

# Metascientific Ontology

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## Science and Ontology

Debates about the links between science and ontology are very active in contemporary philosophy, and, in fact, they have always been present<sup>1</sup>. We can distinguish five main positions: 1) this is a false debate because there is no connection between science and ontology and therefore one does not influence the other; 2) ontology determines science; 3) ontology and science influence each other; 4) science determines ontology; 5) this is a false debate because there is no ontological or metaphysical reality.

The first position is not interesting for all those who want to account for the success of science, especially since ontology or metaphysics is supposed to provide the foundations of reality by revealing “items”, “entities” or “structures” that are not quite physical or material, in order to account precisely for this material world. But if we maintain the position that the two fields, the two magisterium, although real, have no connection, then ontological research and scientific research cannot influence each other. This is still a widespread position since many philosophers produce ontologies or metaphysics without worrying about the sciences.

It is positions two, three and four that are being debated. What is the nature of the *metaphysics of science* and how does it relate to science? It is under this name that this movement is known and that tries to find a place for metaphysics or ontology alongside science. Thinkers agree that there are links between ontology and science but disagree on the nature of these links. On the one hand,

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<sup>1</sup> As for the expression “metaphysics”, we reserve it to designate the metascience of physics, in the same way that there is metachemistry, metabiology, metapsychology, metasociology, etc. We discuss the reasons for this choice of terminology in our article “Metascience: For a General Scientific Discourse” published in the first issue of *Metascience* at Éditions Matériologiques in 2020.

there is an a *priori* metaphysics on which science is based (position 2). On the other hand, there is a science that entirely determines responses to metaphysical questions (position 4). And, between these two extremes, all variants are possible (position 3).

It is important to note that many of the thinkers who defend the idea of a complete determination of ontology by science (position 4) claim that they practice a *scientific metaphysics* that would oppose traditional or a *priori* metaphysics. Scientific metaphysics would be distinguished from other metaphysics because it would solve metaphysical problems only with scientific tools and results. This is to say that scientific metaphysics does not deny the existence of a metaphysical reality, but it is through the sciences that we have access to this reality. In any case, from position 1 to position 4, the existence of a metaphysical reality is taken for granted<sup>2</sup>.

*Metascience*, for its part, defends the idea that the problem of the existence of a link between science and ontology is a false debate since the existence of a metaphysical reality has never been demonstrated (position 5). In particular, Bungean ontology is not a philosophical discipline, but rather a metascientific discipline. As a metascience, ontology studies scientific constructs and not concrete reality, let alone metaphysical reality. It is this position that we defend in our article “What is Metascientific Ontology?”.

Metascience would be very poor without a metascientific practice. We are fortunate to be able to rely on the work of Mario Bunge, the first accomplished metascientist, but a living discipline is a discipline that discovers and invents. This same work has shown us that metascience is a varied activity that is practiced in various ways. Let’s follow our common thread, the Bungean or metascientific ontology, and briefly examine the articles in this second issue of *Metascience*. We pick up on these and several other articles in the next section, but at this point we want to highlight the diversity of metascientific research and the usefulness of metascience. Where philosophy has failed, is metascience possible? This is what we have called the Bunge’s wager (Maurice 2017).

Chemistry is undoubtedly the branch of scientific knowledge that philosophers are least interested in. This lack of interest probably

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<sup>2</sup> In order to better situate the metaphysics of science and scientific metaphysics, the reader can consult Cristian Soto’s article, “The Current State of the Metaphysics of Science Debate” (2015).

stems from a preconceived idea that chemistry is just one branch of physics. Matias Velázquez remedies the situation by offering us a metachemistry article in crystal chemistry entitled “On Some Features of the Scientific Hylorealistic Background of Crystal Chemistry”. Not only does the author demonstrate the autonomy of chemistry, but he also obtains particular metachemical results and general metascientific results. We are in *hard metascience!*

Theories are good, but theories with applications are better. Mario Bunge’s ontology has long been known in information technology. An ontology widely used in information systems, especially for conceptual modeling, is the BWW (Bunge-Wand-Weber) ontology, based on Bunge’s ideas and synthesized by Wand and Weber (Wand and Weber 1988; 1990; 1995). In their article “Foundations of Information Technology Based on Bunge’s Systemist Philosophy of Reality”, Lukyanenko, Storey, and Pastor propose replacing the BWW ontology with a new ontology based on Bunge’s more recent work: *Bunge’s Systemist Ontology* (BSO). This new adaptation of Bunge’s ontology doubles the number of ontological categories made available to researchers in information technology.

Even if we adopt the idea that metascience does not have the same objectives, does not use the same methods, and does not study the same objects as philosophy, that it does not then ask the same questions and that it does not present the problems in the same way, the fact remains that a comparison between the two is inevitable since both are general discourses. Martín Orensanz invites us in his article “Bunge and Harman on the General Theory of Objects” to compare Bunge’s theory of objects to that of Harman, then in his article “Causation according to Mario Bunge and Graham Harman” to compare the theory of causality of these two authors. The comparison of metascience to philosophy allows a faster understanding of metascience since we use our philosophical knowledge to set up a network of metascientific notions.

Another form of comparison is undertaken by François Maurice in his article “Bunge’s Metascience and the Naturalization of the General Discourse”. The scientific metaphysics referred to earlier (position 4) would aim to naturalize traditional metaphysics. But the naturalization of metaphysics can be understood in several ways. The author therefore proposes to compare the naturalization of the general thought in Bunge to the naturalization of

metaphysics as conceived by Ross and Ladyman. Superficially, the two projects are similar, notably in their harsh criticism of the philosophical tradition and the ambition to take into account the results of the sciences, but the results are antithetical.

Among all the doctrines that seek to establish links of beneficial influence between philosophy and science (position 3), Pradeu, Lemoine, Khelfaoui and Gingras have discovered a movement in philosophy of science that they call philosophy *in* science. Philosophers of this movement would use philosophical tools to solve scientific problems. In his article “When Philosophy is No Longer Philosophical”, François Maurice argues that the tools in question are not strictly philosophical and thus thinkers of this movement would rather practice a metascience.

The general theme of the seven articles mentioned is ontology, but we must not lose sight of the fact that metascientific disciplines, like scientific disciplines, do not operate in a vacuum, that metascientific ontology, semantics and epistemology study the same object, science, and not the concrete world, which is the domain of science, nor a metaphysical world, reserved for philosophy.

## Contributions

As with the first issue of *Metascience*, the twelve contributions to this issue come from authors from different backgrounds, as it should be for a general thought that is intended to be useful to all fields of knowledge. Like Bunge’s project, the following contributions are neither part of the analytical nor the continental movement in philosophy.

It should be noted, however, that the contributors to this issue of *Metascience* do not necessarily support the research program of the Society for the Progress of Metasciences, nor the editorial policy of the journal. These are authors who are interested in various aspects of Bunge’s thought. Although ontology is a common thread that links some articles in this issue, we distinguish four types of contribution: 1) studies on Bunge’s system; 2) metascientific contributions; 3) applications of Bungean thought; 4) around metascience.

### 1] Studies on Bunge’s System

François Maurice, in “**What is Metascientific Ontology?**” continues his work of characterization of metascience undertaken in

his article “Metascience: for a General Scientific Discourse” published in the first issue of *Metascience*. Bunge’s ontology differs from philosophical ontologies for its purposes, objects, and methods. In particular, this ontology does not postulate the existence of objects other than those postulated and studied by the factual sciences.

Jean Robillard, in his French contribution “**Théorie des modèles, de la simulation et représentation scientifique chez Mario Bunge**” (*Theory of Models, Simulation and Scientific Representation in Mario Bunge*), examines the theory of scientific models that Mario Bunge developed in *Method, Models and Matter* (1973). He analyzes Bunge’s theoretical integration of formal sciences and experimental or observational sciences, which is based on his philosophy of science. He then summarily compares it to Gilles-Gaston Granger’s theory of models in order to identify the similarities and dissimilarities, but also their common stumbling block: both use an unanalyzed concept whose epistemological function is nevertheless crucial and produces the same effects. Central to Bunge’s model theory is the concept of simulation, which he compares to the one in use in computer science and is nowadays widely applied to various sciences, both social and natural. He concludes on the methodological and metaphysical consequences of the Bungean theory of models.

Martín Orensanz, in a first article, “**Bunge and Harman on the General Theory of Objects**”, compares Mario Bunge’s general theory of objects to that of Graham Harman’s by identifying the similarities between the two theories, despite the significant differences between the two philosophies. In a second paper, “**Causation according to Mario Bunge and Graham Harman**”, Orensanz establishes that Bunge and Harman reject the conception of causality according to which concrete objects come into direct contact with each other. To Bunge, events connect things, while to Harman, they are sensual objects.

François Maurice examines in “**Bunge’s Metascience and the Naturalization of the General Discourse**” the structure of the *Treatise on Basic Philosophy* in order to identify the metascience found therein, despite Bunge’s attempt to inscribe his thought in the philosophical tradition. Rather, Maurice shows that Bungean thought is part of the long process of naturalization of human thought. Finally, the author shows that this naturalization of

general discourse is different from the movement of naturalization known as scientific metaphysics or naturalized metaphysics, despite the superficial affinities between Bunge and these philosophers.

## 2] Metascientific Contributions

Matias Velázquez, in “**On Some Features of the Scientific Hylorealistic Background of Crystal Chemistry**”, offers an ontological and epistemological study in crystal chemistry. Philosophers of chemistry devote much thinking to the periodic table of elements, the nature of the chemical bond, the ontological status of the atom-in-molecule, etc., in writings that mainly address the question of the reduction of chemistry to physics, and secondarily that of determinism. Crystal chemistry, which covers the growth of crystals, their reactivity, and the chemistry of and with crystalline imperfections, is hardly touched upon in this philosophy which, in its current state, looks like the poor relative of philosophy of science. In this contribution, the author tackles the materialist and realistic question by taking the opposite approach of the philosophers of chemistry, recalling that the most fundamental crystalline imperfection in crystal chemistry, namely the atomic vacancy has no atomic number, electronegativity, chemical bonds, box in the periodic table, that it can be electrically neutral, etc., and that yet its materiality—its *scientific hyloreality* one might say—is unquestionable. Vacancies, rigorously defined in statistical thermodynamics, possess energy, are capable of change, in short, they are as real as they are material. The ontological proof is based on the Bungean mode of reasoning and makes it possible (i) to show that the “ontological atom” in a crystal is a building unit, (ii) to introduce the distinction between a constituent and a component, and (iii) to understand that mass is not the foundation of materiality. Moreover, it is shown that vacancies, like any building unit, are concrete things irreducible to atomic physics and particle physics. Possessing no properties—other than energy—studied specifically in particle physics and atomic physics, for example in a highly covalent semiconductor, they can only be defined a chemical potential (and therefore free energy) provided that the number of crystallographic sites is conserved in all chemical reactions in which they are involved. Crystallographic sites have nothing trivially material but are defined only from a set of spatial relations synthetically expressed in

a set of reduced coordinates and a group of site symmetry, and so it is necessary to appeal to the extremely subtle Bunge's ontology of space to fully grasp the metachemical meaning of these construction building units.

David Martín Solano, in “**A Constructive Critique of Mario Bunge's Theory of Truth**”, takes note of Bunge's observation of the shortcomings of the truth-correspondence theories proposed to date, including Bunge's theory, while Bunge considers this to be an essential element of any serious theorization of science. Martín therefore proposes a new theory of truth-correspondence as an extension to Bunge's theory, not without first having dispelled the confusion maintained between truth and some other notions, including that of coherence. Martín's proposal will make truth a private concept.

### **3] Applications of Bungean Thought**

In “**Foundations of Information Technology Based on Bunge's Systemist Philosophy of Reality**”, Roman Lukyanenko, Veda C. Storey, and Oscar Pastor expose the BWW (Bunge-Wand-Weber) ontology, widely used in information systems, especially for conceptual modeling, and synthesized by Wand and Weber from Bunge's ideas. Since this ontology was developed from an older version of Bunge's philosophy, the authors present a new version based on Bunge's more recent work. This new ontology, which the authors call *Bunge's Systemist Ontology* (BSO), incorporates a greater number of Bungean concepts and reverses the relationship between the concept of thing (concrete object) and that of system: for BWW a system is a thing, while for BSO a thing is a kind of system. The authors specify that BSO is not just an extension of BWW: “BSO rather offers a new way of thinking about reality.” The authors finally put forward suggestions for various ontological studies and identify questions that could feed into a research program in both conceptual modeling and information technology in general.

Dorota Zielińska, in “**Linguistic Research in the Empirical Paradigm as Outlined by Mario Bunge**”, presents the limitations of research in clinical linguistics, dominated by an approach that accumulates data without them being theoretically linked. She thus presents a way to conduct linguistic research using the theory of science as exposed by Bunge and limited by Altmann's hypothesis

on the self-created and self-regulating nature of language. She establishes a linguistic law concerning the order of adjectives in Polish noun phrases.

#### 4] Around Metascience

Andrés Pereyra Rabanal, in “**Scientism after its Discontents**”, after reviewing the various conceptions of scientism, defends a positive conception of scientism against some of its critics. Thus, he argues that science is the most reliable approach to acquiring knowledge without harming other important human activities as long as these do not address factual or cognitive issues or contradict the scientific worldview.

Sven Ove Hansson, in “**With all this Pseudoscience, Why so Little Pseudotechnology?**” questions the fact that pseudotechnologies are more rarely mentioned than pseudosciences. To answer the question, the author first presents a definition of pseudotechnology, once completed a work of analysis and clarification by examining the previous uses of the term pseudotechnology, the nature of technology, the nature of science and pseudoscience and the relationship they maintain, then, finally, he characterizes what a technological malfunction is. In a second step, the author will define what an immediately falsifiable statement is, a notion that he can apply to pseudotechnology. This study shows that pseudotechnologies are more often immediately falsifiable than pseudosciences.

François Maurice examines in “**When Philosophy is No Longer Philosophical**” the idea of the existence of a philosophy *in* science suggest by Thomas Pradeu, Maël Lemoine, Mahdi Khelifaoui and Yves Gingras in their article “Philosophy in Science: Can Philosophers of Science Permeate through Science and Produce Scientific Knowledge?”<sup>3</sup>. A philosophy *in* science would address scientific problems using philosophical tools. We show that thinkers of philosophy *in* science practice rather a metascience.

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<sup>3</sup> The article is available online: [journals.uchicago.edu/doi/10.1086/715518](https://journals.uchicago.edu/doi/10.1086/715518).

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