Metascience: For a Scientific General Discourse

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Résumé — L'humain produit des discours sur le monde : mythologies, religions, mysticismes, philosophies, science. La majorité de ses discours sont de nature transcendante. À la suite d'une clarification conceptuelle fondée sur les notions de réflexion et de discours général, la philosophie apparaît comme un discours général transcendant parmi d'autres ; d'où l'échec de celle-ci à rendre compte du monde et de la science ; d'où la nécessité de disposer d'un discours général non transcendant, un discours général proprement scientifique, une métascience. À la lumière des frontières ainsi redéfinies, il sera proposé de fonder la métascience sur une interprétation de l'œuvre de Mario Bunge. Cette interprétation se fonde sur un ensemble de postulats généraux auxquels Mario Bunge adhère et tenus pour acquis par les scientifiques. Il est proposé que soutenir un tel ensemble de postulats sans les problématiser à la manière des philosophes, fait en sorte que la pensée de Bunge ne relève plus de la philosophie.

Abstract — Human produce discourses on the world: mythologies, religions, mysticisms, philosophies, science. The majority of those discourses are transcendent in nature. Following a conceptual clarification based on the notions of reflection and general discourse, philosophy appears as a transcendent general discourse among others; hence the failure of the latter to account for the world and science; hence the need for a non-transcendent general discourse, a properly scientific general discourse, a metascience. In light of these

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redefined boundaries, it will be proposed to base metascience on an interpretation of Mario Bunge's work. This interpretation is based on a set of general postulates that Mario Bunge adheres to and taken for granted by scientists. It is proposed that supporting such a set of postulates without problematizing them in the manner of the philosophers, makes Bunge's thinking no longer philosophical.

> [The philosopher's] imagination should be impregnated with the scientific outlook and [...] he should feel that science has presented us with a new world, new concepts and new methods, not known in earlier times, but proved by experience to be fruitful where the older concepts and methods proved barren.
>
> BERTRAND RUSSELL
>
> My philosophical development

> The idea behind the [Bungean] program is as commonsense as could be. This may sound disappointing, as it lacks all extravagance, but then this is what the program is all about. The idea is to stay well within one world [...].
>
> JOSEPH AGASSI
>
> Ontology and its discontent

> Only philosophers and inmates in a lunatic asylum think that someone can create reality rather than just alter it.
>
> MARIO BUNGE
>
> Chasing reality

Contents

The human need to explain the world is profound. In general, the explanations put forward by science do not satisfy this need. So we're looking for a different kind of explanation. Often the difference between a scientific explanation and a more satisfactory explanation is often translated by the idea that one seeks the why of things and not the how. To explain is to seek meaning in existence and therefore meaning in our lives. Humans need a general discourse about the world.

To meet this need, proposed explanations have taken several forms. Several general discourses on the world have been proposed. These general discourses on the world are, for example, animism, myths and religion. One thing in common with these discourses is the place reserved for one form or another of transcendence, to something more beyond mere material existence, something that cannot be grasped by the natural faculties of the human being. Intuition, reason, reflection, creativity, will, feeling, perception, etc. The apprehension of this transcendent reality can then be done through the intermediary of unnatural faculties: Intuition, Reason, Reflection, Creativity, Will, Sensation, Perception, etc. Often, a general transcendent discourse is integral or total. In this case, such a discourse maintains a cosmology which explains the place of the human in the world, an ideology which explains the place of the individual in society, and a gnoseology, what the human is entitled to know, but especially what he is forbidden to know.

It is common to identify philosophy and general discourse, that is to say to affirm that philosophy is the general discourse par excellence; there would be general reflection only philosophical. We will show that philosophy is a type of general discourse invented by humans in the same way as other general discourses. And if it is one type of general discourse among others, then we can question its relevance in the same way that we question the relevance of animism, myths and religions.

To do this, we will have to focus on the notions of worldview, reflection, pre-methodic reflection, trans-empirical reflection, general postulate, and method. A fair appreciation of these concepts makes us understand that in the methodological order, the adoption of general assumptions precedes the development and use of an approach or method. Thus, the adoption of a number of assumptions only requires our natural ability to think. It is neither a scientific method, nor a religious method, nor a philosophical method, nor a metascientific method that dictates to us the assumptions on which our thinking will be based. If our argument has value, then we can propose a general scientific discourse based on a number of postulates obtained by a pre-methodic reflection. Therefore, we can disprove the widely held idea to justify the use of philosophy: scientists philosophy in spite of themselves.

This text offers a research program inspired by the work of Mario Bunge and in the spirit of the Enlightenment. In fact, it is more than a research program because we propose to establish a new discipline, or rather a new field of science. This scientific field, metascience, can be described as a scientific general discourse. Our redrawing of disciplinary boundaries is based on the observation that general reflection is not to be confused with philosophical reflection. As we will try to show, philosophy does not have a monopoly on general thinking.

Our task is both easy and arduous. It is easy because we have an example of an accomplished metascientist, Mario Bunge. It is enough to use his work as often as necessary to support our point, while bearing in mind that it is a starting point for any metascientific research. We will therefore characterize metascience in the second part entitled “Scientific General Discourse.” But before we even characterize metascience, we must demonstrate that philosophy is a general discourse among others, and, even more difficult, convince non-transcendent thinkers that they do not practice philosophy. This is the objective of the first part, “General Discourses.”

1 General Discourses

1.1 Reflection, Method, and General Discourse

Traditionally, philosophers have argued, including Bunge, that science is based on philosophical principles or assumptions and that it can’t do

without philosophy. We support the idea that these general postulates are not of a philosophical nature. If they are not philosophical, what is their nature then? To answer this question, we must distinguish worldview, reflection, method and general discourse. A vision of the world, or Weltanschauung, is a set of inarticulate beliefs as to the nature of reality. A vision of the world does not seek or desire coherence, which implies that philosophy cannot be confused with a vision of the world (Vuillemin 1986, p. viii) because "any philosophy worthy of the name, not being simply a bag full of bits and pieces but an articulate cluster of parts, becomes intelligible only through the relation of its different philosophical themes to a highest principle" (ibid., p. 128-29). Reflection is a natural faculty in humans. Thinking and reasoning are acts that humans spontaneously perform (which does not mean that there is no effort to be made). Thus, for Descartes, "common sense is the most shared thing in the world." However, "it is not enough to have a good mind, but the main thing is to apply it well." We therefore need a method which makes it possible to "conduct one's reason well and seek the truth in the sciences." Descartes is, of course, neither the first nor the last philosopher to develop a philosophical method in order to reflect well and thus produce a general discourse. But, thinking about objects, using a method to guide this thinking, to finally reach or produce knowledge, requires from the outset to adopt certain general postulates as to the nature of the world and the objects that compose it, as well as to the nature of thought, and therefore the link between the world and our thought. However, this reflection is pre-methodical. What do we mean by pre-methodical thinking?

There is no method to convince ourselves or reinforce our belief that the world is of a certain nature. We think, we weigh the pros and cons, we put forward some examples, but in the end we decide according to a particular worldview. As far as Bunge is concerned, the success of science is convincing enough to adopt, and not to problematize, the general assumptions of science. But these general assumptions of science have not been demonstrated, any more than those of philosophical or religious doctrines cannot be demonstrated. The demonstrations come only after a set of general assumptions has been adopted. These assumptions then constitute a set of premises, most often implicit, to any demonstration that is within a given frame of thought. Let's take one example. Let's think about the important phenomenon of perception. What causes perception? Is it caused

at all or is it an autonomous phenomenon? If it is provoked, is it caused by material, immaterial, spiritual objects, etc.?

The answer to these questions does not depend on a method, but on a pre-methodical reflection. Thus, the Cartesian method only makes sense within the framework of a certain set of general postulates, postulates to which Descartes arrives after a pre-methodical reflection. This applies to any method whether philosophical, religious, mystical or scientific. Thus, Perrin's demonstration of the existence of the atom is only valid if one adopts the general assumptions of science. But these general assumptions are not obtained by the scientific method; they are pre-methodical. To argue that it is material objects interacting with us that provoke perception is not demonstrated by the scientific method. Another example, again linked to the question of perception, is that of the dichotomy between primary and secondary qualities. It is through a pre-methodical reflection that we convince ourselves that objects possess properties that are not those that are spontaneously attributed to them. In this way, we could continue our pre-methodical thinking and thus develop a set of general postulates specific to science. We'll come back to that in the second part. For now, we want to return to the question of the nature of these general assumptions.

Since these general assumptions are obtained by pre-methodical reflection, they cannot be considered as philosophical postulates. Philosophical schools themselves need to think about the general assumptions they will adopt. Only then can they construct a method for philosophizing and developing a general philosophical discourse. Thinking is not a method, it is a faculty, and thinking about general assumptions in a particular frame of thought requires neither a method nor even extensive training in any field, be it philosophical, religious, mystical or scientific. Of course, the above is a posteriori reconstruction of what is actually happening. In fact, there is a back-and-forth between pre-methodical reflections, method and the general discourse that is being developed. It was important for us to highlight the non-philosophical nature of the general assumptions of science.

We thus note that there are several general discourses about the world and about human nature: philosophical, religious, mystical, etc. Oddly enough, science does not have its own general discourse. We will come

back to this in the second part since for the moment we want to underline the transcendent nature that many of these discourses have taken. What do we mean by transcendent? In his Vocabulaire technique et critique de la philosophie, one of the meanings attributed by Lalande to transcendent is "what does not result from the natural play of a certain class of beings or actions, but which implies the intervention of a principle outside and superior to it." In addition, in his Dictionnaire de la langue philosophique, one of the meanings attributed by Foulquié to transcendent is that "which is beyond or outside the domain considered and is not of the same nature as this domain." The two meanings are not mutually exclusive and in fact complement each other. In a frame of thought which postulates only the existence of material objects, we can advance that any general discourse which postulates the existence of objects of a nature different from concrete or material objects, which implies appealing to principles external to these objects, is a discourse transcendent in relation to this frame of thought. It is within this frame of thought that science and its method are developed, and it is within this framework that a general scientific discourse, a metascience, is developed, of which Bunge laid the foundations. Again, it is neither philosophy, nor science, nor metascience that dictates the basic postulates of any thought because there is no philosophical, metascientific or scientific method that comes into play here. Methodologically, you must think and then convince yourself to adopt some elementary postulates before even undertaking a philosophical, scientific or metascientific research.

Mythical, religious and mystical discourses are therefore transcendent discourses in relation to a general scientific discourse. The case of philosophy is more complicated because there are transcendent doctrines and immanent doctrines. We believe, however, that the majority of philosophical doctrines are transcendent. The idealist doctrines are obviously so. The empiricist doctrines seem more down to earth, but it turns out that they are transcendent when we examine them from the perspective of a general postulate, the dichotomy between the factual and the formal, advanced by several philosophers, taken for granted by Bunge and, it seems, by the majority of scientists. This dichotomy is a special case of a more general dichotomy between the world and our representation of the world, or between the real and the fictional.

At the root of empiricism is the idea that we do not have "direct" access to the world beyond perception, or, to put it another way, there are no logical or necessary links between our perceptions and the objects that would produce them. Here, it must be understood that the formal takes precedence over the factual. It is true that such logical links do not exist, but if they do not exist it is because the objects in question are not formal objects. This is where empiricist transcendence comes to light. We then call upon principles external to concrete objects and we grant logic an ontological, epistemological and methodological status. Logic then becomes a philosophical logic and no longer just a formal logic. This philosophical logic would be able to tell us what exists or not, what is knowable or not and, if so, how to acquire knowledge. If we are thinkers who take for granted the general postulates of science, notably the existence of the concrete world and the dichotomy between the factual and the formal, then logic is not an ontology, epistemology or methodology. Now, if we don't have direct access to trans-empirical objects, especially those studied by science, how do we form concepts about them? Bunge provides us with the answer: "The transempirical concepts do not originate in perception, i.e. they cannot be learned from experience but must be acquired by reflection" (Bunge 1983b, p. 161, our italics).

We therefore propose a preliminary breakdown of general discourses; the study of general discourses is a research project in itself, especially the psychological and sociological aspects. The importance of redefining the boundaries we are proposing is that any general discourse that is not clearly mythical, religious or mystical is attributed to philosophy. But since philosophy is largely dominated by transcendent philosophies, and even, we believe, that philosophy is inherently transcendent, then any general discourse runs the risk of being contaminated by transcendent considerations.

To associate immanent discourses with philosophy is a consequence of the weight of tradition. Not knowing what these immanent discourses are, we place them among the philosophical doctrines. But, from our point of view, the writings of the same immanent thinker, according to the object of each writing, can be associated either with a discourse on arts and letters, or with a discourse of connivance or the living-together, or with a general scientific discourse or metascience. This is what Figure 1 attempts to show by the dashes around the category of immanent

philosophies. From our point of view, this category should disappear in favor of the other three categories of general discourse. And these three discourses are autonomous even if they can influence each other. They are autonomous in the sense that there is no strong or necessary, philosophical, scientific, metascientific, logical, religious, or other link that connects them. This autonomy of immanent discourses is an additional reason for not grouping them under a common denomination that is philosophy.

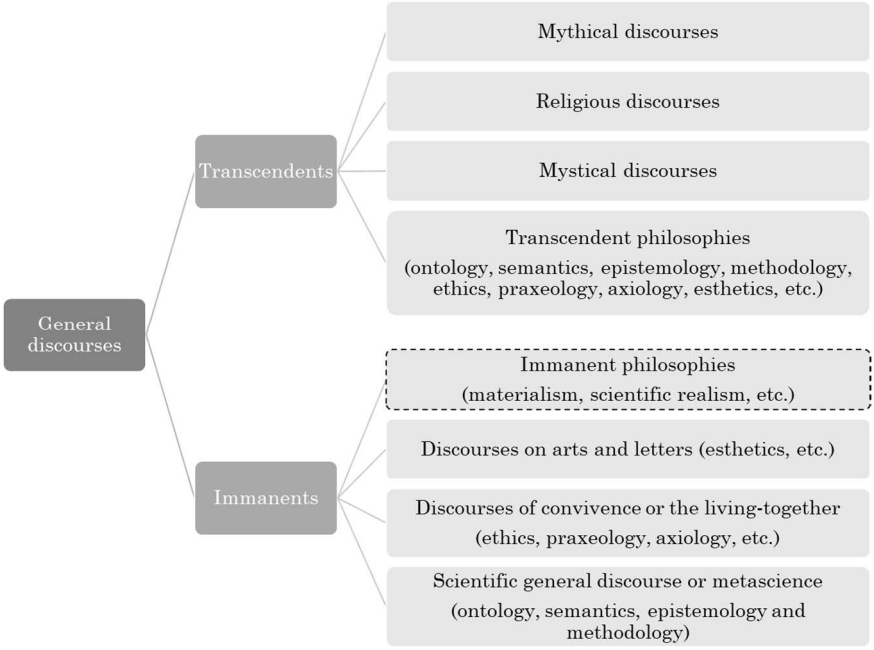

Figure 1: Preliminary representation of some general discourses

We were led to reflect on the nature of reflection, method and general discourse, noting that Mario Bunge took for granted an impressive amount of general postulates. Most thinkers may hold such a large number of postulates, but Bunge had made a habit of spreading them out into the open. He also argues that these assumptions are the ones on which science is based, which is defensible given the nature of these assumptions. What is most surprising, however, is not that a thinker puts forward a few assumptions and argues that science conforms to them, since after all this is what philosophers of science do, it was rather that this same thinker adopts these postulates to construct his semantic, ontological,

epistemological and methodological theories. Instead of questioning the assumptions that can reasonably be attributed to science, Bunge relies on them to develop his general thinking and theories about the world and science. As Mahner notes: "Modern metaphysics involves more than just a collection of general principles: it must present itself as a theory incorporating ontological concepts, consistent with the results of science" (Mahner 2013, p. 44). Thus, Bunge does not problematize the general assumptions of science as one might expect from a philosopher.

If we distance ourselves from philosophy, what do we see? A general discourse among others. The resemblance between Bunge's thought and philosophical doctrines is due to the fact that we are in the presence of general discourses about the world and about knowledge of this world. Other thoughts produce general discourses, such as religions, myths and several mystical doctrines. At the foundation of each discourse is an attitude and an approach. Bunge resolutely adopts a scientific attitude and approach. It is for this reason that we can identify his thought with a scientific general discourse. Since Bunge is interested in knowledge of the world, and since nowadays a good part of this knowledge comes from science, and, finally, since the success of science is obvious, he extracts and adopts what he believes to be the most general assumptions of science. Just as it is a starting point for science, it is a starting point for Bunge's thought.

So, contrary to what one might think, Bunge's methodological starting point is not science or common sense, but the most general transempirical concepts at the foundation of science. These concepts are understood neither by perception alone nor by reason alone. In fact, these concepts cannot be grasped, but must be constructed after reflection. It is a creative act and not a simple apprehension of a perceptual or intellectual given. Reflection and creation go hand in hand. Reflection is a faculty, while a general discourse is a construction. Reflection allows Bunge to identify the general postulates on which science rests. From these postulates, he elaborates his general discourse. Thus, Bunge does not seek to problematize the starting point of the sciences, he seeks to identify it and to rely on it in order to develop a scientific general discourse, a metascience.

1.2 Reflection and Philosophy

To think is to call upon an arsenal of cognitive processes to learn (acquire new knowledge) or to find a solution to a problem (which is a form of learning): compare, generalize, instantiate, memorize, remember, invent, deduce, calculate, associate, preach, classify, predict, focus, pay attention, analyze, synthesize, perceive, explore, form concepts and propositions, learn a skill, criticize, theorize, plan, speak, write, decide, choose, etc. In short, thinking is a complex cerebral process (formerly we spoke of operations of the mind) which involves a large amount of an individual's cognitive resources in order to produce, transform or use knowledge (Bunge 1983b, p. 23).

Every human thinks. Reflection is natural and spontaneous. As soon as we encounter a problem, and unless it immediately endangers our lives, we have the choice to ignore it, hoping that it resolves itself, avoid it or run away from it while taking it into account, or confront it directly in order to solve it. In any case, we are thinking. It seems that there are several degrees of reflection depending on the object or problem about which we are thinking. Most of the time we think about practical issues, whether in our private lives or in our public life. We also reflect on our relationships, private or public, which can lead us to moral reflection.

However, reflection alone does not produce valid arguments or theories, although it is necessary to think in order to argue and theorize. There is no general method for thinking, let alone algorithms that would achieve knowledge, because to think is to continually making assumptions over and over, then thinking again about these assumptions and decisions. And making assumptions and making decisions are creative acts, that is, we create new assemblies of neurons or psychons (ibid., pp. 41–42, 2008, p. 80). And while no algorithm can create material objects, the brain, a material object par excellence, can create fictions, such as an algorithm, by ideation and abstraction, which are material processes (Bunge 1974a, p. 13, 1983b, p. 56).

Although it is true that the same person can think in the context of several general discourses simultaneously or move from one discourse to another without too much difficulty, it does not follow that if I think, I necessarily practice a philosophy, unless I identify reflection and philosophy, and then the very term philosophy loses all its meaning. Any

reflection takes place within a framework whether this framework is mythical, religious, philosophical or scientific.

Thus, reflection is not to be confused with philosophy. Philosophers were not mistaken. They sought to develop methods to know reality, because reflection alone is not systematic enough and does not produce theories. Plato developed dialectics, Aristotle syllogistic, Descartes wrote the Discourse on the Method, Husserl proposed phenomenological reduction and the Vienna Circle, logical analysis. General discourses cannot therefore be confused with philosophy because reflection is not unique to philosophers and philosophers propose particular methods for obtaining knowledge and producing theories.

Reflection requires no advanced philosophical, scientific or metascientific training. It is enough, in general, to have some life experience and elementary education to be able to reflect on the living-together and about the world. Thinking about more advanced topics, on the other hand, requires further learning on the part of a person. Again, reflection is not a discourse or a system of thought or a theory; it is a brain process. And the products of reflection do not form a discourse or a system of thought or a theory. We will come back to that in the second part when we characterize metascience.

In any case, the study of reflection is a matter of psychology. For our purpose, it suffices to admit that there is a human faculty that allows us to make hypotheses, that is to say propositions which are not the fruit of a logical deduction, hypotheses which, concerning the world, often relate to objects that lie beyond perception.

1.3 Transempirical Reflection

Reflection is therefore not to be confused with philosophy. Reflection can be practiced by all, in the sense that there is no need to be a scientist, a metascientific or a philosopher to think of some general questions about the living-together and the world. Let us take an example of reflection which does not require special training. A transempirical reflection, a reflection about what lies beyond sensations and perception, is a thought experiment that allows us to realize the difference between the properties that belong to things, the primary qualities, and the sensations that our interactions with things provoke in us, the secondary qualities. Thinking

about the distinction between primary and secondary qualities is one of the most important thought experiments an individual interested in knowing the world can have. Such a reflection allows us to move away from common sense, which attributes the secondary qualities or sensitive qualities to the object that provokes them in us.

The primary qualities are properties that belong to objects. These are properties that exist independently of sentient beings. Secondary qualities are properties that are wrongly attributed to the objects with which we interact when they are in fact sensations caused by these objects. This reflection is in principle accessible to all, at least it does not require a thorough knowledge of either science, metascience or philosophy. The conclusion that any reasonable person will reach will be to admit the distinction. Science and metascience take this distinction for granted, which is not generally the case with transcendent philosophical doctrines. Philosophers will tend to problematize the distinction because they seek a "strong" link, philosophical, metaphysical, logical, linguistic, discursive, that would unite perception with the perceived object.

Note that such a thought experiment, although it is within the reach of the greatest number, is not obvious. Even if we can suppose that some individuals among our distant ancestors practiced it and that they arrived at the reasonable conclusion which we reached, it was still necessary to wait a few millennia before thinkers clearly stated it, such as Democritus, and it took two more millennia for psychosocial conditions to be met for the distinction to become attractive to members of the emerging community of early modern scholars, such as Descartes, Galileo, Locke and Newton. The distinction between primary qualities and secondary qualities makes it possible to dissolve a philosophical problem described as fundamental by Bouveresse following Vuillemin:

> If philosophy were to be characterized therefore by reference to a fundamental question, it would be that of the distinction between reality and appearance. And since there are, for reasons that are not accidental but intrinsic, several possible ways, fundamentally different and incompatible between them, to draw the dividing line between reality and appearance, it helps to understand why philosophy has always presented itself so far in the form of an irreducible plurality of systems that history has never managed to separate (Bouveresse 2012 p. 41).

Each philosophical doctrine, at least among transcendent doctrines, therefore attempts to determine the border between appearance and reality. The distinction between appearance and reality bears witness to transcendence in philosophy, while this distinction is rejected by Bunge and by science: "In the philosophical tradition appearance is the opposite of reality. This is mistaken, for an appearance is a process occurring in the nervous system of some animal, hence it is just as much of a fact as an external event. (Bunge 2020, p. 26)."Appearances" are facts of the world just like all other facts of the "external world."

There is therefore no opposition between appearance and reality; there is only reality. The problem of distinguishing between reality and appearance therefore becomes a false problem. The rejection of this distinction, the refusal to see an opposition "between what is really and what appears only to be" (Bouveresse 2012, p. 8; italics in the original), will result in Bunge's general discourse about the world, his ontology, which does not try to establish what is, since there is only reality and this is studied by the sciences. Bungean ontology is an abstract representation of the world obtained by a study of scientific constructs and by an ordering of the general postulates of science. Such an ontology does not concern objects which would be more real than the concrete objects studied by the sciences.

Some will protest against the restrictive and dogmatic nature of metascience. The framework of thought that we will propose in the second part, rather than hindering creativity, will stimulate it and direct it towards avenues of research that were previously closed by the old philosophical frameworks. You only have to look over the work of Mario Bunge, especially his Treatise on Basic Philosophy2[2], to convince yourself that the work that awaits the metascientists is immense. To use another image, the exploration of the forest is just beginning and Bunge opened a first path (several paths in fact!). The problems to be solved will require a good dose of creativity and any creativity requires its framework.

[2] The Treatise on Basic Philosophy consists of 8 tomes in 9 volumes: Semantics I: Sense and Reference (1974a), Semantics II: Interpretation and Truth (1974b), Ontology I: The Furniture of the World (1977a), Ontology II: A World of Systems (1979a), Epistemology I: Exploring the World (1983b), Epistemology II: Understanding the World (1983c), Epistemology III, part 1: Formal and Physical Sciences (1985a), Epistemology III, part 2: Life Science, Social Science and Technology (1985b), Ethics: The Good and the Right (1989). In his memoirs, Entre deux mondes (2016, p. 323), Bunge considers that his book Political Philosophy (2009b) constitutes the 10th and last volume of the Treatise.

1.4 Philosophical Transcendence

Vuillemin explains the nature of philosophy by its simultaneous adoption, from its origins, of the axiomatic method, newly invented, and of the postulate of the appearance/reality dichotomy:

> To sum up, philosophy results from the reorganization of the two dimensions of mythical signs. The mythical story gives way to the quest for true principles according to the standards of the axiomatic method. This was the first, foundational relevance of axiomatics to philosophy. At the same time, however, philosophy intends to reform and to restore mythical ontology dismissed by axiomatics. A determinate ontology takes the place of the equivocal reference to reality. The second connection of axiomatics with philosophy is through demonstration. But the requirement of consistency, which no material consideration comes to hinder in axiomatic method, has, in philosophy, to cope with ontology. Between self-evident principles equally recommended by common sense but mutually inconsistent, a choice is imposed on philosophy which explains its divisions. Finally, philosophy is like axiomatics in so far as both seek truth. But in contradistinction to scientific truth, its consideration of ontology makes philosophy generalize an opposition which is only of local and minor importance in science. Competing philosophical systems struggle for recognized, if not fixed, frontiers between appearance and reality. (Vuillemin 1986, p. 114)

But since we can neither agree on a set of axioms nor on the line between appearance and reality, philosophy then split into a plurality of doctrines.

We believe that most philosophical doctrines are transcendent precisely because these doctrines are based on this division between appearance and reality, and that the boundary they seek to draw calls upon principles foreign to the concrete world. And this border will be established by each doctrine using pre-methodical reflection. We do not yet philosophize when we draw the line between appearance and reality; we put forward our object of study and it is only then that we will philosophize by using methods that we believe suitable for this object. Although the majority of philosophers these days do not openly discuss Being, this god of philosophers, they are always animated by his search and by the discovery of an infallible faculty of knowing it.

The faculty to achieve this can be Intuition, Reason, Reflection, Creativity, Will, Sensation, Perception, etc., which gives rise to different philosophies, for example rationalism, intuitionism, empiricism, etc., but in all cases these faculties have nothing to do with intuition, reason, reflection, creativity, will, sensation, perception, etc., with which we are all endowed naturally. We must therefore pay attention to the use that philosophers make of these terms. Even if a philosopher does not write the word with a capital letter, it is a supernatural faculty that he has in mind and not a natural faculty. We note, however, that most philosophers wander from a natural conception to a supernatural conception of these faculties, without always realizing it, that is to say in good faith, which is worse than a philosopher who would assume the transcendent nature of his thought and would develop a coherent discourse, for want of being reasonable and rational.

It is quite common to associate philosophy with rational discourse, which makes our characterization of philosophy as a transcendent general discourse seems even stranger. The form of philosophical transcendence is special. This transcendence seems to be unique to the West, which inherited it from ancient Greece. It is a discursive, rationalizing, logicizing, linguistic, axiomatizing transcendence. Of course, transcendent philosophical discourses are based on discussion and debate, which is far from the case with other forms of transcendent discourses. Even irrationalist philosophical schools, often with an obscure style, produce numerous academic publications to defend their positions, organize seminars and congresses, and pass on their "knowledge" to students. It is perhaps no coincidence, however, that this discursive transcendence appears at the same time as democracy, public debate, argumentation, sophistry, rational thinking, science, logic, theoretical mathematics and the general need for theorization.

From the origins of philosophy, philosophers have therefore given to the "discursive," "logic" and "language" a semantic, ontological and epistemological role. To grant such powers to discursiveness, to believe that it is possible to discuss ontological, semantic and epistemological subjects on the basis of "discursive," "logical" or "linguistic" considerations, is to show transcendence. Since the real world is not made of discursive, logical or linguistic relations, since our relation to the world is neither discursive, neither logical, nor linguistics, a conclusion to which all elementary

reflection arrives, it is therefore not possible to use logic or language to deal with a single problem concerning the world or our knowledge of it. This original sin is called panlogism (or logical imperialism) and glossocentrism (or linguistic imperialism) by Bunge[3].

True logic is a formal science, like mathematics, distinct from the factual sciences, wrongly called empirical sciences, and the conceptual sciences, i.e. metasciences[4]. We will return to this scientific triad in the second part, for the moment it suffices to accept the reasonable idea that logic and language say nothing about the world and how to know it. As we have just indicated, a simple reflection is enough to understand that a "logical" relationship is not to be confused with a concrete, material relationship. The fact that transcendent philosophers insist on taking the path of discursivity, while understanding the distinction between factual relationship and formal relationship, can only be the product of a transcendent belief. They must necessarily assume that reality is not material, from which the appearance/reality dichotomy follows.

Empiricism is often seen as the most relevant philosophical doctrine for science. However, empiricists do not hesitate to use logicist fallacies to make us believe that only sense data are knowable: because there are no "logical" relationships between our sensations, perceptions, impressions or experiences and the objects that would cause them, because an immediate or direct knowledge of these objects is impossible, then, necessarily, these objects do not exist or, if they exist, they are not knowable. The empiricists wanted to combat the excesses of rationalism, but on the basis of rationalist or rationalizing reasoning. By wanting to fight Reason, they lost their reason by raising Sensation or Perception or Experience to the rank of supernatural faculties in the same way as Intuition, Reflection, Creativity, Will, etc. Empiricism is transcendent. It is transcendent because it involves a principle foreign to material objects. He judges the link between objects, in particular between objects and us, on the basis of

[3] Bunge discusses an example of panlogism in Evaluating Philosophies (2012a, chap. 19), and criticizes Chomsky's glossocentrism in "Philosophical Problems in Linguistics" (1984).

[4] A treatment for the formal/factual dichotomy is found in Chapter 8, Sections 1 and 2, and in Chapter 10, Section 2.1 of Semantics II: Interpretation and Truth (1974b), in Chapter 5, Section 2.2 of Epistemology I: Exploring the World (1983b), in Chapter 1, Sections 1.1 and 2.1 of Epistemology III, part 1: Formal and Physical Sciences (1985a) and in Section 1.4 of Philosophy of Science I: From Problem to Theory (1998a).

logical principles, or rather of philosophical-logical principles since it is no longer a question of formal logic, which says nothing about the world.

A basic reflection makes us conclude that the world is not made up of logical relations, that our relation to the world, of which we ourselves are only a tiny part, does not fall within any logic, that interesting knowledge is rarely immediate, that sensations are provoked by our interaction with objects independent of us, objects that existed before our birth, which exist even when we do not interact with them, that will exist after our death and after a possible disappearance of humanity, and that knowledge of objects involves natural sensations and mental faculties, including reflection and creativity. In short, the appearance/reality dichotomy must be rejected, but the formal/factual dichotomy must be accepted.

Philosophy, by keeping the door open to one form or another of transcendence, by favoring discursivity and postulating the existence of supernatural faculties at the expense of the natural faculties we are endowed, excludes itself from any modern rational debate whose canons were gradually established from the Renaissance. We do not announce the death of philosophy, we do not work on yet another re-foundation of philosophy, we do not propose an anti-philosophy or a post-philosophy or a trans-philosophy. Philosophy will not disappear since every transcending discourse that appears on Earth seems to find a buyer at any time. There will always be philosophers as there will always be religious and mystics of all kinds.

1.5 Philosophy in Crisis?

In Philosophy in Crisis, Bunge lays out ten causes, among others, to the crisis of philosophy, and thirteen options available to philosophers who wish to reconstruct philosophy ... or perpetuate the crisis. The ten causes of the crisis of philosophy identified by Bunge are: 1) excessive professionalization, 2) confusion between philosophizing and chronicling, 3) mistaking obscurity for profundity, 4) obsession with language, 5) idealism, 6) exaggerate attention to mini-problems and fashionable academic games, 7) insubstantial formalism and formless insubstantiality, 8) fragmentarism and aphorisms, 9) detachment from the intellectual engines of modern civilization, 10) ivory tower.

The choices available to philosophers who wish to reconstruct philosophy or perpetuate its crisis are: 1) Authentic/fake, 2) Clear/obscure, 3)

Critical/dogmatic, 4) Deep/shallow, 5) Enlightened/obscurantist, 6) interesting/boring, 7) materialism/idealism, 8) noble/vile, 9) Open/closed, 10) Realist/fantastic, 11) Systemic/fragmentary, 12) Topical/anachronistic, 13) Useful/useless).

Of course, the two lists overlap and the second option of each alternative from the second list constitute an additional cause for the crisis in philosophy. The diagnosis is final and the treatment is up to the seriousness of the disease:

> So much for a diagnosis of the ailments of contemporary philosophy. Every one of them ought to suffice sending the dear old lady to the emergency wing. All ten necessitate sending her to the intensive care unit. The adequate treatment of the patient is obvious: A transfusion of new and tough problems whose solution would advance knowledge; intensive exercises in conceptual rigor resulting in the elimination of pseudophilosophical toxics; selected morsels of mathematics, science, and technology; training in the detection and inactivation of ideological minefields; and renewal of contacts with the best philosophical tradition. (Bunge, 2004, Section 10.2)

Unfortunately, the treatment will not be effective. It is not possible to cure the patient because she does not have any disease. Philosophy is no sicker than religion. The state in which philosophy is found is in its natural state. Doing philosophy means supporting many of the second terms of the alternatives presented by Bunge. For example, supporting one form or another of idealism, rather than materialism, is essential for a philosopher, just as it is essential for a religious to believe in deities. Doing philosophy also means problematizing the general postulates on which science is based. Without this questioning of the elementary and reasonable postulates of science, philosophy no longer has its raison d'être.

The lamentable state in which philosophies find themselves is seen by the way philosophers argue: both common sense and science are used to defend the same thesis, and then ignore them a few paragraphs later in the name of a less naïve and more sophisticated philosophical position, but without explaining why common sense and science no longer do the trick. Thus, when reading philosophers, we learn that an effective recipe for writing a text in the analytic dialect of philosophese is to concoct a counterfactual proposition, sprinkle it with a little of relativism, add a

pinch of possible worlds, to brew everything with supervenience, then, finally, to cook to modal logic to give a semblance of consistency[5].

The multitude of philosophical doctrines is not a sign of a crisis, but a normal situation for any transcendent discourse. Thus, the phrase "it is philosophy that demands it," often presented with this emphasis in italics, makes no sense. What philosophy? Analytic philosophy or continental philosophy? Relativism? Antirealism? Or rationalism or empiricism? Who knows! There are so many incompatible "philosophical methods" that it is impossible to know what the expression might mean. When slipped at the right time into an "argumentative" text, the mind is stunned and no longer able to think, especially since the expression is used in the singular, which gives more weight to the author's belief. We dare not reply because philosophy is a mystery and it is both admired and feared.

Equally problematic is the expression "philosophical category." It suffices to call on this expression to claim an imperium on a notion, whether it comes from common sense, the arts and letters, or technologies and sciences. The same remark is obvious. Is this an analytic category? Or a continental category? Relativist? Antirealistic? Or again, rationalist or empiricist? Although it is argued that the various philosophical currents, movements and doctrines belong to the same activity known as philosophy, it makes no sense to convey these expressions without any other qualifier. Transcendent philosophical doctrines share a family resemblance, but they do not share an approach and methods as is the case with the sciences. At most, they share an attitude, a feeling that the world is more than matter (but what exactly?), and, therefore, that the real relation between material objects are not immanent in them (therefore transcendent, but what transcendence?), and that a particular faculty, a sixth philosophical sense, makes it possible to apprehend them (what faculty and how does it operate?).

Similarly, the abundant literature that focuses on defending the need for scientists to collaborate with philosophers neglects the heterogeneous nature of philosophy, a heterogeneity that comes, as we have seen, from the many ways that it is possible to draw the line between appearance and reality. This heterogeneity is constitutive of philosophy: "The plurality of

[5] Adapted from Maurice, "Une triade scientifique ?" (2017, p. 171).

philosophies, their rivalry, their polemics recalled to the reason, from the outset, that to pose is to divide and choose" (Bouveresse 2012, p. 130). The tasks assigned to philosophy would be the clarification of scientific concepts, the critical appraisal of scientific assumptions and methods, the formulation of new concepts and new theories. Philosophy would be able to do this work because it would share with science the tools of logic, conceptual analysis and rigorous argumentation (Laplane et al. 2019). We agree with these authors that a certain type of discourse should in principle correspond to this characterization. But why associate such a discourse with philosophy when philosophical doctrines are plural and irreducible? Many philosophers would not agree to define the nature of philosophy in the way that these authors define it. What do a discourse as described by these authors and transcendent doctrines have in common? We also agree with these authors that several thinkers have contributed substantially to debates in science, including those mentioned by way of illustration in this article, but why associate them with philosophy, when this activity is very heterogeneous?

Thinkers who make a contribution to science necessarily adopt a set of general postulates similar to those attributed to science, otherwise their contribution could not fit into a scientific debate. In other words, their exchanges, not only between themselves, but between them and the scientists, are established within a unified framework of thought. In fact, a plethora of philosophies do not use the tools mentioned by the authors of this article, or if they claim to use them, it is in a very strange way, far removed from the scientific practice. Are the logical and conceptual analyzes within the framework of possible worlds, presented in a rigorous argumentative style, of the same nature as those of sciences and metasciences? Logic, conceptual analysis and rigorous argument are of no use if the same general assumptions are not shared with science from the start. So there is no crisis in philosophy.

We will therefore propose in the second part not the establishment of a crisis unit to find a solution to a problem that does not exist, but rather a research program for the development of a general discourse properly scientific.

2 Scientific General Discourse

2.1 General Postulates and Reflection

Philosophical doctrines are normally referred to by words ending in the suffixes -ism or -logy. Bunge also uses an impressive number of -isms to qualify his thinking. We defend the idea that the majority of these positions are not philosophical, but the result of a reflection, and that the fact of not problematizing them, but rather of taking them for granted, is anti-philosophical. Thus, and paradoxically, supporting these general postulates simultaneously evacuates the philosophical discourse and brings Bunge's way of reasoning closer to the way scientists reason. In other words, Bunge adopts a scientific posture and not a philosophical one.

The set of general postulates supported by Bunge, combined with a keen sense of critical thinking, coupled with an ever-active mind that never sinks into intellectual laziness, combined with a thought that continually refuses any form of transcendence, ensures that Bunge does not practice a form of philosophy. He invented a new way of constructing a general discourse about the world and science. This general discourse can be called metascience, a term already used in the past by Bunge in a sense quite similar to our own. Bunge has managed to extract the general discourse from the mystical mire in which he has been bogged down for millennia. This is a revolution. A revolution for the general thought or a revolution of human reflection. Bunge has built a new framework for reflection, a framework radically different from that of philosophy, but fundamentally in line with that of science. Nearly 2,600 years after the first scientific and metascientific revolution, almost 500 years after the second scientific revolution, we are witnessing the second metascientific revolution.

What are these general assumptions taken for granted by Bunge? Here is a non-exhaustive list of points of view that can be reached with a greater or lesser effort of reflection:

> Ontology: 1) autonomous existence of the world, 2) uniqueness of the world, 3) materialist monism, 4) reism, 5) pluralism of properties, 6), essentialism of properties, 7) systemism, 8) emergentism, 9) levels of reality, 10) dynamism, 11) evolutionism, 12) lawfulness principle, 13) ex

> nihilo nihil fit, 14) fictionalism, 15) causal determination, etc. EPISTEMOLOGY: 1) knowledge of the world is possible, 2) objective knowledge, 3) scientific realism, 4) moderate skepticism, 5) moderate empiricism, 6) moderate rationalism, 7) fallibilism, 8) meliorism, 9) moderate pluralism of explanations, etc. METHODOLOGY: 1) justificationism, 2) testability, 3) confrontation of hypotheses with reality, 4) scientism, etc. SEMANTICS: 1) creation of mental objects by abstraction (constructs or construction of the mind), 2) distinction between a construct and a sign that designates it, 3) reference to the "external world", etc.

It is these and several other positions, which, if supported simultaneously, no longer form a philosophical thought. These general assumptions are methodologically at the foundation of science and metascience.

Let's go back to reflection for a moment. We were saying that you don't have to be trained in science, philosophy and metascience to think about some general questions. Thus, we can argue that the majority of doctrines listed above are the result of a reflection and not the application of a philosophical, metascientific or scientific method. Reflection precedes science and metascience, and dispossesses philosophy of its status of general discourse par excellence. It is for this reason that factual sciences are independent of philosophy and metascience. It is also what explains the mystery of scientific progress despite the fact that the sciences are not well founded philosophically. The best scientists are thoughtful, which allows them to implicitly support very general hypotheses which then form a frame of thought for their scientific research.

It is often argued that science presupposes philosophical conceptions. In fact, what science presupposes in order to function properly consists of very general conceptions which are arrived at by reflection and not by any sophisticated philosophical or metascientific method. The "philosophical" presuppositions of science, which science takes for granted, Bunge would say, are questioned by the various transcendent philosophical doctrines while science and metascience take them as a starting point for their research. These are not philosophical, nor even scientific or metascientific presuppositions, because there are no particular methods to conceive them, as there are methods in science and metasciences, and also

"methods" for the different philosophical doctrines. We are simply using our natural ability to think at a higher level than the common thinking we use in everyday life. As Claude Bernard remarked (1865, p. 83): "I think there is only one way for the mind to reason, as there is only one way for the body to walk."

So therefore, trusting science to explain the world is not a philosophical position. This is the result any elementary reflection achieves after examining the issue. In fact, science imposes itself on us just as the world imposes itself on us. Try to live for a single moment by going against the laws of nature or try to establish a large electricity production and distribution network without having a good deal of scientific and technical knowledge. Despite the disinterested aspect of much of scientific research, science imposes itself because it works, and, if it works as well, it is because it deeply explains the phenomena. An interesting indicator of the veracity of science is the use made of it by large organizations which seek to take, keep or extend their political, economic and social power. Thus, States, armies, political parties and large corporations of all countries, in short the establishments, use science more often than mystical thinking, despite the fact that philosophers still have doubts about the value and merits of scientific propositions. People who run these organizations may well be great mystics or great religious themselves, but like everyone else they live with several general discourses. Even in everyday life, although the majority of people are mystical to varying degrees, strangely, if their health, comfort or finances are at stake, they will trust science and technology. This includes philosophers.

Bunge's use of general presuppositions is what sets him apart from philosophers who defend one form or another of scientific realism. These philosophers stop where Bunge begins. They take science seriously, but only to highlight the most general conceptions that underlie scientific activity, which is not always easy, let's face it. They sometimes make relevant criticisms of philosophical doctrines, but they repeat the same mistakes as philosophers. They try to find solutions, within a scientific realist framework, to pseudo-problems raised by philosophers and they address subjects that fall within the scope of factual sciences. Debates are increasingly similar, within the small community of scientific realists, to the debates of analytical philosophy: increasingly sophisticated, but less and less relevant. These scientific realists may no longer be philosophers because they

do not believe in a form of transcendence, but they have not become metascientists, confining themselves to a reflection on general scientific postulates. The reflections of these thinkers are interesting and shed light in different ways on the results of reflection. Their writings can thus serve as an introduction to what must be taken for granted to practice science and metascience.

It should be noted in passing that it is common to associate critical thinking with philosophy. Yet anything that is interesting in critical thinking is not philosophy. For example, learning to identify fallacies is not a matter of philosophy, but rather of argumentation theory. Although the establishment of critical thinking courses was initially a departmental strategy to attract new clients, the fact remains that those who have specialized in critical thinking are no longer true philosophers. The fact that you are professionally a philosopher does not mean that you are intellectually a philosopher.

In general, Bunge avoids philosophical pitfalls and goes beyond this work of reflection in order to propose metascientific theories, i.e. ontology, semantics, epistemology and a methodology of factual sciences. These theories are not used to defend the general assumptions adopted by Bunge, since these assumptions, these elementary positions, are taken for granted by himself. Rather, Bunge's theories are based on these elementary positions, as well as the theories of science, which means that he can rule out many philosophical pseudo-problems and can solve many conceptual or metascientific problems. Whether all of the general assumptions presented above are not exhaustive or that some of them are being debated should not be an excuse to adopt any philosophical transcendence. Bunge's approach is correct.

2.2 Contribution of Philosophy to Metascience

Bunge was forced to assimilate much of the philosophical doctrines because before him metascience did not exist, or the little that existed was buried under mountains of philosophical ideas. But why have philosophers been able to produce some interesting results? Philosophical doctrines are the only ones among the transcendent general discourses to offer answers to general questions which do not appeal to a notion of entities which would enter into communication with us. This means that

philosophers often ask relevant questions. Let us not forget, philosophy is addressed to intellectuals who postulate principles transcendent to matter, but without being able to eliminate matter; matter is therefore associated with appearances, in ways that differ from one doctrine to another. Philosophers do not seek Communion, but Comprehension, which is perhaps a form of intellectual Communion. They search beyond matter and in spite of science, but this search takes the form of an apprehension of Being using their own Faculties. Most mystics and religious claims to be in communion or in communication with spiritual entities. They would not dare to say that it is by their own means that they reach Knowledge. This is not the attitude of a philosopher, who thinks he can attain Knowledge through the faculties he possesses in his own right. This characteristic of philosophy justifies talking about a metascientific revolution in ancient Greece, although at that time, science, metascience and philosophy were not well distinguished. Thus, as early as Antiquity, thinkers advanced interesting metascientific notions. Then, in the modern era, science gradually separated from philosophy. It remained to separate metascience from philosophy, which took a few more centuries, until the appropriate conditions were put in place and a thinker of Bunge's stature took advantage of it. Thus, to fully understand the history of the general thought, it is necessary to separate, among philosophers, their logical, mathematical, scientific and metascientific contributions from their philosophical doctrines.

Philosophers often raise judicious questions, but almost always put forward answers which appeal to principles foreign to matter. Philosophers, especially transcendent philosophers, seek too far. A recovery work patiently undertaken by Bunge was then necessary. An example of recovery is Bunge's integration of Russell's definite description concept into his semantic theory (see Bunge 1971, 1974b, chap. 9, sect. 3). Once this recovery work is completed, it will no longer be necessary for metascientists to refer to philosophers except for historical reasons, that is to say for the history of metascience. It would no longer be necessary to use any "isms" since metasciences will then form a unified disciplinary field in the same way as factual and formal sciences form unified disciplinary fields[6]. "Isms" are

[6] In Emergence and Convergence, Bunge characterizes the unity of the factual sciences in the following way: "By definition, all of the factual sciences study facts, whether actual or really possible. And all of them, even the social sciences, are expected to study them in a scientific manner, that is, in accordance with the scientific method rather than by navel contemplation, crystal ball gazing, trial and error, or discourse analysis. That is, beneath appearances, the sciences are

necessary where doctrines exist, and doctrines proliferate where there are no objects, problems and methods in common, and there can be no objects, problems and methods in common where a thought confuses reality with fiction.

Thus, metascience does not reject the contributions that some philosophers may have made to the advancement of knowledge. It is preferable, however, to recover these contributions under the name of a general discourse distinct in its approach to those of philosophical discourses. Despite our attachment to philosophy, despite our affection for the very word philosophy, it would be unreasonable to use an overloaded expression, an expression that refers to a transcendent general discourse, a discourse that is not able to account for the world and science. In other words, the term "philosophy" is unrecoverable. The use of another word is not only necessary because the approach of metascience is different from the philosophical approach, but it will also allow minds attracted by general reflections, really eager to know this world, which can be confused by the multitude of philosophical systems as well as by the captivating arguments of philosophers, to distinguish metascience from philosophy. One should not be impressed by the quibbles of transcendent philosophy. We must not engage in debates with analytic scholastics or with the continental cabal.

The use of the term "metascience" is therefore not innocent. It is not simply a question of replacing one term with another, but of changing the approach as to how to construct a general discourse about the world. In philosophical jargon, metascience is realism and materialism, although these "isms" no longer have their raison d'être once one refuses any form of transcendence and one refuses to enter into a game whose rules were established by a thought in search of transcendence and whose criteria are foreign to science and metascience. Because of its transcendent nature, philosophy cannot be a judge of science or metascience, or even collaborate with them.

ontologically and methodologically one: all of them study putatively real things and their changes, in a distinctive manner that is quite different from the way theologians, literary critics, shamans, or even craftsmen proceed." (2003a, p. 270).

2.3 Characterization of Metascience

Since the beginning of the 20th century, the term "metascience" has been used sporadically in ways quite close to each other, but without separating metascience from philosophy[7]. For our part, we will use it to designate both a general discourse on the world and a general discourse on science, the two discourses complementing each other. In order to name the metascientific disciplines, we use the names of some philosophical disciplines. Thus, we welcome within metascience semantics, ontology, epistemology and methodology. Note that these disciplines do not play exactly the same role within metascience. While semantics, epistemology and methodology study science in order to produce semantic, epistemological and methodological theories on it, and thereby a general discourse on science, ontology, meanwhile, aims to produce ontological theories about the world, that is to say a general discourse in the world, based on scientific results (Kirschenmann 1982, p. 94). Although distinct, these four disciplines influence each other.

The primary interest of metasciences is the development of a general discourse on the world, an ontology, but this cannot do without a general discourse on science since science is our main tool of knowledge. Thus, if we wish to discuss properties in general, an ontological concept, it would be wise to observe and then to theorize how properties are conceived by the sciences. In other words, our conceptualization of the general concept of property must be compatible with the way in which the most advanced sciences conceptualize the multitude of properties with which they are confronted. In return, this general conceptualization of properties, which is then intended to be more precise, clearer, can be used for different

[7] For a characterization of metascience by Bunge, see the first chapter of Metascientific Queries (1959b). In addition to this work, Bunge uses the expressions "metascience" and "metascientific" essentially in six other texts: "Laws of Physical Laws" (1961a), "The Weight of Simplicity in the Construction and Assaying of Scientific Theories" (1961b), Method, Model and Matter (1973a), Philosophy of Science I: From Problem to Theory (1998a), Philosophy of Science II: From Explanation to Justification (1998b), Causality and Modern Science (2009a). In his autobiography, Between Two Worlds (2016, p. 102), Bunge tells us that he supported the thesis of the identification of philosophy with metascience in "¿ Qué es la epistemología ? "(Minerva 1, 1944, pp. 27–43), but then realized that science supports a number of postulates and thus scientists cannot avoid philosophizing. From our point of view, scientists who take the trouble to think in general terms do not philosophize. To philosophize, you have to adopt a philosophical method, while the act of thinking does not require any particular method. Descartes had clearly seen the difference between reflection, or reason, and method (unfortunately, his method is philosophical rather than metascientific). This is one of the central points of our text.

purposes. This conceptualization can lead scientists, especially those from the least advanced or most difficult disciplines to study, to reconsider their own notion of property, which in turn will make it possible to further refine the general notion. The general discourse which is then constructed, the metascientific vocabulary which is thus developed, can thus serve as a common discourse for the scientists themselves, but can also be used for teaching science and popularizing science. Note that it is not a question of proposing a universal language for communication as it was proposed for the ido, nor a technical language to express scientific theories, since in the latter case mathematics already play this role. It is about building a general representation of science, using semantic and epistemological theories, as well as a general representation of the physical, chemical, biological, psychological and social world, using ontological theories.

The term metascience thus seems appropriate to describe these disciplines that analyze scientific production, such as scientific concepts, propositions and theories, in order to produce analyses and syntheses, using metascientific concepts, propositions and theories. Metasciences are conceptual sciences in that they study constructions of the mind, more precisely scientific productions, and produce constructs that are neither formal nor factual, that is, constructs that do not fall within the purview of formal sciences or factual sciences[8]. An important consequence of the above is that there would be at least three concepts of truth: formal truth, factual truth and conceptual truth[9]. Thus, with each scientific discourse would correspond a concept of truth.

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[8] It should be noted that formal sciences also study concepts of a particular nature, that is, formal concepts and not factual concepts, i.e. concepts produced by the factual sciences. The formal sciences study formal concepts on two levels: object language and metalanguage. There is thus logic and metalogics, and mathematics and metamathematics. The factual sciences, on the other hand, study concrete objects, but produce concepts to do so. Since logic and mathematics already have their own metascience or general discourse, i.e. metalogics and metamathematics, we allow ourselves to restrict the application of the expressions metascience and conceptual sciences to factual sciences.

[9] Bunge proposes four concepts of truth in Chapter 8, section 1.3 of Semantics II: Interpretation and Truth (1974b): logical, mathematical, factual and philosophical truth. In the case of factual sciences, he advances the notion of partial truth. The partial truth is dealt with by Bunge on several occasions: The Myth of Simplicity (1963, chap. 8), Semantics II: Interpretation and Truth (1974b, chap. 8), Epistemology II: Understanding the World (1983c, appendix 3), Emergence and Convergence (2003a, chap. 15, sect. 3), Matter and Mind (2010, chap. 15), "The Correspondence Theory of Truth" (2012b). See also the treatment by Jean-Pierre Marquis (1990, 1991, 1992) and in this issue, "Vérité partielle et réalisme scientifique".

The prefix meta- can evoke, depending on the discipline, an idea of transcendence, of higher level, of a goal, an idea of cause, of change, of displacement, or even of reflexive self-reference. It also expresses an idea of posterity, change, transformation, as well as an idea of proximity and resemblance. We exclude the idea of transcendence as well as that of superiority to characterize metascience. We prefer the idea that meta- evokes reflection, a reflection on science, but also that it refers to the idea that metascience is with-science.

2.4 Classification of Metasciences

In order to continue our characterization of metasciences, we propose a preliminary classification of these. It is experience that will ultimately dictate the division of the metasciences, in the same way that experience dictates the division of the sciences.

We have already mentioned four metascientific disciplines: ontology, semantics, epistemology and methodology. In fact, we distinguish between general ontology, semantics, epistemology and methodology, and particular ontology, semantics, epistemology and methodology, the two kinds associated with each of the four major scientific fields of physics, chemistry, biology and psychonology[10]. So there are general metasciences and specific metasciences.

At the most general level of particular metasciences, we find metaphysics, metachemistry, metabiology and metapsychonology. Note that we give a limited meaning to metaphysics: metaphysics is the metascience of physics. The metaphysician is then a physicist who conceptually studies physics in its semantic, epistemological, methodological and ontological aspects in order to obtain metascientific results and ideally producing metascientific theories. These four particular metasciences, metaphysics, metachemistry, metabiology and metapsychonology are said to be integrative because they are linked to the four integrative levels of organization of reality: the physical, the chemical, the biological and the psychonological. Note that scientists have divided their four main disciplinary fields

[10] In order to avoid using the expressions “psychology” and “metapsychology”, concepts already loaded with multiple meanings, we formed these neologisms, psychonological and psychonology, on the basis of psychon, to designate this level of organization that is the thinking matter and all the disciplines that are interested in it.

according to the four levels of organization of matter[11]. This is no coincidence since the properties studied at each level of organization cannot be reduced to the properties of the other levels[12].

We must dwell for a moment on the notion of level since the notion is important in itself for the classification of the metasciences, but also because we present a conception of levels slightly different from that which Bunge usually advances. Since he started thinking about the concept of level over sixty years ago, Bunge has conceptualized levels of reality slightly differently from one era to the next. In fact, what seems to be constant in Bunge is to admit the existence of physical, chemical and biological levels. Things get a little less clear after the biological level. Very often Bunge postulates a social level after the biological level, sometimes this social level is preceded by a psychological level, but this psychological level is often a sub-level of the biological level. Sometimes a technical and semiotic level is added[13]. Bunge also maintains that each integrative level can be analyzed in as many sub-levels as necessary, micro, meso, macro, mega, etc.[14], which we call integrated levels. For example, physics can be subdivided into microphysics, mesophysics, macrophysics and megaphysics. We believe that psychonological and social levels are part of this last pattern.

Within the framework of the concept of metascience defended here, psychonology covers the whole of disciplines grouped under the human sciences, social sciences, psychology and neurosciences, in the same way as physics, chemistry and biology embrace all disciplines that deal respectively with physical, chemical or biological systems. In other words, psychonology is concerned with human in what distinguishes it from the three other levels of organization of matter. More precisely, psychonology

[11] There are still debates about the nature and the number of levels. We adopt in this text a conception of the organization of matter in four levels.

[12] See Bunge (1959a) for a discussion of the imperfect correspondence between ontic and epistemic levels.

[13] For some representations of levels in Bunge, see, in particular, "Levels: A Semantical Preliminary" (1960, sect. 9), "Emergence and the Mind" (1977b, p. 504), Ontology II: A World of Systems (1979a, p. 46), Épistémologie (1983a, chap. 7, sect. 4), Matérialisme et humanisme (2004, sect. 3.13 et 4.3), Le matérialisme scientifique (2008, chap. 2, sect. 6), Matter and Mind (2010, sect. 5.8), Evaluating Philosophies (2012a, sect. 18.3).

[14] On the concepts of micro-, meso-, macro-level, etc., see "The Power and Limits of Reduction" (1991, sect. 3), Finding Philosophy in Social Science (1996, chap. 10, sect. 5), Emergence and Convergence (2003a, chap. 9, sect. 2), Matter and Mind (2010, sect. 5.8).

is interested in thinking matter, in the same way as physics, chemistry and biology are interested respectively in physical, chemical and living matter. This thinking matter has systemic or emerging properties, such as the faculties of reasoning, thinking, abstracting, socializing, setting standards, making plans, and many others, whose physical, chemical or biological matters are not endowed. Thinking matter is conceived as matter in its own right. We are organisms, biological beings, within which a non-physical, non-chemical and non-living matter develops: psychonological, mental or thinking matter. The elemental neural unit of thinking matter is called psychon by Bunge. It is the smallest unit able to perform a mental function (see in this regard, Bunge 1979a, chap. 4, sect. 1.2, 1980, chap. 2, sect. 2, 1983b, chap. 1, sect. 1.1). These objects or systems are no longer living matter. Analogy: the cell is not a chemical reactor.

Although the idea of thinking matter has been in the air for several decades, it is not easy to accept. There is a very noble ideological reason which exerts undue pressure to the point of preventing even some scientists from exercising a critical reflection on the question: human beings would not be apart from the animal kingdom! However, our ancestors correctly perceived the unique nature of human beings in the same way that they correctly perceived the unique nature of life. The incorrect interpretations they may have formulated of human nature (and also of the nature of the non-living and the living), particularly in terms of superiority, illustrated by the notion of scala naturæ, or the Great Chain of Being, must not be a hindrance to the acceptance of the idea of thinking matter.

Animal romanticism and the fear of making the same mistakes as our predecessors do not mix well with critical thinking. The idea that humans are no longer animals is not in itself a theological idea. The prowess of “higher animals”, as wonderful as it may seem to us as lovers of nature, has nothing in common with those of thinking matter. This amounts to saying that the animal brain is not endowed with psychons. In other words, the so-called superior animals do not think. The “mental” functions that we attribute to them would be advanced biological functions. It is not these functions that would distinguish thinking matter from biological matter. Or these functions would be necessary for the appearance of thinking matter but not sufficient. Does this make humans external to nature? No, since thinking matter is anchored in living matter, the latter is anchored in chemical matter, and the latter is anchored in physical matter.

The idea of thinking matter will not instantly resolve psychonological problems. Like any general hypothesis resulting from a reflection on the concrete world, it should help to steer minds towards relevant questions.

We now advance the idea that the social is not an integrative level, but rather a level integrated into the psychonological. Let us take the biological as an analogy. Let's also take two extremes of this level of organization, the living cell, the basis of living matter, and an ecosystem. According to the notion of integrated levels, we say that the study of cells is a matter of cytology, the micro level, and the study of ecosystems is a matter of ecology, the macro level. It is clear that it is not the ecosystems which metabolize but cells. However, scientists still include ecosystems in the biological or the study of ecosystems is part of the biological sciences, with the contribution of other disciplines if necessary. Likewise, we believe that societies, although they do not think, should be included in the psychonological, the basic unit of which is the psychon, the micro level, which "thinks" or performs a mental function. In other words, the study of societies is part of the psychonological sciences. Thus, the social is a macro level integrated at the integrative level which is the psychonological. We therefore propose a representation of levels of reality as illustrated in Figure 2[15].

In any event, all of the above is analogy, informed, we hope. It is scientific advances in neuropsychology, and an in-depth knowledge of them, that will inform us and inform metascientific research. In the meantime, we can think about the problem by studying the question of the reducibility of chemistry to physics and that of biology to chemistry (see Bunge 1973a, 1979b, 1982).

To summarize the above discussion, we propose this preliminary classification of metasciences. There are four disciplines in their most general conception: 1. general semantics, 2. general epistemology, 3. general methodology, 4. general ontology. So there is a general metascience. Then there are the same four disciplines, but associated with the four main disciplinary fields of physics, chemistry, biology and psychonology. So there is the semantics, the epistemology, the methodology and the ontology of physics, chemistry, biology and psychonology, which gives the following four

[15] We have not included a technical and semiotic level, concepts advanced by Bunge, since our reflection on the relevance of these levels is not yet finished.

integrative metasciences: 1. metaphysics, 2. metachemistry, 3. metabiology, 4. metapsychonology.

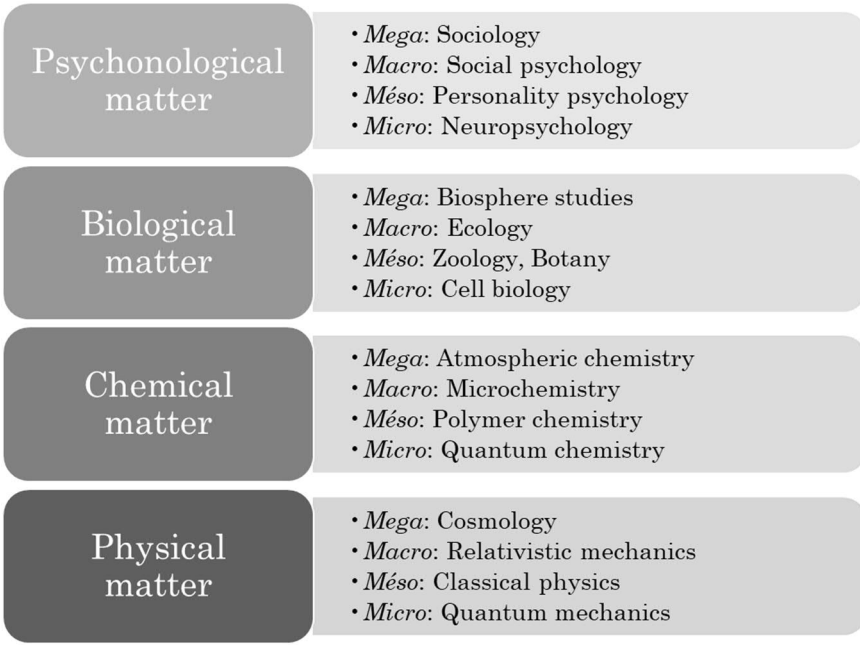

Figure 2: Representation of ontological levels
Disciplines are indicated for illustrative purposes.

Thus, general metasciences are fed by four specific metasciences, which are fed by the four main disciplinary fields of the factual sciences: physics, chemistry, biochemistry and psychonology. More specifically, if you specialize in a scientific discipline, for example sociology, which is part of psychonology, we will then speak of metasociology or metascience of sociology, an integrated and not an integrative metascience, and you will invest yourself in research on semantics, epistemology, methodology and ontology of sociology in order to ideally produce metasociological theories, that is to say a general discourse on sociology (semantics, epistemology and methodology) as well as a general discourse on the social world (ontology). Figure 3 shows schematically the links between the factual sciences and the conceptual sciences.

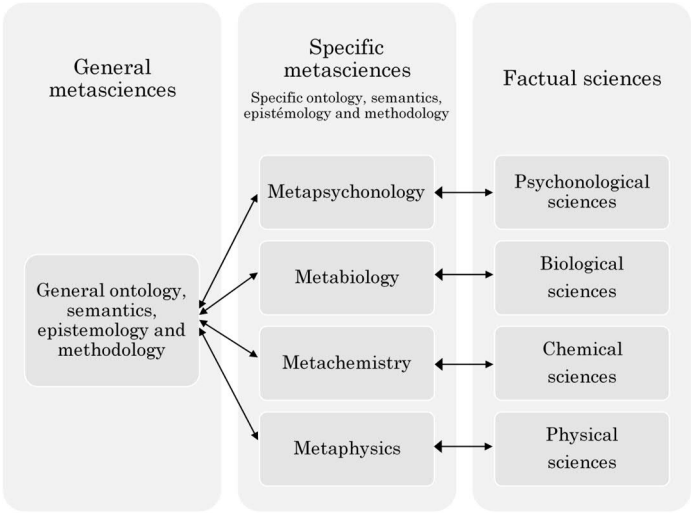

Figure 3: Links of influence between the conceptual sciences and the factual sciences
The arrows indicate the direction of influence. For a double arrow, a larger tip indicates a stronger influence. In order not to burden the figure, we have omitted the arrows of "vertical relations": the particular metasciences are all linked together by reciprocal relationships two by two, while the major disciplinary fields of factual sciences are linked together by one-sided relationships that range from the physical sciences to the psychonological sciences.

The diagram is designed from the point of view of metascience. There is no link of superiority implied by placing the metasciences on the left. Note that the disciplines of the particular metasciences and those of the factual sciences in Figure 3 do not have the same kinds of relationships with each other. While there is a dependence of nature that unites the factual sciences, this dependence is circumstantial in the case of metasciences. Thus, any metascience can influence any other metascience, which is not the case with the factual sciences. Constructs of psychonological sciences have no influence on constructs of physical, chemical and biological sciences, while some constructs of physical, chemical and biological sciences have influence on psychonological sciences. Ontologically, nomic relationships, i.e. laws, of a level are constrained by the nomic relationships of the levels that precede it, which requires that statements that describe the nomic relationships of a given level be consistent with statements that describe the nomic relationships of the levels preceding it. On the other hand, psychonological sciences can have an influence on the teaching of science and on the creativity of scientists, but the constructs of the other

three major disciplinary fields do not contain any constructs from psychonological sciences.

Let us take note of the almost complete absence of the concept of threshold in philosophy, linked to the concept of emergence. However, threshold phenomena are well known to the factual sciences. Just think of the phase transitions in physics. Any specialist, be it in physics, chemistry, biology or psychonology, can name dozens of examples of threshold phenomena that give rise to the emergence or submergence of properties. In other words, a critical reflection, once exposed to examples of thresholds and to the radical transformations that physical, chemical, biological and psychonological matter undergo at certain thresholds, leads us to conclude that reality is organized into levels. The refusal to admit the phenomena of threshold, emergence and qualitative leaps, as well as the notion of level, is linked to the transcendent nature of philosophy. A transcendent philosophical mind cannot be satisfied with a scientific explanation of these phenomena. There would be a "philosophical" explanation, an answer to a why and not only to a how, and this explanation should expose a necessary philosophical connection, other than a necessary link inherent in matter. However, there is no explanation for the fact that objects exhibit a particular property. The question, "Why this property rather than another?" is a particular case of the question, "Why something rather than nothing?" And this last question is a theological question, as Bunge points out, or more generally a transcendent question. For philosophers, science offers no explanation because it cannot say why the world is what it is and not something else.

Finally, the term "level" is unfortunate but it is consecrated. It leads us to think that there is a hierarchical order. The only order that characterizes the level structure is that of precedence, "Level 1 precedes level 2", i.e. a level precedes another level if and only if all objects in the second level are composed of objects from the first level (i.e. objects that have the characteristic properties of the first level). The expression also suggests that reality is made up of homogeneous layers. But as Bunge points out, levels are constructs and not concrete objects, that is, we group with the mind all physical, chemical, biological and psychonological objects into

distinct sets[16]. In fact, objects in all four levels interact and interpenetrate. Hence the complexity of reality and the difficulty of studying it.

2.5 Non-Metascientific Disciplines

We said that any transcendent general discourse can reduce any other discourse to its own frames of thought. Metascience, as an immanent general discourse, does not purport to replace the general discourse of connivance or living-together, consisting of axiology, ethics and praxeology, even if the latter can use scientific and metascientific results in the context of their reflections. Thus, there is no metascientific axiology, ethics and praxeology as there can be axiology, ethics and praxeology in philosophy[17]. Metascience is therefore radically different from transcendent general discourses since it does not attempt to find a link that would unite natural laws with human laws. Human laws are conventions while natural laws are representations of natural regularities that exist objectively, independently of us. No law of nature prevents us from adopting anti-social conventions. In fact, all societies of all times have condoned barbaric practices, and any establishments have always maintained, explicitly or implicitly, a double morality, one that applies to them and another that applies to us. Metascience is therefore not concerned with the living-together. That said, Mario Bunge's contribution to the general discourse of connivance is just as exceptional as his contribution to the scientific general discourse.

Unlike transcendent philosophies, metasciences do not attempt to advance "interpretations" of formal sciences. There are already formal metasciences that deal with logic and mathematics: metalogic and metamathematics. Although independent of the conceptual sciences and the factual sciences, the formal sciences play a considerable role in the development of knowledge. The neutrality of the formal sciences, the fact that they say

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[16] For the notions of level and precedence, see Bunge (1979a, chap. 1, sect. 1.5).

[17] Volume 8 of Bunge's Treatise on Basic Philosophy, Ethics: The Good and the Right, is an arbitrary addition. There is no necessary connection between Bunge's ethics and his metascientific theories. The author of the Treatise was reasonable enough not to attempt to make such connections. There is a tension in Bunge's work between his desire to know the world and make a representation of it based on science and his desire to be part of the philosophical tradition and to be recognized as a professional philosopher. It was this same tension that made him abandon the use of the expressions metascience and metascientific after the 1970s in favor of the expressions philosophy of science or foundations of science.

nothing about the concrete world, which is the responsibility of the factual sciences, and that they say nothing about the world in general and the factual sciences that study the world, which is the responsibility of the conceptual sciences, allows us to have a rigorous common language. Formal sciences are a subject of study for logicians and mathematicians and a tool, an organon, for scientists and metascientists[18]. Note that metascience is a subject of study for metascientists and an organon for factual science, and the latter is a subject of study for scientists and an organon for any endeavor that requires scientific results to succeed. The scientific triad made up of formal, factual and conceptual sciences is a subsystem of the system of human knowledge as conceptualized by Bunge (1983c, chap. 14, sect. 3.1). It is the system of scientific knowledge. Figure 4 shows schematically the links of dependence or influence within the triad.

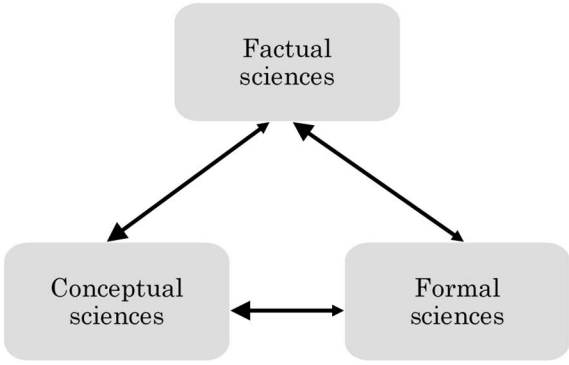

Figure 4: Links of influence within the scientific triad
The arrows indicate the direction of influence.
For a double arrow, a larger tip indicates
a stronger influence.

[18] For examples of formalization of metascientific theories see the first four volumes of the Treatise on Basic Philosophy. Pay particular attention to the fact that Bunge uses general mathematics to formalize his concepts and theories. He makes extensive use of set theory, but also group theory. These general theories can be applied in the same way that geometry, algebra and analysis can be applied. This is to say that Bunge associates metascientific semantic postulates with his formalism, just as factual sciences associate factual semantic assumptions with their formalisms. In other words, Bunge's formalism refers to extra-logical or extra-mathematical objects, the concepts of factual science, objects that Bunge has set himself to study, in the same way that the formalisms of factual sciences refer to extra-logical or extra-mathematical objects, objects of the world, objects that science has given itself to study.

Another discipline which is not a metascience, but which is of great importance for his development, is the history of science. Bunge points out that this is a large laboratory for the metasciences (Bunge 2003a, p. 173). Another laboratory is the critical analysis of academic pseudosciences, such as psychoanalysis, neoclassical economic theory, game theory, decision theory, rational choice theory, ethnomethodology, etc. The application of metascientific concepts and theories should make it easier to identify such pseudosciences. We also mentioned that a major task awaiting metascientists for years to come is the operation of recovering philosophical concepts with metascientific value. Such texts of critical analysis of philosophy can be an opportunity to distinguish the metascientific approach from the philosophical approach.

Contrary to a practice that seems to be spreading, we exclude from metascience the sociology of science, the history of science, the philosophy of science and science studies. Sociology and history of science are not metasciences since they are factual sciences. In general, it does not occur to us to name metaculture or metasociology of culture, the sociology of culture, or, again, to name meta-education or metapsychology of education, the psychology of education. Being interested in culture or education does not make a discipline a metaculture or a meta-education. So why would being interested in science make history or sociology a metahistory or a metasociology? History and sociology of science study concrete facts in their historical and sociological contexts, and not the products of science detached from these contexts. As far as transcendent doctrines in the philosophy of science are concerned, they can only confuse metascientific research and hinder the development of a scientific general discourse.

Be careful not to confuse history of science with history and philosophy of science. This last discipline treats the history of science from a philosophical point of view, and therefore, very often, in a transcendent way. A true history of science is practiced by historians who use historical methods, research methods specific to this factual discipline. Finally, “science studies” are part of a reactionary, irrationalist and anti-scientific social movement of intellectuals within universities. “Studies” form a heterogeneous set of ideologies and philosophies that passes for multidisciplinarity and interdisciplinarity. This cultural movement seeks to discredit scientific disciplines and replace them with “studies”. Intolerance towards this

movement is essential since the search for truth is denigrated within the institutions that are tasked with advancing science (Bunge 1995).

2.6 A Metascientific Community

To escape the influence of transcendent philosophy is not easy if we are too attracted to general discourse, and not enough to factual science. In fact, even if we have a real desire to know the world and even though we believe that science is the best way to achieve it, it remains difficult to detach ourselves from philosophy since it is the only example of general discourse that presents itself to us.

Unfortunately, being a scientist and immersing yourself in Bunge's metascientific spirit will not be enough at this stage of metascience development. It cannot be assumed that Bunge recovered everything that needed to be recovered or that he had properly recovered everything that he himself had recovered. It is the nature of scientific research to constantly revise its concepts and theories. Nevertheless, you will have to familiarize yourself with philosophy. If you are already a philosopher, professional or not, you already know philosophy. If you are also a teacher or professor-researcher in philosophy, you can desert transcendent philosophical sects and become a masked metascientist within departments of philosophy. In any case, all you have to do is become a scientist and develop your metascientific mind.

If you are a scientist with a penchant for generalizations, interested in general questions about the world and science, reading Bunge's work will help you develop your critical thinking and metascientific spirit, but you will be still forced to read a good number of philosophical texts, if only to follow Bunge's thought, who, as the first metascientist, refers to many philosophers as well as many philosophical doctrines. There is no ideal course for a student who would like to become a metascientist. The only advice we can offer at this point is that of reading scientific realists and Bunge's work while learning philosophy, but also studying a science. And that of keeping both feet on the ground ... on this Earth.

What are the safeguards for the metascientist? What can keep him with both feet on the ground? Factual and formal sciences have equipped themselves to prevent unbridled speculation from hindering their development. This does not prevent pseudoscientific theories being developed

or even that academic pseudosciences are developing in a remarkable way. However, in general, the whole thing is kept under control within the physical, chemical and biological sciences. It is only in the psychonological sciences, for which there is also a lot of serious research, that literate charlatans can still prosper. Do we have a set of criteria in metascience that would avoid the wildest speculation? We think so. We mentioned that all the doctrines supported by Bunge ensure that his thinking is no longer philosophical. It is therefore enough to support a set of similar points of view to avoid slipping too often. In other words, we take as our starting point the general postulates mentioned before, which are taken for granted by science and now by metascience. Without these restrictions, the scientific general discourse will never reach sufficient unity of thought; the plethora of philosophical doctrines is not a mark of open-mindedness. Even if the list of general postulates will never be exhaustive, even if certain general postulates are problematic and subject to debate, there is no need to question the existence of reality or to believe that you are the only spirit to exist!

Of all the general postulates necessary for metascientific research, the most important is the reality/fiction dichotomy, which involves other dichotomies: factual/formal, thing/construct, property/attribute, etc. If you fail to convince yourself that constructs of the mind do not muddle with concrete objects, it is unlikely that you will be able to advance any metascientific research. In science, even if a researcher maintains many beliefs, he will still undertake his research according to scientific criteria. Unlike science, metascience requires the researcher to have a clear and distinct idea of reality and constructs. The reality/fiction dichotomy is not only a necessary safeguard for metascientific research, but it also constitutes a criterion of demarcation between metascience and transcendent philosophy. Any idea which implies a confusion between reality and fiction, between the factual and the formal, a thing and its construct, a property and its attribute, must be classified among the transcendent philosophical ideas and be rejected for this reason.

Even the good faith reader might be tempted to think that it is risky to categorically exclude some philosophical ideas. Doesn't history show that ideas rejected at one time were accepted in later times, both in the factual and formal sciences? As long as a concept is factual or formal, there is a possibility that it is right; it must pass the tests and meet the evaluation

criteria of science. This does not apply to the strictly philosophical concepts, which presuppose a form of transcendence. As soon as there is reification or ideaefication, there is transcendence[19]. More precisely, as soon as an ontological, epistemological and semantic quality is attached to a "logic", there is reification and therefore transcendence. There will never be anything good to draw from conceptions that postulate the existence of fiction, as Laplace argued before Napoleon I according to an anecdote reported by Victor Hugo (1972):

> Mr. Arago had a favorite anecdote. When Laplace published his Celestial Mechanics, he said, the emperor [Napoleon I] brought him in. The emperor was furious. "How," he cried, seeing Laplace, "makes you the whole system of the world, you give the laws of all creation, and in all your book you do not speak once about the existence of God!" "Sire," replied Laplace, "I did not need this assumption."

We can therefore reject without further ado all transcendent philosophical concepts without fear of missing out on history or of remaining in the annals like the one who has not been able to appreciate an idea at its true value.

2.7 Bunge as the Alternative

From the point of view of metascience, Bunge is the last of the philosophers and the first metascientist. He retains from philosophy the idea of a complete system that would integrate semantics, ontology, epistemology, ethics, axiology and praxeology, but he refuses to problematize in the same way as philosophy. In particular, he rejects the appearance/reality dichotomy, fundamental to transcendent philosophers. Since Bunge is the first true metascientist, it is therefore wise to take his work as a starting point. This starting point must remain what it is, a starting point. The research program we are proposing is not free of pitfalls. The biggest trap

[19] We find the following definitions in Bunge's Philosophical Dictionary: Reification: The treatment of a property, relation, process, or idea as if it were a thing. Example: "I have worries" instead of "I am worried"; the popular notions of energy, mind, justice, and beauty as entities; the ideas that language (rather than a speaker) is creative and grows in the mind; and the theses that biospecies are individuals, and that lineages are historical entities. Ideaefication: The construal of concrete things or processes as ideas, in the manner of Plato and Hegel. Contemporary examples: the identification of a solid body with the set representing it; of a basket of goods with the vector representing it; and of a social mechanism with a theoretical model of it.

that awaits us is that of indulging in intellectual laziness and indulging in a futile exegetical exercise. Yes, we must immerse ourselves in Bunge's work, just as physicists have imbued themselves with the works of Kepler, Galileo or Newton, and yes we must assimilate the way of thinking of this thinker, which is none other than the way that scientists think, but, no, we must never debate what the master really said. The aim is not to develop a school of thought, but rather to develop a representation of the world in accordance with science. Bunge's work should not be seen as a system of thought to be preserved, but rather to be surpassed.

What is most important in this work is not the results, although it was a feat of having produced them, but the way of thinking that led to them. The exercise is not easy since general discourses tend to split into separate schools of thought. One of the objectives of Mεtascience is to promote the development of metasciences in a unified framework. In fact, the future of metascience rests on the usefulness of metascientific results for the sciences, and this usefulness has not been proved. So far, scientists have managed to solve their problems with some implicit preconceptions while submitting themselves to the standards, criteria and methods of science. In any case, we must never lose sight of the fact that we want to know the world, the natural world, the concrete world, the material world, the worldly world. This future also depends on our ability to develop a community of researchers who agree on the objects of study of metascience, on relevant and acceptable problems, on the methods for studying them and on the criteria for evaluating metascientific results.

Just as the scientific approach is one, but made up of a multitude of methods, the metascientific approach should be one, but made up of a plurality of methods. We are Bungeans as we are Galileans.

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all programmers, especially those who offer free and quality software, without which the intellectual work would be much heavier; these tools make up for the lack of resources of an independent researcher.

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