

THE APOLLO-DIONYSUS MOTIF IN THE APPROACH OF CONTEMPORARY SCIENCE

Ana BAZAC¹

ana_bazac@hotmail.com

ABSTRACT:

The paper uses the Nietzsche's Apollo-Dionysus motif in order to highlight some aspects of the contemporary science. The reasons of the historical divergence and unity of the Apollonian and the Dionysian versants of science are showed, as well as the philosophical images of the crises and limits of science. The stake is the emphasis of both epistemological and social causes of the problems of contemporary science and its reverberation in society.

KEYWORDS: science, Nietzsche, Apollonian and Dionysian, Lucian Blaga, scientific discovery, system of reference, criteria, perspective perception, alternative theories, holism.

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1. The motif

As it is known, Nietzsche used the Apollo-Dionysus motif in an *integrative* manner. While in the Greek mythology Apollo was the god of clarity, order, thus reason with its logic emphasizing the discrete nature of things and their causal connections, and Dionysus was the god of vagueness, disorder, emotion, drunkenness, that leads to a blurry image of the continuous whole – thus being adversative symbols of adversative ontological principles – the clever insight of *The Birth of Tragedy* was that these principles intermingle both in the Greek tragedy and in the human life, including in the human knowing². And obviously, this conjoining reveals the inherent and dynamic *contradictions* felt and presented by the human mind.

¹ Professor, Division of Logic, Methodology and Philosophy of Science, Romanian Committee of History and Philosophy of Science and Technology, Romanian Academy

² Friedrich Nietzsche, *The Birth of Tragedy or Hellenism and Pessimism* (1872), Translator: William August Haussmann (1910), Project Gutenberg eBook 2016, 4, p. 41: "Apollo could not live without Dionysus!"; 15, p. 116: "There would have been no science if it had only been concerned about that *one* naked goddess and nothing else. For then its disciples would have been obliged to feel like those who purposed to dig a hole straight through the earth: each one of whom perceives that with the utmost lifelong exertion he is able to excavate only a very little of the enormous depth, which is again filled up before his eyes by the labours of his successor, so that a third man seems to do well when

These contradictions require people to be *aware* of them and thus, to control them and avoid the fall in different one-sided views about the human life and the human comprehension. Actually, Nietzsche pointed out that though the human being is a “dissonance” of contradictory tendencies, its life – that can be understood only in terms of the metaphysics of art displayed by the Apollonian and Dionysian principles – is marked by the intertwined and successive ways of treating the world in the fundamental unembarrassed creative mode (the Dionysian), but that at the same time intends to put order in things, thus to conceive the world in the disciplined articulated manner (the Apollonian) without which to approach to truth, a first painful purpose of man, is not possible. Each way contains somehow aspects of the other, and especially of its motivation, and each way shows also the opposite direction: because both ways have the same *reason to be*, beyond the peculiar ones.

2. Its correspondence in science

The Apollo-Dionysus motif was so attractive that later it was used in the philosophy of science. However, even in the last decades of the 19th century, the big pattern-creating discoveries – issued in a Dionysian way *from* the Apollonian quest for the always last causes of phenomena orderly arranged in different “ablation circles” – showed that science evolves also by exceeding the *system of reference* taken by the previous research. We are used to say that science developed toward multi-, inter-, and trans-disciplines studies³, but a more accurate expression is that of the *multiplication of systems of reference*. Made by concepts, paradigms, theories and methods – and obviously, bibliography – the system of reference⁴, possible by new means of detection and measurement⁵, frames the research, giving the possibilities, the necessity, and the alternatives of reasoning in order to better understand the chosen problem.

Actually, the problem of possibilities etc. may shed light on new, exterior systems of reference only on the basis of exhaustion of the internal capacity of the assumed system of reference to provide plausible judgements, truth or falsity⁶. And certainly, we cannot see the real importance of the system of reference without underlining not only that it reflects and is based on *criteria*, chosen according to the scientific experience of researchers and the problems arisen in the inquiry of former systems of reference, but also that it is based on estimation and survey, thus *measuring* of all the elements of the scientific experience, of events and facts⁷. Their calculation, quantification, weighing and sizing should not fool us with an old, today impossible, ignorance of the *quantitative*

on his own account he selects a new spot for his attempts at tunnelling”. (Here Nietzsche considered that the principle of relay in knowledge supposes both clarity – without which it cannot be transmitted, so performed – and the emphasis of mystery, of problems and contradictions).

³ See only Constantino Baikouzis and Marcelo O. Magnasco, “Is an eclipse described in the Odyssey?”, PNAS, 105 (26), 2008, pp. 8823-8828; Axel Timmermann et al., “Climate effects on archaic human habitats and species successions”, *Nature*, 13 April 2022.

⁴ We may resemble the drier scientific concept of *system of reference* with the more poetical concept of hermeneutics, *the horizon*. See Hans-Georg Gadamer, *Truth and Method* (1960), Translated by Joel Weinsheimer and Donald G. Marshall, London and New York: Bloomsbury Academic, 2006, p. 301: “The horizon is the range of vision that includes everything that can be seen from the particular vantage point”.

⁵ Jan F. Simek, Stephen Alvarez, and Alan Cressler, “Discovering ancient cave art using 3D photogrammetry: pre-contact Native American mud glyphs from 19th Unnamed Cave, Alabama”, *Antiquity*, Volume 96, issue 387, 2022, pp. 662-678; Yeon-Hee Kim et al., “Observationally-constrained projections of an ice-free Arctic even under a low emission scenario”, *Nature Communications*, volume 14, 2023, Article number: 3139.

⁶ In order to better show the Dionysian aspect of the living philosophy of science, see Mano Singham, *The Idea that a Scientific Theory can be 'Falsified' Is a Myth*, September 7, 2020, <https://www.scientificamerican.com/article/the-idea-that-a-scientific-theory-can-be-falsified-is-a-myth/>.

⁷ We discern *events* – as occurrence, considered from without, as objective matters – and *facts* as involving human participation.

by the humanities facing science⁸. In reality, mensuration is taking the measure/extent/degree/proportion of the existence, thus emphasising its *qualitative* changes⁹. This is because the quality is measurable since it “consists” of signs¹⁰.

In the second half of the 19th century, a concrete *convergence* of “Apollonian” and “Dionysian” patterns of science had room in the *qualitative* spring of science: Charles Darwin, James Clerk Maxwell, Henri Becquerel, Gregor Mendel, Louis Pasteur, Robert Koch, Justus von Liebig, Lord Kelvin, Gottlob Frege, Ray Lankester, to name only them, could not have created their paradigmatic representations of the world without the daring *transgression of ordered cognisance in given systems*: without the multi-dimensional and intersected view of old or absolutely new problems and perspectives. The 20th century shift in paradigms cannot be understood without *the epochal and founding theories and discoveries made in the late 19th century*. Even the notion of “crisis of physics” as opposition between the Newtonian and Einstein principles appeared after the demonstration of relativity and quantum physics, in the 20th century, but it was prepared in the last decade(s) of the former¹¹.

3. Philosophy of science: the form of the motif in Lucian Blaga

The 20th century has experienced not only both the apparent contradictions between the “Apollonian” science and the “Dionysian” one and their new convergence, but also the development of the philosophy of science around the Apollo-Dionysus motif. The birth of new paradigms, the progress of pragmatic knowledge fuelled by disciplined referencing inside carefully circumscribed areas, the limits of this type of knowledge, the problems of the possibility to surpass these limits, all of these were the philosophical topics ardently generated by the 20th century science¹². Obviously, the philosophy of science could not escape from the straps of metaphysical philosophy, namely, from the explanation of the world and its knowledge *from principles*. Nietzsche’s proposed motif arose from this type of philosophy (of course, not only from it), but this was normal in those times. And, do not forget, Nietzsche conceived of the adverse faces of knowledge in an *integrative* manner.

In the first half of the 20th century, the Romanian philosopher Lucian Blaga outlined a *dualistic* categorization of knowledge, the “paradisiacal” one (corresponding to the Nietzsche’s Apollonian), the *scientific rational* knowledge, aiming at reducing the mystery of the object, and the “Luciferic” one, a *poetical-intuitive* knowledge amplifying the mystery, bringing to light the unknown, the problematic that highlights the *crisis* in the object of science and the scientific

⁸ See C.P. Snow, *The Two Cultures*, 1959. However, a special divergence between the “humanities” spirit and science was observed even today: more landmarks in papers/quotations in Aristotle than in present scientific breakthrough paradigms; actually, Aristotle with his intuitively understandable theories represent a return to an emphasis on intuition – specific to the small ancient communities – towards the modern emphasis on experimentation/science. And this divergence translates also as divergence between science and technologies, see Ladislav Kováč, “The two cultures revisited: new widening gaps”, *World Futures*, 58, 2002, pp. 1-11.

⁹ Emily Elhacham et al., “Global human-made mass exceeds all living biomass”, *Nature*, 588, 2020, pp. 442-444. But also: the many papers of footprint science.

¹⁰ George Eliot, *Middlemarch. A Study of Provincial Life*, Cabinet Edition, Vol. 1, Edinburgh and London, William Blackwood and Sons, New York: Scribner and Wellford, 1878 (1871-72), George Eliot Archive, p. 34: “Signs are small measurable things, but interpretations are illimitable”. Also Liqian Zhou, “Why cybersemiotic star is necessary for information studies”, in *Cross-, Inter-, Multi-, Trans-. Proceedings of the 13th World Congress of the International Association for Semiotic Studies (IASS/AIS)*, Kaunas, 2018, pp. 134-141.

¹¹ Helge Kragh, “A Sense of Crisis: Physics in the *fin-de-siècle* Era/The ‘new physics’”, in Michael Saler (Ed.), *The Fin-de-Siècle World*, Abingdon, New York, Routledge, 2014, pp. 441-455.

¹² Andrey Galukhin, Elena Malakhova, Irina Ponzovkina, “Methodological Paradigm of Non-Classical Science”, *Wisdom*, 1, 2022, pp.13-26.

construction of this object, i.e. the risks and errors and fails. After stating the irreducible opposition between these types of knowledge, Lucian Blaga emphasized the creation of *new directions* in science (his examples were the theory of relativity, the quantum theory and the biological theory of entelechy) as a daring revelation of the mystery of the world just after the paradisiacal knowledge revealed its “perfection”. These new directions are not established in an easy way, and first they intertwine with the former consistent system of ideas in a new form of cognizance, full of antinomies, where logic is no longer sufficient (if it would have been so, it would have led to a cognizance with internal consistence – as scientific truths have). Calling this form of cognizance a *dogma* – not in the accredited modern meaning of this word, but in an *ad hoc* meaning of assumption of logically contradictory ideas – and discussing this dogma in the philosophical knowledge, Blaga ascertained that the contradictory elements contained and *united within the dogma* suggest some specific relationships and characteristics of the world which could be grasped only following the *assembling* of the former separate elements: and people *attribute an understanding to dogma, even though this understanding is absolutely missing out*: Blaga’s dogma is a *halo of presupposed senses*¹³ and may allow a dogmatic knowledge that becomes a habit¹⁴.

Actually, this is also the “Luciferic” direction of surpassing the accredited logical scientific theories. Briefly, although both types of knowledge were necessary or useful, actually the jaunty “Luciferic” type explained the evolution of the human cognition of the world, the “revolutions” in the scientific understanding of the mystery of our deep and large surroundings, revolutions based on “conjectures” and “refutations”, if we once again connect that metaphorically expressed epistemology with both Thomas Kuhn’s and Karl Popper’s insights about the logic of sciences.

4. Growth of science as a challenge of its philosophy

However, the philosophy of science does not develop autonomously from and in a neutral manner towards its object: just because it is philosophy *of*, thus focusing on the *problems* this object raised, as Hans Reichenbach defined philosophy as such¹⁵. And science is, firstly, a terrestrial institution framing people and deploying functions which answer to many origins of interests and problems seen through the different lenses of these origins, and not only to the disinterested human curiosity. Consequently, the philosophy of science, cherishing the scientific freedom of imagination – we immediately think to the Dionysian soar, obviously – should first consider its prosaic dimension, its magnitude. And from this standpoint, if science in general grew in an explosive manner, each doubling of the world population leading to the increase of the volume of science

¹³ At the level of concepts, we can see a resemblance with *the metaphor*, as it was explained by modern thinkers from Max Müller to Paul Ricoeur and Hans Blumenberg.

The above meaning of the dogma can be retro-traced to Friedrich Max Müller, *Comparative Mythology: An Essay* (1856), London: Routledge and Sons, Kessinger Publishing, 2003: the idea of divinity was created through a “radical metaphor”; this idea is a finally created abstract idea after many stories about concrete events with synonymous words signifying different concrete characteristics (and between these synonyms there was also the manner to personalise the characteristics or even the stories). The natural phenomena were thus described as personages with relationships, passions and actions, i.e. by transforming each metaphor (reproduced just through the word that described the particular features of the phenomenon) into a story. With the emergence of abstract words, the names became no longer related to the original image, lost their metaphorical significance and what remained was only the simple story/the myth.

¹⁴ Ana Bazac, “Lucian Blaga and Thomas Kuhn: The Dogmatic Aeon and the Essential Tension”, *Noesis*, XXXVII, 2012, pp. 23-36.

¹⁵ Hans Reichenbach, *The Rise of Scientific Philosophy*, Berkeley, L A, London: University of California Press, 1951. Apart from the focus on the history of philosophical analysis of problems, instead of philosophical analysis of schools/systems, the book insists on the epistemological interpretation of the different historical solutions to problems, showing that philosophy has evolved from speculation to science / a scientific approach. Differently put, philosophy has attacked that which Bacon defined as *idola theatri*, has it?

eight times¹⁶, it was not only in its “calm” Apollonian sort but inevitably in its Dionysian revolutionary form, too: and thus neither the growth of population nor its emergence *qua* educated folks able to lucid grasp of the world should affray us, should it¹⁷? But the tricky aspect of *quantity* makes us to divagate.

5. The order of reason and the many perspectives¹⁸

The discussed motif concerns the *qualitative* aspect of *ways* of knowledge acquisition. It is an old problem, obviously, starting from the ancient insistence on the *improper* knowledge if based only on senses and, inevitably, on subjective perceptions, and thus on the conclusion of the absolute necessity to connect the capture of the world by senses with the *logos*: only in this connection are, again inevitably, the *perspective perceptions* useful for knowledge. Heraclitus thought that only deployed in a logical manner and thus reflecting the universal ontological *logos* is the human knowledge truthful. He replied to Xenophanes’ relativism given by the *many perspectives* through which people see the world¹⁹ and, in Nietzsche’s terms, he was an Apollonian. However, would Xenophanes have been the Dionysian? Paradoxically, he would: although intuitively the perspectives involve the experience of senses, so rather their significance as clear proofs *only by* their reasonable analysis – which, all of these, provide and illustrate the Apollonian type of knowledge – actually, the deployment of perspectives in front of a thinking person requires and leads to a synthetic overview, inherently leaving aside different aspects and suggesting just the necessity to *further* investigate the mystery that seems to be greater than the acquired elements of knowledge, even if these ones are “laws” and efficient procedural algorithms.

6. Unity of the moments of science and of science and its philosophy

The Apollonian quest for clarity through dissection of the unknown whole was not “reductionism” and neither the Cartesian specification of *res extensa* and *res cogitans*, separated but united and leading to their separated and orderly inquiry²⁰, was. To the excesses of rather positivist *philosophers* who interpreted the positivist spirit of the modern 19th century science, than of the positivist scientists as such, already Einstein responded by underlining not the substitution of Newtonian physics with the relativity physics but the *change of perspectives* and thus the completion worked with the turning of the 20th century²¹. It’s true that reductionism, i.e. the institutionalised pattern of circumscribed, thus discontinuous fragments and the separation of paradigms, does not fit with the problems of *complex* systems²². We could equate the search for

¹⁶ Derek J. de Solla Price, *Little Science, Big Science*, New York: Columbia University Press, 1963, p. 15.

¹⁷ Caroline S. Wagner, Lin Zhang & Loet Leydesdorff, “A discussion of measuring the top-1% most-highly cited publications: quality and impact of Chinese papers”, *Scientometrics*, 4, vol. 127(4), 2022, pp. 1825-1839.

¹⁸ For a present theoretical discussion of the perspectives, see Gordana Dodig-Crnkovic, Raffaella Giovagnoli (Eds.), *Representation and Reality in Humans, Other Living Organisms and Machines*, Cham, Springer International Publishing, «Studies in Applied Philosophy, Epistemology and Rational Ethics», 2017.

¹⁹ Joel Wilcox, “The Origins of Epistemology in Xenophanes and Heraclitus”, in *Greek Philosophy and Epistemology*, Volume II, Edited by Konstantine Boudouris, Athens: International Center for Greek Philosophy and Culture & K.B., 2001, pp. 215-226.

²⁰ See Ana Bazac, “The Machine Motif in Descartes”, *Noesis*, XXXV, 2010, pp. 71-87.

²¹ The great significance of transition from, ultimately, a simplified or simplistic Newtonian view to the Einsteinian approach of physics was revealed by Bachelard in 1931 and Alfred Korzybski, *Science and Sanity. An Introduction to Non-Aristotelian Systems and Semantics* (1933), Fifth edition with Preface by Robert P. Pula (1994), New York, Institute of General Semantics, 2000. (See also Ana Bazac, “What does a new scientific spirit mean? Bachelard from the thirties of the last century and the science of our days”, *Noema*, XVI, 2017, pp. 47-69).

²² Fritjof Capra, *The Turning Point: Science, Society, and the Rising Culture*, (1982), New York: Simon and Schuster, 1983.

holistic understanding²³ of these complex systems with the Dionysian way to arrive to meanings and at the same time to marvel in front of the mystery of things. Strictly technically, the holistic understanding involves analysis based on *many/all criteria* of approaching the object of research: on the basis of a pluralistic methodology. Thus, in science the Dionysian cannot show its entire worth without the Apollonian. As also, especially nowadays, the Apollonian proves to be insufficient without the Dionysian way of thinking.

Actually, this interdependence in the scientific approach reveals rather the *unity* of “normal” scientific effort – if we can borrow Kuhn’s adjective – and nonconformist daring to go beyond the accredited theories. But this unity itself is accomplished as / through the mutual *continuity* of these moments. The agglomeration of information²⁴ – possible only with new research techniques and devices²⁵ – acquired as a result of the research fulfilled in the frame of demonstrated efficient theories, is the terrain of questions related to contradictions or inadvertent details in this whole research. As daring hypotheses based on scientific and extra scientific information which may become the starting points of a formidable new scientific way of knowledge. At the end of 19th century Santiago Ramón y Cajal could say that “for a century, *a priori* principles, intuition, inspiration and dogmatism have been definitively abandoned”, i.e. we cannot “explore our own spirit to discover in it the laws of the Universe and the solution of the great arcana of life”, that the speculative philosophy cannot know the laws of nature, that observation, classification and knowledge of the determining conditions and empirical laws allow the practical goal of *foresight and action*²⁶.

A century later, David Bohm pointed out that, indeed, in different moments of the process of knowing – concretely, in the present stage of the quantum theory – some theories as the quantum theory “can say little or nothing about reality itself”, but “it is concerned only with our *knowledge* of reality and especially of how to predict and control the behaviour of this reality”²⁷. This type of *reflection on our knowledge* – obviously, related with our understanding of the world as such, but beyond the images of the world – is already a signal of the Dionysian approach. And a last remark here: the above peculiarity of quantum theory cannot be generalised; “some theories may be more nearly determinate, while others are less so”²⁸; it’s a question of *domains* if the practical prediction – that is knowledge, not ontology – involves and at what extent a theoretical representation of existence.

²³ The holistic understanding is “applied” to all the concrete problems or studied systems. It does not concern only the “great mysteries” of matter and consciousness or of nature and culture.

An interesting example is that of the simultaneous and nested theories about the deployment of causes in biology. See Lucas Mix, “Nested explanation in Aristotle and Mayr”, *Synthese*, 193 (6), 2015, pp. 1817-1832.

²⁴ A methodological conclusion highlighted by science is: *structure explains the functions*, and *the functions explain the structure*, in both non-living and living systems. See Erik Svensson Grape et al., “Structure of the active pharmaceutical ingredient bismuth subsalicylate,” *Nature Communications*, 13, 2022, Article number: 1984.

²⁵ See the research of Einstein’s gravitational waves, so already mathematically demonstrated, in 1916, but understood only with detection possible because of Laser Interferometer Gravitational-Wave Observatory in 2015 and the continuous gathering of information by North American Nanohertz Observatory for Gravitational Waves (see Gabriella Agazie et al., “The NANOGrav 15 yr Data Set: Evidence for a Gravitational-wave Background”, *The Astrophysical Journal Letters*, Volume 951, Number 1, L8, 2023), but also J. Antoniadis et al., “The second data release from the European Pulsar Timing Array III. Search for gravitational wave signals”, 2023, <https://arxiv.org/abs/2306.16214>), and the Five-hundred-meter Aperture Spherical Telescope in Guizhou (see Heng Hsu et al. “Searching for the Nano-Hertz Stochastic Gravitational Wave Background with the Chinese Pulsar Timing Array Data Release I”, *Research in Astronomy and Astrophysics*, Volume 23, Number 7, 075024, 2023).

²⁶ Santiago Ramón y Cajal, *Reglas y consejos sobre investigación científica (Los tónicos de la voluntad)*, (1897), 6.^a edición, Madrid, 1923, Project Gutenberg, 2021, pp. 1-2.

²⁷ D. Bohm and B.J. Hiley, *The Undivided Universe: An Ontological Interpretation of the Quantum Theory* (1993), London and New York: Routledge, 2003, p. 2.

²⁸ *Idem*, p. 3.

The above example of philosophical interpretation challenges the problem of the *types of knowledge* posited in front of this interpretation. Generally, these types are: the *clear-cut, precise and established* knowledge and the *elusive* one. It would be wildcat to presume that only the elusive knowledge would involve a Dionysian pattern of treatment. On the contrary, the Apollonian research on well-analysed structures of reality/ established knowledge generated further equally Apollonian research which arrive to *shifts* in the focus on established structures of reality and thus to new paradigms: not necessarily opposed to the former but from a different perspective.

An older example is Jakob von Uexküll's *Umwelt*: not only mutual exchanges between the living organism and its environment but also *meanings* in the living being's access consciousness regarding the space of its exchanges, analysed similarly accurately as before the animal reactions by themselves. A more recent one is *consciousness*, developed from the focus on anatomic-physiological structures²⁹ to functionality highlighting the unity of bottom up and top-down causation as well as the unity and interdependences of the different classes of top-down causation, to the most important theories about the transition from structures and relations to consciousness (the Higher Order Thought theory, the Global Neuronal Workspace theory, the Recurrent Processing Theory, and the Integrated Information Theory, and Extended Theory of Neuronal Group Selection), including to their testing and, apart from their common evaluation³⁰, to the idea that *each of them* reveal a part of the conundrum and its solution, and that only retaining the valuable parts in a unitary view can we arrive to the grasping of the whole.

7. Social causes of the difficulty of unity

Nevertheless, the unity of the Apollonian and the Dionysian is not an easy fact and scope in the making of science. The causes are *epistemological* and also *social*, exterior to the scientific reasons as such but inexorably shaping the meanders of knowledge. Concerning the epistemological cause, poetically said there is the inertia of the existent accredited theories, while dryly and clearly, one needs a deeper application and verification of theories; in fact, a theory is not superseded until it can be applied³¹ and had not proved contradictions which have a bigger weight than its scientific efficacy. And obviously, in the psychology of scientific work the accredited theories and scientific practical algorithms are more comfortable³². Concerning the social cause, the many political and

²⁹ Luciano Floridi, "A Defence of Informational Structural Realism", *Synthese*, Vol. 161, No 2, 2008, pp. 219-253; Holger Lyre, "Neurophenomenal structuralism. A philosophical agenda for a structuralist neuroscience of consciousness", *Neuroscience of Consciousness*, 2022(1): niac012.

³⁰ Gabriel Finkelstein, "Emil du Bois-Reymond on 'The Seat of the Soul'", *Journal of the History of the Neurosciences: Basic and Clinical Perspectives*, 23:1, 2014a, pp. 45-55; Nancey Murphy, George F. R. Ellis, Timothy O'Connor (Eds.), *Top-Down Causation and the Neurobiology of Free Will*, Human Brain, Berlin, Heidelberg, Springer, 2009; Stephen M. Fleming, "Awareness as inference in a higher-order state space", *Neuroscience of Consciousness*, 2020, 6(1), niz020; Giulio Tononi, Melanie Boly, Marcello Massimini & Christof Koch, "Integrated information theory: from consciousness to its physical substrate", *Nature Reviews Neuroscience*, volume 17, 2016, pp. 450-461; Jeffrey L. Krichmar, *Gerald Edelman's steps toward a conscious artifact*, 2021, <https://arxiv.org/abs/2105.10461>; The Dehaene-Changeux model, wiki; *Recurrent processing theory and the function of consciousness*, January 25, 2020, <https://selfawarepatterns.com/2020/01/25/recurrent-processing-theory-and-the-function-of-consciousness/>; Lucia Melloni et al., "An adversarial collaboration protocol for testing contrasting predictions of global neuronal workspace and integrated information theory", *Plos One*, 18(2), 2023, e0268577; Matthias Michel et al., "Opportunities and challenges for a maturing science of consciousness", *Nature Human Behavior*, 3(2), 2019, pp. 104-107.

³¹ In the scientific research, not in technology.

³² Arnold Van Gennep, *La question d'Homère: les poèmes homériques, l'archéologie et la poésie populaire*, Paris: Mercure de France, 1909, p. 6: "It is believed with great conviction that scholars need less than others to accept ready-made opinions and formulas. No way: their 'critical thinkin'' is usually limited to narrow series of phenomena, narrow cycles of ideas. The fault consists in the fact that specialisation, initially a simple means, has gradually become an end, a 'duty' for the scientist. The public on its side does not allow a specialist to leave the box that he has assigned for residence. Often the specialist does not want to leave it, but prides himself on the narrowness of his horizon".

economic interests of both the private and state sponsors of science – framing and influencing the choice of projects, thus of paradigms (or of philosophies of domains/ problems/ tackling), means and results – are well-known and paradoxically generate an anti-science bias in the common knowledge³³.

Otherwise put, while we understand the historical process of necessary integration of the Apollonian and the Dionysian, we may ask *why, despite a wealth of knowledge and know-how, we are failing in responding to the social purposes of this wealth*. Is there only a question of delay in knowledge given by the inherent difficult step by step plunging in the mystery of the world?

8. The natural philosophy and the crisis in science

Letting these worldly causes aside, the unity of the Apollonian and the Dionysian can be understood with the adding of *natural philosophy* to science. This is knowledge – and not (only) philosophical interpretation of the elements of the scientific approach – and concerns the principles and *reasons to be* of the *objects* of science (nature, abiotic and living systems): and only as a result of this targeting, a discussion of the usual and unusual concepts and means is deployed. The knowledge of natural philosophy includes both the form of hypotheses before and during the scientific exercise and that of philosophical theories: which can be absolutely speculative but also very close to scientific theories and results. All of them spring from a vivid curiosity and iconoclast view: and even though they may substantiate a further Apollonian ordered research, they were and witness a genuine Dionysian spirit.

The *meta* reflection of natural philosophy generates knowledge from its thorough questioning and critique of every aspect of science (of theories, paradigms, methods, results), emphasising not only their logic – and the logic of the process of questioning and critique, but also/especially their discrete paradoxes and reciprocal connectivity³⁴. Natural philosophy is *a priori* holistic and “Dionysian”, not only by relating in a very nonconformist view the farthest areas from each other but also by warning “the normal science” that develops by assuming privileged separate theories and paradigms, that it’s time to change. See for example, the historical quarrel between genetics and epigenetics³⁵ but, more importantly, the limits of genetics’ reductionism and the exclusive and separated consideration of genetical, epigenetical and social-cultural evolution, theoretically surpassed in a complex, ordered, demonstrated theory³⁶.

The grasping of contradictions generates the awareness of the crisis of sciences. However, the meaning of *crisis in science* should not cover everything: i.e. the quest for *integration of perspectives* (so, of theories) and for *holistic* tackling does not necessarily answer to contradictions within the body of accredited specific theories according to a perspective, but aims only to know more, *beyond the limits of those theories* which could solve their contradictions with their own means. The mathematical warning for the accuracy of analysis in the “normal science”³⁷, the

³³ John Mecklin, *Martin Rees explains how science might save us*, December 22, 2022, <https://thebulletin.org/2022/12/martin-rees-explains-how-science-might-save-us/>.

³⁴ Arran Gare, “Natural Philosophy and the Sciences: Challenging Science’s Tunnel Vision”, *Philosophies*, 3 (4), 33, 2018.

³⁵ Ana Bazac, “The Microenvironment and the Human Space”, *Noema*, XVIII, 2019, pp. 95-153.

³⁶ Eva Jablonka, Marion J. Lamb, *Evolution in Four Dimensions: Genetic, Epigenetic, Behavioral, and Symbolic Variation in the History of Life*, Revised edition, Cambridge, Ma., London, England: A Bradford Book, The MIT Press, 2014.

³⁷ See for instance the *Simpson’s paradox*, but also its neglecting (in epidemiological causation), the *fractal* approach and the avoiding of reductionism etc. Or the attitudes towards *mathematical models*: the example of the 1924’ J.B.S. Haldane’s theory of evolution (of a species of moths) in the context of industrial pollution, contributing to the development of population statistics but also advancing the biological logic of the theory that illustrates also population genetics, *unifying* evolutionary and genetic views (giving the modern synthesis theory). The synthesis theory was

formidable saga of *quantum gravity* theories, the new face of *teleology in the net of biological causes*³⁸, the tenacious integration of *information* in the biochemistry of living beings – as well as its *phenomenological* meanings as signs of life in the formation of the Universe³⁹ –, the *instrument dependent* models⁴⁰, research and discovery, all challenge the transformation of paradigms and are notorious examples of the *trend of “Dionysian turn” in the present science*.

More: since the mystery /the unknown are greater than the known, the crisis in sciences does not lead to “the end of science”: if science is not equated only “with the search for great universal truths”⁴¹. Because: the Dionysian is not related only to these paradigmatic revolutions, but to the *many theories which reveal new aspects of the world*. Without exceeding the existing great paradigms, these theories light the richness of *standpoints / systems of reference / horizons* – which at their turn show the possibility and necessity of their “*fusion*”, giving a new horizon etc. – without which the truth of paradigms is pale.

Considering the present science, we may conclude that the limits given by the speed of light and, this time lesser metaphorically, the event and particle horizons, the quantum limits, the amounts of data and information, and the shortage of scientists and moral energy for research in an authoritarian science system, the limits of instruments but also of the philosophical background of science making, substantiate the theory that mystery exceeds the known: but 1) the solution is not the pessimism of “*ignorabimus*”⁴² and 2) the Dionysian courage is that which transgresses the

marked: by Julian Huxley, *Evolution: The Modern Synthesis* (1942), The definitive edition with a new foreword by Massimo Pigliucci and Gerd. B. Müller, The MIT Press, 2009; and by Ernst Mayr, *Systematics and the Origin of Species, from the Viewpoint of a Zoologist* (1942), Harvard University Press, 1999). The example of J.B.S. Haldane’s theory of evolution is positive; but the example of some mathematical models used to predict the recent/present pandemic show how these models can be used in reductionism.

In a deeper epistemological understanding of the treatment of quantities, we can relate it to the problem of *underdetermination* of theories – i.e. the shortage or the ignorance of data –. The qualification of a theory as valuable does not concern its momentary, stage theories which obviously may be equivalent from the standpoint of limited data each of them taking into account, nevertheless this empirical equivalence not being tantamount to the epistemological, namely, methodological equivalence; rather, the qualification as a valuable theory occurs after its assuming of the (same) data and thus it is a (historical, that is temporary) qualification after a historical process of demonstration, verification and falsification of hypotheses/theories. At any rate, its *epistemological* distinction as proved hypotheses, thus as reliable theory entails not so much/not only data, but rather the *meanings* of hypotheses and of theories. A theory does not derive mechanically from (more/newest) data, as the initial hypothesis may or not start from data, but anyhow it is an insight (a novel correlation, a novel look/interpretation): as J.B.J. Fourier’s equation of heat (1811) as an “exotic” revelation of an *irreversible* process, towards the *reversible* processes studied by the 19th century equilibrium thermodynamics, Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos: Man’s New Dialogue With Nature* (1978), Foreword by Alvin Toffler, Toronto, New York: Bantam Books, 1984, p. 12.

³⁸ Spyridon A. Koutroufinis, “Modern Biological Neo-Teleologism vs. Aristotle’s Genuine Telos”, *Biocosmology – Neo-Aristotelism*, Vol. 6, No 3 & 4, 2016, pp. 414-426.

³⁹ Attila Grandpierre, “The Fundamental Biological Activity of the Universe”, in Attila Grandpierre, W. S. Smith et al. (eds.), *Eco-Phenomenology: Life, Human Life, Post-Human Life in the Harmony of the Cosmos*, Analecta Husserliana CXXI, Springer, 2018, pp. 115-140.

⁴⁰ An important aspect of the *instrument dependent models/theories* is the necessity to use *multiple data analysis strategies* for the same set of data, in order to reduce the uncertainty remaining when a single statistical technique/model is used. This restrictive data analysis generate a “model miopia”. See Eric-Jan Wagenmakers et al., “Seven steps toward more transparency in statistical practice”, *Nature Human Behaviour*, Vol. 5, 2021, pp. 1473–1480; Balazs Aczel et al., “Science Forum: Consensus-based guidance for conducting and reporting multi-analyst studies”, *eLife*, e72185, 2021.

⁴¹ As Thomas Eisner said to John Horgan, in John Horgan, *Was I Wrong about “The End of Science”?*, April 13, 2015, <https://blogs.scientificamerican.com/cross-check/was-i-wrong-about-8220-the-end-of-science-8221/>.

⁴² For the explanation of Emil du Bois-Reymond’s *Ignorabimus* conclusion in „Grenzen des Naturerkennens“, A lecture at the 2nd public session of the 45th meeting of German naturalists and physicians in Leipzig on August 14, 1872, see his „Die sieben Welträtsel“, An address delivered in the Academy of Sciences at Berlin, in honor of the birthday of

impression that science would mean only more or less tiring accumulation of data and information confirming the existing patterns of reasoning. Actually, *the Dionysian is inserted in the honest "Apollonian" research*. The problems of the honesty of research, "the gap between the ideal of science and its messy, all-too-human reality (that) has never been greater than it is today"⁴³ are not generated firstly by epistemological shortcomings but just by external social causes.

9. Limits of science

The intertwining of the Apollonian and the Dionysian seems to be challenged by the criterion of *kinds of problems* posited in front of science and discovered by it⁴⁴. If there is routine research within an established theory – the Apollonian; if the established theory has shortcomings, the courage of researchers is challenged and they begin to wave iconoclast hypotheses, and also predilection for external domains to science as philosophy and theology.

This situation has a difficult history, though. Most of researchers tend to solve the inadvertences of the body of science and its theories with the *dialectical reasoning allowed by science*. For instance, in order to understand the limits of science – in the explanation of the consciousness – Emil du Bois-Reymond showed that the idea (he supported) of material origin of life is not tantamount to the idea (rejected by him) that life could be explained only in terms of matter, and the idea "that consciousness is bound to material antecedents" (he supported) does not lead to the idea that the consciousness would be reducible to material reactions⁴⁵; but equally inconsistent is the idea that life and consciousness would be determined by a transcendent spiritual force. Rather it is about a question of limits of science in its inexorable progress that implies not the definite *ignorabimus* conclusion but the *dubitemus* warning about the existing excessive materialist or metaphysical theories⁴⁶.

Leibniz, July 8, 1880, and translated as "The Seven World-Problems", in *The Popular Science Monthly*, February 1882, pp. 433-447.

⁴³ John Horgan, *Was I Wrong about "The End of Science"?*, April 13, 2015,

<https://blogs.scientificamerican.com/cross-check/was-i-wrong-about-8220-the-end-of-science-8221/>.

⁴⁴ It's difficult to not quote the paragraph from G.W.F. Hegel, "On the Scientific Approaches to Natural Law, its Role within Practical Philosophy and its Relation to the Positive Sciences of Law", appeared in *Kritisches Journal der Philosophie*, Volume II, art. 2 and 3, 1802, 1803; Translated: H. B. Nisbet, 1999, Transcribed: Kwame Genov ([youtube.com/kwamegenovv](https://www.marxists.org/reference/archive/hegel/works/nl/ch01.htm)), 2017; I,

<https://www.marxists.org/reference/archive/hegel/works/nl/ch01.htm>: "In the first place, empirical science conceives of scientific totality as a totality of the manifold or as completeness, whereas true formalism conceives of it as consistency. The former can raise its experiences to universality as it pleases, and pursue consistency in its thought determinacies [*gedachten Bestimmungen*] until it reaches the point where further empirical material which contradicts the previous material, but has an equal right to be thought and expressed as a principle, no longer sustains the consistency of the previous determinacy but forces it to be abandoned. Formalism can extend its consistency as far as the vacuity of its principle – or a content to which it has falsely laid claim – will at all permit; but it is at the same time justified in proudly excluding whatever lacks completeness from its apriorism and its science and in denigrating it as 'the empirical'. For it asserts its formal principles as the a priori and the absolute, thereby implying that whatever it cannot master by means of these principles is non-absolute and contingent – unless it can get out of the difficulty by finding, in the empirical realm at large and between one determinacy and the next, the formal transition of a progression from the conditioned to the condition [itself] and, since the latter is in turn conditioned, so on in an infinite sequence. But in so doing, formalism not only renounces all the advantages it has over what it calls empiricism; in addition, since the conditioned and the condition, as interconnected opposites, are posited as subsisting absolutely, formalism itself sinks totally into empirical necessity and lends the latter a semblance of genuine absoluteness by means of the formal identity, or negative absolute, with which it holds the opposites together".

⁴⁵ Emil du Bois-Reymond, "The Seven World-Problems", *The Popular Science Monthly*, February 1882, pp. 433-447 (pp. 434, 443-447).

⁴⁶ For du Bois-Reymond's understanding of science as a body of heuristic means providing that everything arises from natural causes, see Gabriel Finkelstein, "Emil du Bois-Reymond's Reflections on Consciousness", in C.U.M. Smith and

As it already was mentioned – and du Bois-Reymond showed – the *limits* of science are not only time framed but also come from the distance and mutual ignorance of specialised disciplines. Bruno Latour insisted that the ecological paradigm – the peculiarity of the environment as a *whole*, the interdependence of the natural and social actions – is not assumed by “the thinkers of the intimate”, and is related to the old opposition between body and spirit and between man and animals, to the modern antagonism of nature and culture, to the reduction of cultures and civilisations to the single model of the Centre, to the approach of the actor without taking into account that he is moved and to the approach of action without taking into account the participation of objects, to a single voice of nature, instead of its pluralistic appearance⁴⁷. All of these historical forms of reductionism have been paradigms of the modern and contemporary science and generate the inertia of some limits which are not constitutive of the essence of science. The *integrative* manner of considering science – including science and philosophy – was and is a *tendency* covered by the ignorance of the integrative, systemic logic of the existence: although the objective facts/systems are integrated, they are not seen in this manner by the inertia of isolated sciences.

But just “life”, i.e. the experience of facts and the experience of researchers, pushes to the change of perspectives, including to the *meta* and *holistic* look over the results of the existing science. This change is the Dionysian aspect and tendency of science. The problem is, however, the rhythm and the *kairos* of the implementation and predominance of this tendency. Because: only the propitious rhythm and moment assure fruitful Apollonian developments, including in the philosophical interpretations of the new perspectives. Otherwise these interpretations either remain at the level of early warnings preceding the necessity of changes or, distorted in different ways, do bring nothing to the corpus of human wisdom.

10. Faces of the Dionysian

The “Dionysian turn” in the present science is only a trend: and obviously, it is not specific only to the contemporary science, however it is stronger now as a result of the overwhelming accumulation of information, and by more evidently transcending not only the disciplines but also the areas of problems and studies.

The one who helps us to better value the Dionysian was the “anarchist epistemologist” Paul Feyerabend. He explained not only that the creation of science – i.e. of really groundbreaking theories, being directions to *paradigms* (conceived of by Lakatos as *research programmes*) – is less rigid than it was thought of and it is rather a prankish infringement of accredited epistemological and concrete methods⁴⁸, but also that society must be defended from – I add, an ill-advised – science that arrives to impose “the only truths”⁴⁹. Briefly, only in this approach is science efficient, that is to say it is a free flight (this is the Dionysian, is it?) leading to more freedom of thinking in society: as was put in a normative manner by Robert Merton⁵⁰.

Well, in theory the development of science means the Dionysian nonconformist focus on “everything”, the connection of studied problems with everything. In practice this type of focus is

H. Whitaker (eds.), *Brain, Mind and Consciousness in the History of Neuroscience*, History, Philosophy and Theory of the Life Sciences 6, Dordrecht: Springer Science+Business Media, 2014b, pp. 163-184.

⁴⁷ Bruno Latour, *Nous n'avons jamais été modernes. Essai d'anthropologie symétrique*, Paris : La Découverte, 1991; *Re-assembling the Social. An Introduction to Actor-Network Theory*, Oxford: Oxford University Press, 2005; *Face à Gaïa. Huit conférences sur le nouveau régime climatique*, Paris: La Découverte, 2015.

See also Nicolas Truong et. al., *Les penseurs de l'intime*, Paris: Éditions de l'Aube, 2021.

⁴⁸ For a historical approach see also Robert Djidjian, *The Secret of Geniality*, Yerevan, Armenia: Noyan Tapan Printing House, 2002, republished in *Noema*, 2017-2022.

⁴⁹ Paul Feyerabend, “How to Defend Society Against Science”, *Radical Philosophy*, no. 11, Summer 03, 1975, pdf.

⁵⁰ Robert K. Merton, “The Normative Structure of Science”, (1942), in *The Sociology of Science: Theoretical and Empirical Investigations*, Chicago: The University of Chicago Press, 1973, pp. 267-278.

mostly directed by *extra scientific reasons*. So as to already in 1972 Albert Szent-Györgyi lamented over the grants distributed according to the official science management which favoured conformism with the instituted power centres in and over the scientific research. Szent-Györgyi protested not only from the standpoint of fundamental research feeling constrained by the detailed accounting of its funds and schedule, but also from the one of applied research when this is nonconformist. This type of protest led him to reuse Nietzsche's metaphors, actually contrasting the Dionysian "dissenters" transgressing the well-established boundaries and an Apollonian view deployed within these boundaries⁵¹. The problem was, for him too, the necessary mutual compensation of these two ways of doing science, and their reciprocal critique and help⁵². The methodological result of this reciprocal criticism and help was the following: science, including in its Apollonian optimism, creates *models* which explain the world; but the models do not substitute the world as such: although some scholars believe they do, the understanding of the world involves the *corroboration* of models and of models and "details". These ones are emphasised by the scientific research that evaluates its choices of "details" – as well as of models – and its endeavours to clarify them according to the criterion of growth of knowledge: is this "detail" contributing to the growth of knowledge? By answering, the Apollonian becomes Dionysian. Indeed, the *many perspectives* and an *acute critical and self-critical spirit*⁵³ generated in the last decades a Dionysian flavour of many research. However, an inflation of papers required for the institutional accreditation gave room to fake results as well.

The Dionysian concerns both the creation of big theories and unconventional applied research, involving a *holistic* view not only over disciplines and world areas but also over sciences and human values⁵⁴. Both Albert Szent-Györgyi and Linus Pauling supported this view: in their applied interest for vitamin C and diet (the effort of the second was denied by science during his life but reconsidered after⁵⁵), thus not rejecting other results of allopathic medicine but insisting on the knowledge that *integrates* the healing power of nature and the ingenuity of science; but also in their attitude towards the *values* and the inconvenient social facts which the official narrative has tended and tends to pass over in silence.

In science there is a common slipstream of the above big scientists and of the great, paradigm creator, bio-economist Nicholas Georgescu-Roegen: but a dominant neglect in the exterior direction of science. In 1975⁵⁶, the excellent *demonstration* of the latter concluded: "in bio-economics we must emphasize that every Cadillac or every Zim--let alone any instrument of war--means fewer plowshares for some future generations, and implicitly, fewer future human beings, too" (p. 370), and that „the production of all instruments of war, not only of war itself, should be

⁵¹ Albert Szent-Györgyi, "Dionysians and Apollonians", *Science*, 176, 1972, (4038).

⁵² Albert Szent-Györgyi, "Teaching and the Expanding Knowledge", *Rampart Journal of Individualist Thought*, Vol. 1, No. 1 (March 1965), pp. 24-28 (<http://fair-use.org/rampart-journal/1965/03/teaching-and-the-expanding-knowledge>; retrieved April 15, 2022).

⁵³ A counter-example – or an example of adversative perspective, an opposition to what is scientifically studied, in the name of feelings of the abstract depth – is *Manifesto for a Post-Materialist Science*: https://www.researchgate.net/publication/264463775_Manifesto_for_a_Post-Materialist_Science. Yes, Nietzsche could consider that the sentiments which unify in a fuzzy manner are more important, including for finding out the truth, than a fake pedantic knowledge. But this manifesto is the illustration of pedantic irrationalism.

⁵⁴ See a paper about the valuation of human choices, John Gowdy and Susan Mesner, "The Evolution of Georgescu-Roegen's Bioeconomics", *Review of Social Economy*, Vol. LVI, No. 2 Summer 1998, pp. 136-156.

⁵⁵ Sebastian J. Padayatty et al., "Intravenously administered vitamin C as cancer therapy: three cases", *Canadian Medical Association Journal*, March 28, 174(7), 2006, pp. 937-942.

⁵⁶ Nicholas Georgescu-Roegen, "Energy and Economic Myths", *Southern Economic Journal*, Vol. 41, No. 3 (Jan., 1975), pp. 347-381.

prohibited completely” (p. 377) etc. Georgescu-Roegen’s paradigm was not an absurd⁵⁷ “death of civilisation” theory but, on the contrary, an explanatory key for the *continuity of human civilisation if this one strives to control its matter, energy, information exchange in and with the environment*⁵⁸. The laws of biology are not absolutely disconnected from man: the ardent example-problem of antibiotics resistance proves the interdependence⁵⁹. In this respect, Georgescu-Roegen’s key denied the similar warnings of Club of Rome since these ones became subordinated to “ambitions for the global management of growth”⁶⁰. The key is not of a simple de-growth, but one not based on egotistic interests and their rule, namely, *for the human species’ and its every member’s prosperous existence by the mentioned control*⁶¹.

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If we commonly witness today that there are lots of research in and about apparently “Apollonian” measuring of parameters – that however substantiates and sheds light on a cascade of paradigmatic⁶² and unexpected theories⁶³– but also a lot of fake science responding to extra scientific motivations, we can conclude by iterating the old epistemological optimistic presumption: “it is because of the lack of scientific knowledge, and concretely of scarce breakthrough theories,

⁵⁷ As if he would have advocated the return to simple or even to the inexistence of tools necessary for the saving up of the human energy and time. What he banned – in the same article – was the useless luxury and the harmful wasting activity for the natural resources. And if some one would equate the useless luxury with a utopian old-fashioned frugality, a quite strong present idea of economisation for the health of our common and single nature contradicts the former supposition of the necessity of useless luxury. And see Ralph Nader, *Solar Energy on the Frontlines of Old-Fashioned Clotheslines*, October 8, 2021, <https://www.counterpunch.org/2021/10/08/solar-energy-on-the-frontlines-and-old-fashioned-clotheslines/>; as well as Aurore Julien, *Four ways to reduce your household energy use – proven by research*, October 10, 2022, <https://theconversation.com/four-ways-to-reduce-your-household-energy-use-proven-by-research-191794>.

⁵⁸ A proof of the natural necessary exchange in environment and of the holistic, integrated consequences of the lack of scientific, i.e. anticipative, control of this exchange, in Rob Dunn, *A Natural History of the Future: What the Laws of Biology Tell Us about the Destiny of the Human Species*, New York: Basic Books, 2021. We must not ignore the highlighted *methodological* biases which infested the ecological approach of life sciences (anthropologism, Eurocentrism, simplification of diversity but also ignorance of holistic integration). One of the most important lessons of life sciences is that life, meaning diversity, is ecologically dependent. This implies the methodological principle that “the unknown is large; the known is humble” (p. 25).

The above quotes from Georgescu-Roegen should not be understood as ignorance of the second law of thermodynamics but as necessary thrift of both material and energy resources. On the contrary, he put the later developed theories of carrying capacity, of Gaia, and of criticism of Jevons paradox. See John Polimeni, Kozo Mayumi, Mario Gianpietro and Blake Alcott, *The Jevons Paradox and the Myth of Resource Efficiency Improvements*, London, Sterling, VA: Earthcan, 2008; Mario Gianpietro, Kozo Mayumi, Jesus Ramos-Martin, “Multi-scale integrated analysis of societal and ecosystem metabolism (MuSIASEM): Theoretical concepts and basic rationale”, *Energy*, Vol. 34, Issue 3, 2009, pp. 313-322; Mario Gianpietro and Kozo Mayumi, “Unraveling the Complexity of the Jevons Paradox: The Link Between Innovation, Efficiency, and Sustainability”, *Frontiers in Energy Research*, Volume 6, article 26, 2018.

⁵⁹ Rob Dunn, *A Natural History...*, but also M. Baym et al., “Spatiotemporal microbial evolution on antibiotic landscapes”, *Science*, Volume 353, 2016, Issue 6304, pp. 1147-1151.

⁶⁰ Clément Levallois, “Can de-growth be considered a policy option?: A historical note on Nicholas Georgescu-Roegen and the Club of Rome”, *Ecological Economics*, 2010, pp. 2271-2278.

⁶¹ This control implies a collective management of non-personal ownership because only this type of management is efficient from both economic and environmental viewpoints (see Elinor Ostrom, “A General Framework for Analyzing Sustainability of Social-Ecological Systems”, *Science*, 325 (5939), 2009, pp. 419–422).

⁶² The new scientific paradigmatic theories are different from the old philosophical theories emphasising the same concept.

⁶³ IPCC, *Climate Change 2022: Impacts, Adaptation and Vulnerability*,

<https://www.ipcc.ch/report/ar6/wg2/chapter/technical-summary/>: the rhythm of changes is faster than expected by previous scientific reports.

that the human activities are so damaging for the natural and social environment”. But nowadays science offered enough⁶⁴ in order to change the direction of these activities. So why does it not change⁶⁵? An old saying, consonant with the above big scientists’ view, seems to answer: “*Science sans conscience*” (“*c’est la ruine de l’âme*”), Rabelais. Therefore, a simple – and fragmented⁶⁶ – “civil disobedience”⁶⁷ is not enough without the coherent promotion of human values. The philosophy of science has its place in this promotion⁶⁸.

11. In lieu of conclusions

When all is said and done, the reason of science – of knowledge that is true opinion inquired and helped by causal reasoning⁶⁹, so of both knowledge and understanding⁷⁰ – is the *good life*⁷¹ (Aristotle) of the human beings. This life itself can be considered with the Apollonian and Dionysian metaphors. The humans need – and strove for – both order and tranquillity so as they could fulfil their activities, and fresh air, i.e. a suitable social atmosphere to develop their propensity to creation.

From an epistemological standpoint, these requirements mean *conditions* to expand the habit and pleasure to learn, to acquire knowledge: which, at their turn mean to learn and internalise the abiding intellectual discipline and effort. If the mass education shrinks them, if people are not used to critical thinking, to hypotheses and logical evaluation, to discovery through one’s own deductive power, to curiosity about alternatives – because the “facts”/the only true information are given to them and thus neither the problem of discernment between true and false (and between good and evil) does appear them⁷² – the amount of researchers shrinks also; and thus, the valuable Apollonian-Dionysian scientific research shrinks as well.

Still from an epistemological view, the “at hand” information – deprived from intellectual formation – and the taking over by programmes (“apps”, concretely, as the programming of the fridge to “buy” by itself in order to not have empty shelves; or as a pair of sneakers with sensors that connect to the internet via a mobile phone app and give you personalized real-time advice to improve your training performance; or your electrical toothbrush connected to your mobile phone) of tasks formerly easy, necessary and assumed as elements of the responsibility towards one’s own body, transform not only the cognitive abilities of humans, as memory and attention, but also their

⁶⁴ Charlie J. Gardner & Claire F.R. Wordley, “Scientists must act on our own warnings to humanity”, *Nature Ecology & Evolution*, 3, 2019, pp. 1271–1272.

⁶⁵ See the exasperation of scientists: *Extinction Rebellion Scientists*, <https://www.scientistsforxr.earth/>. The important papers in this site add to other ones exterior to this movement but equally “rebellious”.

⁶⁶ *Scientists Stage Worldwide Climate Change Protests After IPCC Report*, April 13, 2022, <https://www.smithsonianmag.com/smart-news/scientists-stage-worldwide-climate-protests-after-ipcc-report-180979913/>.

⁶⁷ Elizabeth Cripps, *Is civil disobedience OK if it’s the only way to prevent climate catastrophe?*, 12 Apr 2022, https://www.theguardian.com/commentisfree/2022/apr/12/civil-disobedience-only-way-prevent-climate-catastrophe-just-stop-oil?CMP=share_btn_tw.

⁶⁸ Helen Zhao, “What is a Radical Analysis of Science?”, *Science for the People*, Vol. 22, number 1, 2019, <https://magazine.scienceforthepeople.org/vol22-1/what-is-a-radical-analysis-of-science/>.

⁶⁹ Plato, *Meno*, in *Plato in Twelve Volumes*, Vol. 3 translated by W.R.M. Lamb. Cambridge, MA: Harvard University Press; London: William Heinemann Ltd. 1967, 86e, 98a.

⁷⁰ *Idem*, 88e.

⁷¹ The UN’s Sustainable Development Goals were not met in June 2023, see *Global Sustainable Development Report 2023*, Advance, Unedited Version 14 June 2023, pp. 20–41, <https://sdgs.un.org/sites/default/files/2023-06/Advance%20unedited%20GSDR%2014June2023.pdf>

⁷² Ana Bazac, *The Haptic Culture*, 12/06/2023, <https://egophobia.ro/?p=14750>.

capacity to act in indeterminacy, in surprise, in the new, thus to have “free will”⁷³. Science must have the full freedom to research everything: its application and use – must have the preventive Aristotelian questioning “what for”, “will the content of life of the human beings improve with these apps?”. And obviously, this questioning is made not only by philosophers, but by the whole human species, i.e. every member of it.

The scientists are framed by their society, by the present society. Thus, they show their responsibility from their understanding that they – and the society as a whole – reside in “the critical zone”, our planet from which all knowledge is deployed and to which this knowledge has consequences⁷⁴. The result of this understanding is their transformation and integration within the present “geosocial classes”⁷⁵.

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⁷³ Eric Sadin, *La société d'anticipation. Le Web Précognitif ou la rupture anthropologique*, Paris: Inculte, coll. Essais, 2011.

⁷⁴ Bruno Latour, *Où suis-je ? Leçons du confinement à l'usage des terrestres*, Paris: Éditions La Découverte, 2021.

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