive transformation, even justifying the movement of history itself.

Ironically, it can be said that when motion was reintroduced into philosophy by the historical dialectic of Hegel and Marx, it comes as something that needs to be suppressed through a kind of "redeeming negation of nature" towards the eternal and immobile stillness to be found at the end of the history. Finally, time resurfaces, but as a sad story of a conflict that needs to come to a happy ending. It's like there's something wrong with nature that needs to be fixed. It is even

[6] Differing from Plato, Aristotle does not support a transcendental world of Ideas (Forms), but that substances have in themselves the potency to become what they are, defending an immanent vision whose metaphysical feature would be basically in his teleological vision of becoming (see Cornford, 1966; Jaeger, 1962; Zeller, 1889, 1897).

[7] Again, this is not to say that the same paths would not have been taken if Christianity had not had such political strength, but the fact is that it did.

[8] Interpreters of Marx's works would have divergent positions on his view of nature, especially from an investigation carried out through an environmental bias. For further information, see Sousa, 2013.

possible, but this is a subject for further discussion in the field of ethics.[9]

In sum, it can be said that philosophy sought to frame nature's motion. In Platonic metaphysics, which spills over into Christian theology, motion denotes the imperfection (corruption) of matter. In Aristotelian philosophy, as in historical dialectics, the motion runs towards an intentional and desirable end. In classical mechanics, nature must be subjected to necessary and universal rules that designate repetition and predictability.

Roughly speaking, the subject-object dichotomy, pronounced by Cartesian epistemology, in no way favored the understanding of an integrated nature (see Bohr, 1961, 1963; Heisenberg, 1958, 1958a; Prigogine, 1997) once it considers the body as the place of extension and motion while the mind is a *res cogitans*. Descartes (2006, 2008) posits that "I know that I exist as a thinking thing" despite the fact that I am not sure about the properties of the objects that surround him. It's as if to say: I don't know if the properties of the wax of this candle actually belong to the wax because they transform, they fall apart. And, this is because my senses can deceive me since these changes – that I perceive – occur over time. Therefore, time, or rather, the motion that is inherent to it, is a kind of enemy of the certainty that I can obtain from extensive, material things.

Ultimately, modern philosophy, scored by Cartesian dualism and by essentialism, seems to boil down to the existence of an external (material) world, distinct from an internal (immaterial) world. For our purposes, it does not matter so much whether the truth is in the subject or object of knowledge, but that the subject-object split may be situated in different substances that, in order to communicate, need to make use of a process of representation that is always placed under suspicion[10].

Hence, rationalists and empiricists will respectively fight for the primacy of the subject or the object in the process of understanding reality. In turn, seeking to settle the epistemological polarization between empiricists and idealists (rationalists), Kant (1996) establishes the limits of metaphysics in his claim to reach

[9] I recognize the huge importance of discussing ethics, especially from the perspective of epigenetics, underlining the role of culture in the evolutionary process; however, it seems rash to me to state that "[…] *the biology of humans has become gradually de-Darwinized*" (Szathmáry, 2015, p. 10110 apud Lindholm, 2022, p. 94) without firstly make a clear distinction between mutual aid and ethics.

[10] In the 17th century, Spinoza (2002) is an exception to this rule, which I will consider next.

the *thing-in-itself* [*Ding an sich*] or the *noumenon*, by stating that, of things, human beings can only know what the experience of their senses offers, even though they have a rational, necessary and universal structure, which would make it possible to organize phenomena from the so-called "forms of sensibility" (dimensions of space and time) and to know them according to "categories of understanding" that would correspond to the faculties a priori of the reason that, in turn, would allow them to make judgments about the world. Ideas would then be constructions of reason, but as thought has no limits, one can think beyond the certainty of knowledge so that ideas can neither be proved nor denied. Thus, the understanding of an object is limited to the conditions of thought that give humans the phenomenon, and it is only possible to speculate about the *thing-in-itself*. Metaphysics cannot claim to establish necessary and universal laws proper to nature. Knowledge then becomes a possibility of certainty conditioned to our own understanding, not being absolute.

The Kantian solution may be effective in terms of seeking the boundaries between science and metaphysics, and the inexorable dependence of knowledge on the observer, but it left open at least two flanks that can be considered interdependent: a) it maintained the existence of the *thing-in-itself*; b) it disregarded motion. With this, he preserved the essentialism that, whether applied to ideas (mind) or even to matter (body), so well defines metaphysical thought. Further, Kant's Copernican revolution did not end the tensions between science and metaphysics, as well as between objective realism and phenomenological subjectivism. As an example, it is enough to think about the discomfort brought about by the central role of the observer in Schrödinger's equation (Bohr, 1961, 1963; Heisenberg, 1958) when placing quantum mechanics within the limits of phenomenology.

Also, maintaining time (as well as space) as an a priori form of sensitivity could not satisfy the demands of physical science which, at least since Eddington (2022), proposed an "arrow of time"[11] in the description of nature, seeking to overcome

[11] "I shall use the phrase 'time's arrow' to express this one-way property of time which has no analogue in space. It is a singularly interesting property from a philosophical standpoint. We must note that: (1) It is vividly recognized by consciousness. (2) It is equally insisted on by our reasoning faculty, which tells us that a reversal of the arrow would render the external world nonsensical. (3) It makes no appearance in physical science except in the study of organization of a number of individuals. Here the arrow indicates the direction of progressive increase of the random element" (Eddington, 2022, p. 35).

the limitations both from classical Newtonian dynamics and, to some degree, from later theories of relativity and quantum physics in which time appears respectively spatialized or as a probabilistic variable incorporated into the observer. This spatialization of time goes back to the famous Zeno's arrow paradox (Zeller, 1889) in which, at the limit, it was intended to deny the possibility of movement by showing that an arrow in flight is at any moment at rest. Such an expedient took place insofar as Zeno spatialized time, considering each moment of the arrow's trajectory as a frozen point contiguous to the other, so that motion would only be possible through a kind of illusion of the observer.

Aristotle (1991, Physics, p. 110; § 9 239b5-239b9) had already considered Zeno's reasoning[12] fallacious and comes close to our point by saying that "time is not composed of indivisible nows, just as no other magnitude is composed of indivisibles", but Bergson's analysis goes even more straight to our contentions when he compares this situation to the cinematographic mechanism in which there is a succession of static frames, which, once placed in sequence at a certain speed, create the illusion of movement. A situation that would be expressed in the way of thinking inherited from that philosophical tradition that has always sought to deny nature's motion. "We may therefore sum up what we have been saying to the conclusion that the *mechanism of our ordinary knowledge is of a cinematographical kind*" (Bergson, 1944, p. 332). And, still, in agreement with Bergson, we can say that "movement is indecomposable" in its continuity.

Once again, the relevance of time, as a variable capable of justifying the motion and changes that occur in nature, remains a fundamental element in epistemology since the pre-Socratics, but the response that philosophical tradition gave to becoming was basically metaphysical and essentialist, something that was only categorical and scientifically contested by evolutionism in the 19th century, and by quantum mechanics and chaos theory in the 20th.

It is important to note that, by the rejection of essentialism, we are not suggesting that things are just names (nominalist, linguistic or analytical philosophy thesis) or even the result of social constructions. It would again be a

[12] Bergson (1944, p. 335) sets out this reasoning clearly: "Take the flying arrow. At every moment, says Zeno, it is motionless, for it cannot have time to move, that is, to occupy at least two successive positions, unless at least two moments are allowed it. At a given moment, therefore, it is at rest at a given point. Motionless in each point of its course, it is motionless during all the time that it is moving".

mistake to deny essentialism on the basis of a dichotomous vision that opposes pairs as energy-matter; consciousness-body; culture-nature; but precisely to think of the interaction between these "parts" in which identity appears only as a moment in a process, or as an inexorable need to classify in order to understand, or above all, to dominate. Therefore, we insist on the question of the negation of time by its spatialization, considering it as a succession of static moments set in motion. It is to this extent that we associate essentialism with a perspective of negation of motion since the identity of being is only possible through this method of freezing becoming.

TOWARDS A NEW EPISTEMOLOGICAL APPROACH

Burying Aristotelian metaphysics and, above all, Christian theology, the theory of evolution (Darwin, 2008; Futuyma; Kirkpatrick, 2017; Kitcher, 1984; Mayr, 1942, 2002; Peacocke, 2004; Ridley, 2004) restores the concept of nature in motion, as an integrated whole, made up of interdependent species which obey a logic of the struggle for existence in which environmental variables are as relevant as genetics in promoting that order. Hence, despite the well-known reproaches imposed on him, Darwin produced a work that placed the human in the right dimension that belongs to him: as a being among others, with an evolutionary origin and with a probable end, subject to the same logic as other beings in their struggle for existence. A few years after the "Origin of Species" (Darwin, 2008), Nietzsche wrote sarcastically:

> In some remote corner of the sprawling universe, twinkling among the countless solar systems, there was once a star on which some clever animals invented *knowledge*. It was the most arrogant, most mendacious minute in "world history", but it was only a minute. After nature caught its breath a little, the star froze, and the clever animals had to die (Nietzsche, 2010, p. 17-18).

Finally, in the second half of the 19th century, a non-moral sense of nature blossoms. It is a nature devoid of any teleology (see Ginnobili, 2022), in which even the characteristics that are supposedly taken to be essentially human are merely reduced to abilities that may – or may not – compete for their survival. Thus, the possessions of the rational faculty, of language, of the symbolic inclination, and of producing means of work, even if it might be criteria of distinction in relation to other species, do not imply superiority that justifies privilege in a hierarchical scale. As Mayr (2002) and Lovejoy (2001) mention, the

idea of a *scala naturae* that establishes an order that would go from the least to the most complex becomes untenable in the face of evidence from the theory of evolution, at least as regards an unchangeable essence predestined to eternity.

Taken as a complex system that places inanimate, living, and human beings, matter and energy, time and space, in interaction, nature cannot be understood as a single and static reality, nor governed by necessary, universal, and eternal laws. However, this moving and integrated conception of nature faces certain epistemological obstacles, such as those we mentioned before: a) the existence of the "*thing-in-itself*"; b) the absence of motion. Both seem to have been overcome by the theory of evolution and, somehow, by quantum mechanics and chaos theory.

Concerning the existence of "*thing-in-itself*", it is necessary to stress that such a Kantian concept implies an archaic conception of substance that does not consider organisms as dynamic structures. When we move into the realm of quantum mechanics as well as evolutionary biology, we realize that there are no static structures as foreshadowed in both physics and philosophy inherited from the modern age (Bohr, 1961, 1963; Heisenberg, 1958, 1958a, 1971; Prigogine, 1997).

Niels Bohr (1961, 1963) emphasizes that new conceptual structures are necessary to act in this new field of investigations, disagreeing with Einstein's view for whom there would still be some incompleteness in the theoretical approach of quantum mechanics for not dealing with the certainty of prediction of the next moment from a given instant. Bohr tends to be distressed with the maxim that "observation disturbs the phenomenon", or even that "observation introduces uncertainty into the phenomenon" since the very notion of phenomenon would not apply to the quantum context. In fact, Bohr criticizes the concepts of objectivity and subjectivity, saying that these are observational situations that demand a "complementarity relationship" so that both the notions of the *thing-in-itself* and of the object would need to be revised in the face of this new epistemic paradigm (Bohr, 1961, 1963; Heisenberg, 1971, p. 103-116). The essentialist materialism that was strengthened from the 18th century onwards, and which understood atoms as real substances, "the immutable buildingstones of matter" (Heisenberg, 1958a, p. 12) would have dissolved with the march of discoveries in quantum physics. Thus, although there is disagreement regarding a

phenomenological (Heisenberg's) or realistic (Bohr's) approach, the metaphysical conception of the *thing-in-itself* seems to be abandoned in the face of advances in quantum mechanics.

As well as the matter of the "*thing-in-itself*", the issue of the "arrow of time" and its irreversibility (Eddington, 2022; see also Hull; Ruse, 1998; Lineweaver; Davies; Ruse, 2013; Prigogine, 1997) faces the same epistemological challenge enclosed in the anthropocentric vision of Kant's Copernican revolution, namely, phenomenology. Such a position leads us to believe that we must have the modesty to recognize that we do not have a science of nature, since "even in science *the object of research is no longer nature itself, but man's investigation of nature*" (Heisenberg, 1958a, p. 24), therefore depending on the history of human culture in a way that we cannot aim for unrestricted objectivity in science.[13] However, Prigogine tries to overcome this impasse when he states that: "The role of the observer was a necessary concept in the introduction of irreversibility, or the flow of time, into quantum theory. But once it is shown that instability breaks time symmetry, the observer is no longer essential" without this entailing a return to "a classical deterministic orthodoxy" or the denial of "the role of probabilities statistical character of quantum physics", but on contrary allows a "realistic formulation" of it (Prigogine, 1997, p. 5).

Thus, Prigogine seeks to dissociate science from certainty and, at the same time, probability from ignorance, correcting the gap between the phenomenology of imperfect observers and the certainties of a non-moving and non-creative determinism. In this sense, agreeing with Popper, Prigogine (1997, p. 132) states that: "indeterminism is compatible with realism, and that the acceptance of this fact allows us to adopt a coherent objective epistemology of the whole of quantum theory and an objectivist interpretation of probability". Actually, Popper (1979, p. 296) considers indeterminism present even in classical physics, although disagrees with Bohr's "idea of complementarity to living organisms". Be that as it may, we emphasize the need to overcome identity as the sole principle of validation of being, introducing ambivalence as its ontological

[13] The lack of epistemic guarantee is obviously a key issue, especially when we insert questions involving the (ir) reversibility of time and quantum mechanics (see, for example, Williams, 2022).

condition.[14]

Concerning the field of evolutionary biology, we may address the critique of essentialism (Eldredge, 1993; Hey, 2001; Hull, 1965, 1989, 1997; Hull; Ruse, 1998; Richards, 2010; Sober, 2000, 2006) by the species problem, trying to understand them as a category of analysis (methodology) rather than a fixed concept (ontology). With the aim to do so, we will maintain the same epistemological challenges discussed above: the question of the "*thing-in-itself*" and the motion.

We could begin with the most obvious objection that could be made to essentialism: nominalism or even conceptualism. An objection that runs through the history of philosophy and that, roughly speaking, begins with the sophists and cynics, goes through the quarrel of universals, by the medieval Peter Abelard and William of Ockham, by moderns like Thomas Hobbes and John Locke, and reaches contemporaneity by different flanks ranging from semiotics to social constructionism, from the philosophy of language to analytical philosophy. The contribution of nominalism to the defense of the existence of particulars, or singularities, in ontological opposition to universals, is remarkable, however, taken to paroxysm, it lacks the empirical foundation, compromising any theoretical formulation for the natural sciences, as can be seen in Hume (1960, 2007), when he reduces cause and effect relationships to mere mental habit, once it denies predictability from the regularities observed by past experience. If, on the one hand, this radical empiricism led to skepticism at the time, today his reasoning can be consonant with ideas close to those we have defended, such as the arrow of time or even by reformulation of Hume's skepticism through the principle of falsifiability that attributes a conjectural character to scientific knowledge as proposed by Popper (2002).

Although not assuming a nominalist position, Hull (1989, p. 80) upholds, for example, that "if species are units of evolution, then they cannot be interpreted as classes; they are individuals", purposing "a change in the ontological status of species"[15]. Returning to the Kantian matter of the *thing-in-itself* in the field of biology, we can precisely establish its correspondence with universals which,

[14] There is certainly a field of controversies, or at least subtleties, surrounding the question of matter and creation from a metaphysical or teleological point of view (see, for example, Ginnobili, 2022; Ostachuk, 2020). I have sustained that there is creation not by a deterministic or actualization process, but both by chance and by the ontological ambivalence of beings.

[15] Dobzhansky (1951), for example, says that the species is rather a stage of a process than a static unit.

incidentally, goes back to the discussions contained in the Aristotelian categories. As it could not be otherwise, in biology, the ontological matter of being is so relevant that it is called the "species problem" (Eldredge, 1993; Hey, 2001; Hull, 1965, 1989, 1997; Hull; Ruse, 1998; Mayr, 1942, 2002; Richards, 2010). In this case, the question is whether there is, and to what extent, an ontological correspondence between the species (universal) and its members (particulars). In other words, we have to think about whether species would correspond to natural species, that is, to essences [*eidos*] as it has been proposed by metaphysics since Plato, keeping in mind that one of the oppositions to essentialism is the "disagreement among biological systematists" (Richards, 2010, p. 2) in the composition of sets that can be based on morphological, genetic, mestizo or phylogenetic criteria (see Dobzhansky, 1951; Eldredge, 1993; Mayr, 1942, 2002; Hey, 2001; Hull, 1965, 1989, 1997; Hull; Ruse, 1998).

The lack of consensus among biologists regarding the criteria used in the classification of species affects an ontological issue, as it calls into question their real existence from the idea that they are effectively static and discrete units, something that would be questioned by the notion of "biotic flux" (Eldredge, 1993, p. 6) suggested by Darwin. Eldredge (1993, p. 4), for example, argues that, although there is no consensus in evolutionary biology about the boundaries between one species and another, "biotic nature is indeed 'packaged' into discrete or quasi-discrete entities of different sorts". Despite this, we understand that its essentialist statute is, if not undone, seriously shaken. We would even go so far as to say that "species" is more of a category of analysis than a concept of an ontological dimension unless we want to include the variable motion-time-becoming in this dimension. Or, it could be said in evolutionary terminology, that species do not exactly have a real existence in nature but present a continuous evolution, and more broadly, they are in motion, not being static. This is no longer than the Darwinian thesis that "species as we see them today are merely status reports in the flux of morphological change that is bound to continue to accrue as geological time progresses" (Eldredge, 1993, p. 6).

Authors may differ as to the more or less ontological character of the concept of species (cf. Dobzhansky, 1951; Eldredge, 1993; Ghiselin, 1997; Hey, 2001; Hull, 1965, 1989, 1997; Hull; Ruse, 1998; Richards, 2010; Sober, 2000, 2006), but those with whom we are in tune tend to treat the notion of species much more as a category of analysis than as a set of identitary beings for the simple reason that

there is no empirical evidence to support it since Darwin (2008) started to consider the principles of population thinking and gradualism.[16]

In fact, we tend to agree that the notion of species is something like a unit of evolution such as "spatio-temporally restricted *individuals*" (Richards, 2010, p. 145, with reference to Michael Ghiselin and David Hull), bringing the concept of organisms closer to that of species. Furthermore, we think that evolution, through selection, plays a "creative role in the evolutionary process" (Godfrey-Smith, 2014, p. 39), although being purposeless.

As a matter of fact, the origin of this essentialist bias, beyond the metaphysical conception of being (*eidos* or even substance), can be addressed both to Plato and to the Aristotelian logical principles which, in turn, derive from the "principle of identity" proposed previously by Parmenides that ensures that a thing or a proposition it must be equal to itself to be true, therefore not entailing ambivalence (see Zeller, 1876, 1889). Identity has been the founding principle of all science until, at least, the upheavals suffered by several fringes, including the theory of evolution, quantum mechanics, and the theory of chaos, introducing probability, uncertainty, unpredictability, change, and, above all, time. At last, it is in the eagerness to avoid ambivalence that time is denied or spatialized, affirming, as Aristotle had done, the identity of being through the principle of non-contradiction and the excluded middle in which one thing cannot be another *at the same time*.

SIMILARITIES BETWEEN THE *PHYSIS* CONCEPT AND CONTEMPORARY NATURAL PHILOSOPHY

In fact, the question of motion was already posed since the beginning of philosophy and has a straight connection with the Greek understanding of the concept of *physis* (nature). However, as the primary sources of this period are scarce and fragmented, as pre-Socratic philosophy is plural, in addition to being subject to different interpretations by its commentators, it is difficult to reach a consensus. Therefore, there are controversies about the meaning of nature in

[16] Peterson (2010), for instance, makes a retrospective analysis of philosophical anthropology with the aim of defining a critical ontology that locates the human being "in nature". Thus, still according to Peterson (2010, p. 92) "The challenge today is to combine the anti-essentialist critical resources of post-Kantian constructivism with a naturalist's appreciation of biophysical reality".

Greek culture, especially regarding its affiliation with myths in the face of the growing rationality introduced mainly by Plato[17]. Nevertheless, it can be said that the close relationship of Greeks with the concept of nature was such that these early philosophers were called physicists or naturalists or even *physikoi*, instead of philosophers (Jaeger, 1948, 1995; Vernant, 2006). The Milesians of the Ionian school, for example, claimed that "nothing existed that was not nature, *physis*" (Vernant, 1982, p. 103), or "all that really exists is natural" [including the myths or the supernatural] (Cornford, 1966, p. 15). For the ancient Greeks, nature encompasses all things as characteristics of a living whole in an organic, systemic way, and, according to Heraclitus, logos is something like the very law that governs the universe. Nature appears as a totality that comprises thought, speech, daily practices, and the arts. But the word *physis* may also encompass the original source of things, that from which they develop and thanks to which their improvement is renewed constantly; in other words, the reality underlying things in our experience (Burnet, 1920; Jaeger, 1948, 1995; Kahn, 1960, 2004; Vernant, 1982, 2006).

Thus, we lay emphasis that the meaning of nature inherited from Ancient Greeks is much closer to a contemporary view of natural sciences than what the Christian matrix and modern philosophy have raised. If once nature seemed to encompass the motion and to resemble more of a systemic paradigm, then, it becomes progressively to be framed by the introduction of Platonic metaphysics and Aristotelian logic to then be consolidated by Christian theology. That is, since myth started to be opposed to reason and eliminated by "rationality" – by the principle of identity; of non-contradiction; of excluded middle – the ambivalences that were constitutive of primeval narratives began to fade (Kahn, 1960; Vernant, 2006).

A certain distance between the human being and nature has always existed because we are beings who precisely think about reality, but this did not result in an epistemology that would make a split like the one that would be observed from the problems posed by Christianity, and that the modernity will then attempt to resolve through the subject-object dichotomy (Descartes, 2006, 2008)[18].

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[17] Cf. Burnet, 1920, 1928; Cornford, 1966; Goldsmith, 1970; Jaeger, 1948, 1995; Kahn, 1960, 2004; Vernant, 1982, 2006.

[18] This is exactly why I stated earlier (see note 3): the attempt to consider every standpoint as anthropocentric is innocuous. My point has been precisely to show that this anthropocentrism is a striking feature of modern

Kahn (2004, p. 99), for instance, considers the term *physis* as "the watchword of the new natural philosophy that radiates from Miletus", and Burnet (1920, p. 7-8) states that "the name φὐσις [nature, physis] was given to the everlasting something of which the world was made", and that "its original meaning appears to be the 'stuff' of which anything is made", howsoever "is the quest for what is abiding in the flux of things" that seems to be the common issue. Zeller (1876, p. 184; 1889, p. 67) makes clear Heraclitus' doctrine of "constant flux" as the fundamental principle of motion, of transformation of all things, and Burnet (1920) states that, among the Ionians, until Parmenides, there was not even a need to explain motion. Therefore, as we stated at the beginning, it is from the "controversy between Parmenides and Heraclitus" about the apparent or real motion in nature (see also Burnet, 1928; Kahn, 1960, 2004; Naddaf, 2005) that we have two distinct epistemological paradigms that cross the history of natural sciences and philosophy.

The general conception among many pre-Socratics, especially in Heraclitus, of a nature [phusis] understood not only as "essential properties" of a thing but as a non-static whole process, integrating origin, development, and result, is defended by Naddaf (2005, p. 1) who sees, for example, in Plato a "primary reproach" to those who deny to nature "the notion of intention (implied by *techné*) as the explanatory principle behind the order that governs the universe" through an "atheist" bias[19]. Thereby, although the Greek cosmogony (i.e., Anaximander and Heraclitus) contained a divine and moral connotation, both the fate of human beings and the universe had no intentional cause, insofar as the "order" of nature [*phusis*] is immanent in itself, not being moved by any force outside itself, a position, by the way, shared by the Sophists (Naddaf, 2005).

Regarding the more or less theological or mythical character of this cosmology, present mainly in the philosophers of the Ionian school, some of the leading commentators of Ancient Greece[20] offer interpretative nuances that, however, do not compromise our hypothesis that the conception of nature

epistemology based on subject-object dualism. In turn, as I have tried to demonstrate, this dualism was the result of the modern attempt to overcome the epistemic theocentrism posed by Christian theology, just as Christian morality legitimized anthropocentrism. Following this line of reasoning, the humanism that flourishes in the modern age is nothing more than the rationalization of this Christian morality.

[19] Cf. Burnet, 1920, 1928; Jaeger, 1948, 1995; Vernant, 1982, 2006; Zeller, 1876, 1889, 1897.

[20] Cf. Burnet, 1920, 1928; Cornford, 1939, 1966; Goldsmith, 1970; Jaeger, 1948, 1995; Vernant, 1982, 2006; Zeller, 1889.

bestowed in the philosophy of the Ionians and Heraclitus contains a systemic and ambivalent character, as can be seen, today in the theories of evolution, quantum mechanics, and chaos.

Cornford's argument that the earliest philosophy is far from a scientific theory for not working with experimentation, remaining in the domain of a mythological construction, does not seem to recognize that, in that context historical, there was no way to be different, because an experimental science only finds meaning in the context of the modern age (see Vernant, 1982, p. 102-118; 2006). On the other hand, we understand that, despite possible mythological references, there is enough evidence in this cosmology to make us believe in similarity with contemporary science, in tune with a systemic and non-metaphysical view of nature.

Therefore, what we infer is that metaphysics, which emerged with Plato, and fill classical philosophy, establishes a conception of nature hostile to motion and diversity, providing the moral and epistemological backings that will feed the middle and modern ages. What sort of nature is this? It is a static nature, devoid of movement, made up of substances defined by essential properties, which will favor a creationist vision of a universe populated by species and identity categories.

No doubt, there were exceptions to the rules such as Spinoza's conception of nature, disruptive in his time. By proposing a single substance that is expressed in several attributes, Spinoza suggests a comprehensive idea of motion that encompasses mind and body: "The order and connection of ideas is the same as the order and connection of things" (Spinoza, 2002, Ethics, Part II, Proposition 7, p. 247). As stated by the editor Michael L. Morgan, Spinoza criticizes as much Descartes' idealism for having separated mind and body into distinct substances as materialists such as Hobbes for "reducing mental phenomena to physical ones". "He constructs a view of nature as a whole in which physical events and mental events are both understandable, in which they are related but separate, and in which the sciences of the physical world and of the mental world are related but distinct" (Spinoza, 2002, xiii).

Undoubtedly, this understanding of nature, although theological, caused him religious persecution, as we have seen in history with countless other thinkers who took the side of a vision that was not in accordance with Christianity and,

therefore, we affirmed from the beginning that the moral support for a utilitarian and reified conception of nature is given on religious grounds. What follows is, to a large extent, a consequence of this moral legitimation. And what follows? The consolidation of a democratic state of law that, in order to deconstruct divine law and found natural law on a rational basis, had to admit the equality of human beings. Human beings who find themselves apart from nature and who understand it as a source of resources that are subtracted through the domain of technoscience or, in many instances that today feel like guardians of its survival. Thus, it does not matter whether other cultures did or would do the same or differently, but it matters that this has been the dominant and hegemonic culture.

CONCLUSIONS

Especially in times when there is so much talk about sustainability, it is necessary to review the concept of nature from a genealogy of the epistemological paradigms that support our way of understanding reality. The hypothesis that we started with was that the theological reworking of Greek metaphysics, which Christianity carried out in the Middle Ages, produced a radical split between the spirit/consciousness and the world/nature that the modern age had to assume, even if seeking to replace faith by reason, or even the transcendence of a supernatural world by the immanence of a physical and natural world. However, by recovering the centrality of human rationality in the process of knowledge (humanism), it ended up making nature not only a mere object of investigation, but also legitimized its domination.

We point out two metaphysical aspects posed by modern epistemology that, even – or above all - after Kant, remained: the essentialist idea of "*thing-in-itself*" and the denial of the inherent movement of things. We continue to argue that it is only with the theory of evolution that this epistemological paradigm is unsettled by questioning both the essentialism contained in the idea of species - which could be extended to the notion of substance - and the denial of the motion, by showing that beings are the result of mutations as well as their relationship with the environment, recovering the relevance of time, that is, of becoming, but, unlike Aristotle, becoming devoid of teleology , in which contingency plays a fundamental role in evolution. In the 20th century, not only does the philosophy of biology continue this perspective, but quantum mechanics and chaos theory

increasingly consider science as probabilistic, as well as open to indeterminism and ambivalence – challenging the law of identity.

Finally, we try to stress that this contemporary development of the natural sciences implies a new epistemology when considering nature through a systemic and complex model, which tends to repel anthropocentrism and metaphysical essentialism. Yet, we establish a parallel of this systemic epistemological model with the view of nature in Ancient Greece, especially pre-Socratic, showing that they have similar aspects in assuming a moving character, open to contingency and ambivalence, without however denying its assertiveness.

In short, we understand that the concept of nature cannot remain the same as the one shaped by Christian theology and morals, nor the one constructed by the humanism of the modern age, which made reason an instrument of domination. Therefore, we reiterate the systemic, irreversible, purposeless, but creative conception of nature as a framework for thinking about the concept of nature.

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