

AXIOMA STUDIES IN PHILOSOPHY OF NATURE  
AND IN PHILOSOPHY AND HISTORY OF SCIENCE



Álvaro Balsas  
Bruno Nobre (Eds.)

# The Insides of Nature

## Causality and Conceptions of Nature

*In memoriam*

*Prof. António Luciano Leite Videira (1935-2018)*



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# AXIOMA STUDIES

IN PHILOSOPHY OF NATURE AND IN PHILOSOPHY AND HISTORY OF SCIENCE

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### *Axioma Studies in Philosophy of Nature and in Philosophy and History of Science*

The *Axioma Studies in Philosophy of Nature and in Philosophy and History of Science* series – a initiative of professors of philosophy, history of science and related fields, from Portugal and Brazil –, aims to contribute to the dissemination of works in these fields of knowledge in order to strengthen the interdisciplinary dialogue, not just philosophical or historiographical, but also in a wide cultural perspective, among those who believe that science, in its multiple aspects, can be a link between different spheres of contemporary society. Its authors, as well as its readers, may come from either the humanities – in a broad sense, to include, for example, theology and anthropology – or the natural sciences.

Recognizing that science, on which points its focus of interest, has passed – and still passes – through many changes over time, the *Axiom Studies* series is based on the basic assumptions that pluralism and respect for theoretical and methodological differences are essential elements, not only for the academic dialogue, but also for the meeting between the different specialties and the interested general public. We believe that the wealth of science can only be perceived and lived, if analyzed from multiple points of view, interested in understanding it as a human phenomenon in progress.

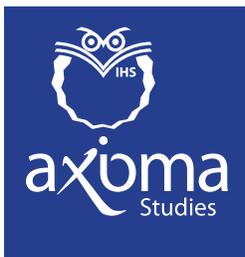
The texts published in this series, in English, Portuguese and Spanish, should be critical, not dogmatic and informative. The editors of *Axiom Studies* series hope thus to contribute to the collaborative efforts of different specialists become reality. In particular, aspire to see overcome the barriers that prevent the collaboration between natural scientists, on the one hand, and philosophers and historians, on the other.

*Álvaro Balsas, SJ (Braga, Portugal)*  
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**AXIOMA STUDIES**

IN PHILOSOPHY OF NATURE AND IN PHILOSOPHY AND HISTORY OF SCIENCE

# THE INSIDES OF NATURE



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# THE INSIDES OF NATURE

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CAUSALITY AND CONCEPTIONS OF NATURE

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## THE INSIDES OF NATURE: CAUSALITY AND CONCEPTIONS OF NATURE

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### Presentation

ÁLVARO BALSAS \*

BRUNO NOBRE \*\*

Philosophy of nature is the branch of philosophy which, out of the dialogue with the various sciences, reflects on our knowledge of nature (in its various meanings). Although its research object is that of the particular sciences, Philosophy of nature takes a philosophical-metaphysical perspective, having as a goal to arrive at a comprehensive, interdisciplinary, and harmonic understanding of the different images of Nature – although, not always consistent – associated with the corresponding particular sciences.

A comprehensive understanding of nature is fundamental for the self-understanding of the human being. And it is also crucial for the understanding of the relationship of human beings among themselves and with nature. Thus, a better understanding of these relationships will allow: an improved self-balance and personal fulfillment; the construction of

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more inclusive societies; an increased adoption of human and ecological styles of life; and a more sustainable interaction with our planet.

The problem of causality within natural phenomena is, nowadays, one of the most significant challenges for the interdisciplinary dialogue between scientists, philosophers and theologians. Since the beginning of the 17<sup>th</sup> century, the approach to the study of causality has been mainly reductionist (*bottom-up*), placing it at the level of the elementary objects, constitutive of higher-level systems. Contemporary science, however, has disclosed some limitations to that traditional reductionist paradigm, drawing the attention of both philosophers and scientists to the problem of causality at higher levels of complexity, namely, at the level of chemistry, microbiology, epigenetics, evolutionary biology, physiology, neurosciences/cognitive sciences, psychology, social sciences, and computer and information sciences. This new paradigm of causality – called *top-down* causality – concerns not only each individual science but also the relationship between the various scientific branches. Top-down causality is complex, multifaceted, and related to the emergence of contextual complexity throughout the cosmic evolutionary process. It is also highly relevant for the study of the mind, ethics, and religious phenomena.

It was within this broad theoretical framework that many scholars convened from 10-12<sup>th</sup> September 2018, at the Faculty of Philosophy and Social Sciences of the Catholic University of Portugal, in Braga, as participants in the first *International Conference of Philosophy of Nature* – under the title “The Insides of Nature: Causalities, Causal Processes, and Conceptions of Nature” –, in order to address the problem of causality in its different aspects. This volume gathers several essays based on some of the communications presented and discussed during the conference.

Since the aim of this volume is the discussion of the nature of causal processes, it starts with a philosophical analysis of

the very concept of “cause”. This important task is undertaken by Juan Arana in his article “Explicación y Procesos Causales en la Naturaleza”. While acknowledging that many difficulties arise when the concept of cause is subjected to a philosophical analysis, Arana argues that “we would not do without it”. According to the author, the philosophical analysis of this key concept requires the application of an “epistemology of risk”, since the type of precision associated to epistemologies of rigor turns out to be completely inadequate.

Louis Caruana, in his essay “The Limits of Causality”, argues that the long-standing approach to causality and causal processes from the standpoint of the natural sciences remains insufficient because of the refusal to accept a certain degree of pluralism within the concept. This pluralism is evident in how we use the ideas of cause and effect in everyday life. Caruana explores the limits of the concept of causality by determining the extent to which our ideas can remain consistent as one stretches this concept along two dimensions, one concerning the maximizing of the effect and the other the maximizing of explanatory depth. As an application, the author discusses the very cause of the universe.

In his article “Top-down causation in natural sciences”, Gennaro Auletta argues for a new and objective assessment of the problem of causality, focusing his discussion on both the arising and the basic mechanism of top-down processes. In fact, the novelties represented by quantum mechanics, science of complexity and chaotic systems, for example, suggest a retrieval of Aristotle’s formal causes, while progresses in biology and neurosciences raise the problem of goals and especially of top-down causation.

António Leite Videira, in “Este Nosso Mundo Emaranhado”, proposes the notion of entanglement as the key physical concept to describe and explain the World by theoretical physics. Starting with the Big Bang as the primordial entanglement of space-time (the geometrical stage) and funda-

mental players (the dynamical actors: photons, electrons, neutrinos, quarks, gluons, etc.) in the holistic geometrodynamics of our Cosmos, Leite Videira applies that fundamental notion to the three classical relativistic theories: the physics of Galileo-Newton (Galilean relativity), the physics of Maxwell-Lorentz (Special relativity), the physics of Einstein (General relativity). Then, the author addresses the issue of Einstein's reality vs. quantum positivism, through the discussion of the EPR's challenge (quantum entanglement as Einstein's "spooky" physics), the Noether's theorem and the entanglement. He concludes with some annotations on quantum mechanics and natural philosophy.

Samuel Simon and Ademir Santana, in "Causation, Symmetry and Time Irreversibility", discuss the notion of causation in the context of physics, focusing particularly their attention on the issue of time-irreversibility. The authors' starting point is the definition of measurement in physics in terms of concepts such as the state of a physical system, the space-time symmetry (and the breaking of symmetry), and a physical system described by a field. After presenting a general characterization of physical causation and defining restricted causation, the authors discuss the notions of causation and time-irreversibility.

In "Uma Análise do Argumento a Favor do Princípio da Relatividade", Ricardo Tavares da Silva offers a detailed analysis of the argument Einstein used to defend his own principle of relativity. After showing that Einstein's argumentation is analogous to Galileo's, the author argues that both arguments are invalid, then concluding that one can only say that the laws of nature are the same for systems at rest and for systems with shared motion.

Astrid Modera, in "La Causalité en Biologie Relationnelle", draws our attention to the theme of causality in biological systems by exploring the notion of causality associated with relational biology – founded by Nicolas Rashevsky and perpetuated by

Robert Rosen and A.H. Louie – and its philosophical value. The author argues that insofar as the approach of relational biology proposes a holistic consideration of living entities, it is particularly fit to address the greater questions concerning life in a renewed way. In fact, relational biology underpins new definitions of life which invite a greater appraisal of the specificity of life.

Paulo Vieira and Judith Zamith Cruz, in “A Aprendizagem em Sistemas Naturais e Artificiais” argue that natural and artificial systems are strongly correlated, since the latter ones, although created by the human being, have their inspiration in nature. In the article, the authors present a survey that identifies and categorizes teaching-learning situations existing in nature, suggesting how the analysis of this survey may be used to improve the algorithms of artificial systems.

In “A Causalidade em Nietzsche: uma Ficção Útil”, Wigson Rafael Silva da Costa and Roberto de Almeida Pereira de Barros discuss Friedrich Nietzsche’s view of causality. Based on a scrutiny of Nietzsche’s work, the authors sustain that the “overestimation of causality”, typical of modernity, is anchored in a certain conception of the self, namely the self as acting. According to Nietzsche, the notion of causality can be seen as a useful fiction that underscores the human effort of survival and development.

Zahra Karandish, in “Al-Ghazālī’s Occasionalism”, discusses the occasionalism thought of al-Ghazālī, the most famous occasionalist Islamic scholar. In his defense of the possibility of miracles, al-Ghazālī questions the acceptance of notions such as necessary causality and the validity of scientific observation in the natural world. Karandish reexamines recent works on the link between Ibn Sīnā and al-Ghazālī, concerning the issue of causality, and addresses the discussion on defining al-Ghazālī as either a natural philosopher or an occasionalist theologian, arguing in favor of the last option.

John Taylor addresses the theme of causality within

economic systems, inviting the reader to imagine how macroeconomics would look like, had Adam Smith chosen occasionalism as the basis for moral philosophy, instead of his utilitarian starting point. Accordingly, Taylor argues that if one starts with a macroeconomic system based on occasional philosophy, one gets different theories of luck or chance, a different set of tools for mathematical analysis, and, above all, different theories of the role of moral philosophy in macroeconomics.

Sensitive to the urgent need to propose a philosophical approach sensitive to the ecological problems that currently afflict the world, Ana Reis Cunha, in “Geofilosofia: O Pensamento em Sintonia com a Terra”, sketches a new world view based on the works of the biologist Jakob von Uexküll and the philosophers Heidegger, Merleau-Ponty, Michel Henry, and Deleuze, co-author, along with Félix Guatarri, of the neologism “geophilosophy”. Geophilosophy proposes a more positive appraisal of space, with enough sensibility to the existential value of the movements that take place in the territory.

Still within the general theme of causality and ecology, Thiago de Lucena, in “Manifesto de uma Política da Natureza”, proposes the notion of “nature policy”, in order to express the idea that politics should organize public life, acknowledging the inseparable relation of human with extended nature. Compiling ideas spread out on the scientific universe by thinkers of different areas from the second half of XX<sup>th</sup> century, de Lucena endorses five attitudes that may contribute to the overcoming of the barriers, which prevent the construction of a planetary citizenship.

It is our hope that the present volume may contribute to a deeper understanding of the crucial theme of causality in its multiple aspects. We hope, also, that this book will be of benefit to all those who may be interested in this topic. Finally, we would like to express our deepest gratitude to the authors for their invaluable contributions.