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INTRODUCTORY ESSAY: METAPHYSICS AND SCIENCE: A FICKLE RELATIONSHIP[1]

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1 Introduction

The relation between metaphysics and science has historically been marked by tribulation. It was heavily influenced by contemporary events, most notably the scientific revolution of the early modern period[2]. One important reason the scientific revolution had such an impact is that it changed our ideas of science profoundly, giving it its own methods and fields of enquiry. Gradually, the intimate bond

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[2] In using the term 'scientific revolution', I do not wish to suggest that it concerns a single, unique event that can be delineated sharply from the preceding and succeeding periods (cf. Shapin 1996). Rather, I use the term in the ordinary sense, namely to denote the highly heterogeneous collection of intellectual achievements stretching from about 1550 to 1700, including the most important discoveries made by such towering figures as Copernicus, Galilei, Kepler, Newton, Boyle etc.

between philosophy and science that had existed since antiquity was severed. This was a long and dynamic process, and many philosophers have resisted it (and some still do), but ultimately, the successes of the new sciences made metaphysics, with its age old problems and intractable disputes, look unfruitful by comparison. The various positions on the relationship between metaphysics and science that have since been developed by philosophers, can be interpreted as attempts to come to grip with this new situation.

In this introductory essay, I will present the main changes that the relation between metaphysics and science underwent during the past centuries. By and large, it is a story of increasing separation, and yet, as we will see, there are reasons to believe that a revival of the relationship is possible. The various contributions to this special issue are testimony to a renewed interest from philosophers of science in the various roles metaphysics plays in scientific practice.

This essay describes the various attitudes philosophers and scientists have displayed toward metaphysics over the centuries. There are, of course, dissenting voices in every era, but I will confine myself to describing the general attitude that prevailed at the time. In section 1, the pre-Kantian attitude is described. This era is marked by a profound respect for metaphysics, which was thought to describe the fundamental structure of reality, and to be the foundation upon which all further scientific inquiry rests. In section 2, the Kantian position is discussed. Here, the focus shifts away from reality towards the knowing subject. Bluntly put, according to this school of thought, metaphysics is the way we carve up the world. In section 3, the anti-metaphysical attitude of the logical positivists and logical empiricists is described, according to which metaphysical claims are nonsensical. Section 4 traces the reverberations of this dismissive attitude towards metaphysics through 20th century philosophy of science, ending with the possibility of a revival for metaphysics as relevant to science.

Section 5 concludes the essay with a brief recapitulation and a description of the contributions to this special issue.

2 Early days: metaphysics as the foundation of science

Today, we mostly take it for granted that metaphysics and science are distinct enterprises. People might disagree as to what this distinction precisely amounts to, and there may be intellectual pursuits that are not so easily classified as belonging to either one or the other[3], but in very broad terms we can say that metaphysics is a branch of philosophy rather than a scientific discipline. In turn, this implies that there is a difference between philosophy and science – an implication that, again, will generally meet with approval both inside and outside the academic community. Yet we would do well to remember that these distinctions are historically contingent. In antiquity, philosophy, metaphysics and science were held to be closely related. Aristotle referred to the branch of philosophy that would later become known under the heading 'metaphysics' as 'first philosophy', that is, one philosophy among many other philosophies that included disciplines we today would label as scientific, such as physics, astronomy and biology.

Nevertheless, as the term 'first philosophy' indicates, for Aristotle, there was something different about metaphysics. Whereas all the other

[3] More specifically, the boundaries between metaphysics and science are often blurry, and some working in theoretical physics or philosophy of physics might not care to draw such a distinction at all (the same applies to the relation between theoretical biology and philosophy of biology). Indeed, I do not think that a rigid distinction is to be had. However, nothing in this essay requires anything beyond the rough intuition that metaphysics and science are different endeavors.

sciences study reality (or 'being') under some special aspect, for example in so far it is physical or living, metaphysics studies reality as such, that is under no specific aspect. On this account, metaphysics is the most general of the sciences, and its aim is to provide insight into the fundamental structure of reality – to uncover the first causes (*aitia*) of things. In his *Metaphysics*, Aristotle adds another qualification that helps to bring the distinct character of his first philosophy to the fore: whereas physics studies material, changing objects, metaphysics studies that which is eternal and unchanging. The status of metaphysics as the most general of sciences was affirmed in medieval times, with philosophers like Thomas Aquinas and Duns Scotus referring to it as the study of 'being qua being'.

In the early modern era, epistemology replaced metaphysics as the primary branch of philosophy. In no small part, this was due to the rise of the metaphysical doctrine of corpuscularism, which in the sixteenth and seventeenth century came to replace the old hylomorphist metaphysics. According to this new doctrine, the physical world is comprised of tiny particles that interact solely by means of local contact. This view had its consequences for theories about perception. Whereas for Aristotle, perception is the reception of the forms with which all objects are imbued, for the corpuscularist perception essentially involves the senses being bombarded by an astronomical number of incoming physical corpuscles – hence, an epistemological divide between the manifest and scientific images of reality arose, and with it the need to justify the reliability of sensory experience (Sellars 1963 ch. 1). Thus, in his *Meditations on First Philosophy* (notice the use of the Aristotelian phrase 'first philosophy'), Descartes effectively embarked on an epistemological project, considering seriously the possibility that all our opinions about the outside world are radically mistaken. Nevertheless, it should be evident that this dominance of epistemology primarily concerns the way in which one should study philosophy: the aim is still to uncover the metaphysical truths on which

all our knowledge is to be founded. Ultimately, the meditations are aimed at establishing, among other things, the existence of God, the outside world, and the immortality of the soul.

Thus, the status of metaphysics as providing the foundations of science lasted well into the seventeenth century, that is, during the scientific revolution itself. In the preface to the French edition to his *Principia Philosophiae*, Descartes famously likened the whole of philosophy to a tree, the roots of which are constituted by metaphysics, the trunk by physics, and the different branches growing from the trunk by all the other various sciences. Indeed, the structure of the *Principia* itself mirrors this ordering, first establishing metaphysical claims about the existence and nature of God, substances, and free will, and only then turning to explanations of physical phenomena.

Descartes was not alone in his admiration of metaphysics as providing the foundations of science. For all their differences, other seventeenth-century philosophers such as Spinoza, Malebranche and Leibniz vigorously pursued metaphysics, constructing complex systems or worldviews in which the results of modern science played an important role, but the foundations of which were effectively shaped by their views on God, substances, modes, attributes, contingency, necessity, and so on. For Leibniz, the forces that were studied by physics were derivative of what he called 'primitive forces' that are the subject of metaphysics (Letter to Clarke, reprinted in Ariew & Garber 1989 p. 119). In case conflicts between scientific hypotheses and metaphysical principles, it was by no means a foregone conclusion that the former would win. This is exemplified in Leibniz's dismissal of the void in nature on metaphysical grounds:

> I lay it down as a principle that every perfection which God could impart to things, without derogating from their other perfections, has actually been imparted to them. Now let us fancy a space wholly empty. God could have placed some matter in it without derogating, in any respect, from all other

> things; therefore, he has actually placed some matter in that space; therefore, there is no space wholly empty (Letter to Clarke, quoted from Ariew & Garber 1989 p. 332).

There was a time then, when metaphysics was regarded as the primary science, providing the foundations of all the other sciences. This situation did not last however, as philosophers soon became disillusioned with its lack of results compared to other sciences. Even Leibniz, who still believed metaphysics to be the most fundamental branch of philosophy, sometimes lamented its poor condition – hence his desire, voiced in his *Reform in Metaphysics* and *Primary Truths*, to adopt the methods of geometry in metaphysics (Brown & Fox p. 198). The first serious dints in the reputation of metaphysics however, appeared in the works of the empiricists and Kant, to whom we now turn.

3 Locke, Hume and Kant

Arguably, the first cracks in the relationship appeared in the works of the great empiricists. Locke, in his *Essay Concerning Human Understanding*, still referred to physics as 'natural philosophy'[4] (1975), but nevertheless embarked on a path that would ultimately result in a depreciation of metaphysics. According to Aristotle's *Posterior Analytics*, the proper objects of science are necessary truths, expressed in syllogisms. On this account, when it comes to understanding nature,

[4] During this period, the Latin word 'scientia', from which our word 'science' stems, was still reserved for knowledge gained by means of logical demonstrations, and thus associated mainly with mathematics and geometry. In the centuries to come, the term 'science' would be increasingly used to refer to the products of observation and experiment rather than formal proof.

scientific knowledge is knowledge of formal causes or essences. To avoid infinite regresses, this means that the premises of the syllogisms should be self-evident. According to Locke, with the exception of fields like algebra or geometry, this level of certainty is simply not on the cards. Science is ultimately a human affair, and while he maintains demonstrative certainty as an ideal, perhaps attainable by minds more powerful than ours (God or angels; Ibid. p. 440), when it comes to understanding nature, we cannot know the essence of substances. If we did, we could infer the qualities of substances by means of deduction: we would know from the essence of hemlock that it causes death, and from the very idea of opium we could infer that it causes sleep, without 'trial' (Ibid. pp. 16-19). Failing to meet this standard, we are left with trial and experimentation.

Accordingly, we do not know the necessary connections between properties of substances, but only their regular co-existence. This constitutes a kind of knowledge which transcends mere opinion, even though it does not attain the ideal of certainty. The requirement for this kind of scientific knowledge is that our complex ideas are ultimately reducible to simple ideas that correspond to observed instances of co-existence in nature.

Although Locke still hesitates to discard the ideal of certain knowledge of the essence of substances, it stands to reason that others would draw more radical conclusions. Indeed, Hume further develops these points, effectively framing a strategy for rooting out metaphysical speculations from among our scientific views. Hume's views on these issues are familiar enough, so I will suffice with a brief summary here. Distinguishing between impressions, or the lively perceptions of the outside world, and ideas, or the 'faint copies' of impressions, Hume invites us to provide, for any idea, the original impression from which it stems. Applying this strategy to the metaphysical notion of a necessary connection, he argued that there is no corresponding impression – ultimately, it is a feeling of necessity in our own mind. Hume's further

distinction between relations of ideas and matters of fact is meant to exhaust all the 'objects of human reason and enquiry', effectively sealing the fate of metaphysical speculation, which neither resembles the necessary mathematical or geometrical claims belonging to the former, nor the factual and contingent claims belonging to the latter, and culminating in the sweeping statement at the very end of the *Enquiry Concerning Human Understanding* to commit all books that contain neither of them to the flames.

In short, it became increasingly apparent that there was something very different about metaphysical claims when compared to the theories provided by natural science. Where during the scientific revolution, the physical sciences proved themselves capable of producing spectacular successes, metaphysics, with its perennial problems regarding causation, souls and free will, seemed to utterly lack progress. Considerations like these led Kant to refer to metaphysics despairingly as a 'battleground' on which endless controversies were discussed without any hope of resolution – case in point being the inability to prove the existence of the external world, the so-called 'scandal of philosophy'.

> Time was when metaphysics was entitled the Queen of all sciences; and if the will be taken for the deed, the pre-eminent importance of her accepted tasks gives her every right to this title of honour. Now, however, the changed fasion of the time brings her only scorn; a matron outcast and forsaken, she mourns like Hecuba: *Modo maxima rerum, tot generis natisque potens – nunc trahor exul, inops* (Kant 1781, A viii-ix)[5]

[5] The Latin quotation derives from Ovid's *Metamorphoses* xiii. Roughly, it translates as: "Earlier I was endowed with the greatest things, many sons, now I am dragged away into exile, helpless."

As is widely known, Hume's distinction between relations of ideas and matters of fact foreshadows Kant's distinction between analytic and synthetic judgments, which, paired with the epistemological distinction between a priori and a posteriori judgments, seems to leave little room for metaphysics, since its claims appear to be neither analytic a priori, nor synthetic a posteriori. Although Kant did believe that this situation could be remedied, in particular through his own project of transcendental philosophy, in the long run his efforts were not enough to counter the idea of metaphysics as an obsolete discipline. In a sense, philosophy as we know it today is the result of a process of peeling away disciplines, leaving us with a substratum marked (if we go along with Hume and Kant for a moment) by confusion and dogged controversies.

4 Metaphysical claims as (dangerous) nonsense

In the early twentieth century, things got still worse for metaphysics. The dislike of the logical positivists for metaphysics has been well-documented. Particularly striking is their assertion that rather than being false, or even so speculative that we can never be sure about them, metaphysical claims are in fact nonsensical: in order to be false, a statement should at least make sense. The characterization of metaphysics as consisting of nonsensical statement is arguably the most damning indictment of metaphysics yet. What made this attack so much more vehement and destructive than any previous critique?

According to the logical positivists themselves, the introduction of modern symbolic logic takes the lion share of the credit (or bears the brunt of the blame, according to your personal inclinations), together with the application of logic to language. The idea was that through application of logical analysis, the sciences could be made stronger by

illuminating scientific concepts and their interrelations, while metaphysics could be *demonstrated*, rather than merely claimed, to contain only nonsense. Thus applied, logical analysis constitutes a much more powerful weapon against metaphysics then was available in the time of Hume or Kant. Carnap informs us that:

> In the domain of metaphysics, including all philosophy of value and normative theory, logical analysis yields the negative result that all alleged statements in this domain are entirely meaningless. Therewith a radical elimination of metaphysics is attained, which was not yet possible from earlier antimetaphysical standpoints. It is true that related ideas may be found already in several earlier trains of thought [...] but it is only now when the development of logic during the recent decades provides us with a sufficiently sharp tool that the decisive step can be taken (1959, pp. 60-61).

According to Carnap, metaphysical statements contain words that fail to refer to anything, or if they do refer to something, are not properly put together according to the rules of syntax. They *pose* as meaningful statements, but careful analysis unmasks them as nonsense ('Scheinsätze'). Somewhat viciously, Carnap gives a lengthy quote from Heidegger's *Was ist Metaphysik?* and proceeds to analyze it. Needless to say, the verdict comes out negative (Ibid p. 231).

In any case, many of Carnap's contemporaries shared his anti-metaphysical stance. Metaphysical statements were viewed as neither analytic nor a posteriori, and as such suspect. Schlick wrote that if positivism should be understood as the view that metaphysics is impossible, he would happily subscribe to it (1991, pp. 37-38). Neurath conceived the unification of science as an anti-metaphysical project, and composed a so-called index verborum prohibitorum, a list of forbidden metaphysical terms. Wittgenstein's dictum that the meaning of a statement is the method of its verification was used as a means of sifting out meaningless, unscientific claims. We have to know what the

world should look like in order for a statement to be true or false. We don't know in the case of metaphysical statements, so there you go. Could things get any worse?

Yes they could. With the rise of totalitarianism on the continent and the outbreak of the second world war, events which of course had a major impact on the logical positivists and logical empiricists, Neurath became convinced that often, those who persecute others for their convictions often have strong metaphysical world views and a disregard for empirical evidence, while on the other hand, those who have an open mind, are pluralistic and allow the evidence to change their minds, are typically the ones who do not succumb to totalitarianism. In a letter to Carnap he remarked that:

> I found that empiricists on an average are less prepared to become merciless prosecutors [...] because they are not prepared to sacrifice their own and other people's happiness to something 'idealist' and antihuman. [...] I think that this merciless habit in history is very often connected absolutism in metaphysics and faith" (Neurath 1943).

Particularly in Plato's Republic, Neurath thought to have found evidence of how metaphysics can encourage fascism and totalitarianism (Parrini et al. 2003 p. 102). After the war, he would again comment on the supposedly unhealthy character of metaphysics, comparing the tolerant empiricist utilitarianism of the west with the metaphysical idealism that dominated in Germany (1946 p. 504).

Lumping together metaphysics, absolutism and persecution might seem a bit of a stretch, and I believe it is safe to say that the quote above represents a minority view, but it does exemplify a more general tendency to link empiricism with liberalism and political tolerance, and the more metaphysical philosophies such as idealism and romanticism

with nationalism[6]. After all, Neurath was not the only one who made a link between Platonic metaphysics and totalitarianism, as Popper's *The Open Society and its Enemies* attests.

5 Further developments in the 20th century and beyond

We have now hit rock-bottom. Not only is metaphysics nonsense, it is potentially *dangerous* nonsense. Fortunately, there is light at the end of the tunnel. As the twentieth century progressed, metaphysics has come to the forefront once more. In the latter half of the previous century, a number of philosophers started to question the views of the logical positivists and empiricists had on the relation between metaphysical and scientific claims. Maybe this relation was more complex than hitherto suggested, and perhaps this left some room for metaphysics to explicate some of the basic assumptions of science. Nelson Goodman, Willard Van Orman Quine, Hilary Putnam, Saul Kripke and David Lewis worked on a conglomerate of themes that can be labeled as metaphysical, including issues surrounding the notions of necessity and contingency, meaning and reference, and natural kinds. The ideas proffered by these philosophers in turn led to a complicated discussion about law-hood and causality, with a number of philosophers defending the view that there are certain necessary connections in nature that can be discovered by a posteriori means. In the philosophy of mind, the status of mental properties or events as natural kinds was deemed

[6] Galison (1990) provides an in-depth discussion about the relation between the philosophical views of the logical positivists and their political (and indeed, artistic) leanings.

directly relevant to questions about the relation between higher- and lower-level theories. Some of the principal figures here were Hilary Putnam, Jerry Fodor and Jaegwon Kim. Of course, this has everything to do with the question whether mental or functional states are multiply realized, and if so, what multiple realizability exactly entailed. This discussion, touching both metaphysical and scientific issues, is still actively pursued (Aizawa & Gillett 2009; Polger 2009; Shapiro 2008; Shapiro & Polger 2012; Wilson 2009). Don Ross and James Ladyman's comprehensive edited volume *Scientific Metaphysics* (2013) may serve as further testimony to the fact that these issues still influence contemporary discussion about the relation between science and metaphysics.

Meanwhile, the question of the explanatory status of laws, which occupied a central place in philosophy of science since Wesley Salmon and Philip Kitcher's criticisms of Carl Hempel's famous covering-law model of scientific explanation, has been raised anew at the dawn of the twenty-first century. This development is due in no small part to the rise of the new mechanist movement, the chief proponents of which, such as Carl Craver, Lindley Darden and Bill Bechtel, explicitly contrast their views on explanation with the old nomological views as exemplified by Hempel's model. The idea is that rather than explaining a phenomenon by showing that phenomenon to be an instance of a more general regularity, explanation often consists showing how a phenomenon arises as the result of the interplay of activities, entities and their organization, in short, as the result of a mechanism. However, since the relation between the mechanism as a whole and its parts is mereological in nature, this has led to a complicated metaphysical debate about whether inter-level relations are best seen as causal, or as some kind of constitutive dependency (cf. Craver & Bechtel 2006).

As a final example, consider the rise of so-called embodied/embedded cognition, a related group of research programs dedicated to free cognitive processes from their Cartesian isolation

within the subject, and understand it explicitly as being constituted by the interplay of brain, body and environment[7]. On this account, the environment is no longer a backdrop against which autonomous cognitive processes are played out, but actively constitutes a part of a dynamic, coupled interaction, along with the brain and the body. Yet at the core of this movement rests the extended mind/cognition hypothesis: the idea that the mind is itself extended beyond the skull of the subject (Clark and Chalmers 1998), which is fundamentally a metaphysical claim – indeed, the phrase 'extended mind' deliberately pokes fun at the Cartesian duality between *res cogitans* and *res extensa*. In this dynamical movement, even Heidegger's philosophy of being, Carnap's dismissive analysis notwithstanding, is now used to study cognition (cf. Wheeler 2005).

6 Conclusion and overview of the contributions

With all these historical developments in mind, we can rightly say that the relationship between metaphysics and science has indeed been a fickle one. But as the developments in the twentieth century and beyond show, it seems that metaphysics is making something of a comeback. It is probably safe to say that she will never again be queen of the sciences, but the idea that science and metaphysics can mutually influence each other, and moreover that this interaction is beneficial for both, is very much alive. Just how the two interact however, remains controversial. The various contributions to this special issue in

[7] For a spirited overview, see Clark 2008.

Philosophica attest to this. Let me end this introductory essay with an overview of these contributions.

The first contribution is by Cristian Soto. In *The Current State of the Metaphysics of Science Debate*, he conducts a detailed and critical analysis of contemporary discussions of the relation between metaphysics and science. He argues against the view that metaphysics is a guide to, or heuristic for, science, and against what he calls the 'maximalist' claim that metaphysics makes science possible. Instead, examples from scientific practice suggest that science can actually act as a guide to, or heuristic for, metaphysics, and that metaphysics is motivated by, and restricted to, science – there is no special role to play for a metaphysics independently from science. Ultimately, Cristian Soto opts for what he calls a 'minimalist metaphysics of science'. In this approach, metaphysics might make valuable contributions to science, if it acknowledges science as providing the best account of reality, if its methodology is compatible with that of science, and if it studies the same physical reality as science.

In *The Complementarity of Science and Metaphysics*, Cláudia Ribeiro addresses the important isue of naturalism. The debate about the relation between science and metaphysics seems largely dominated by the opposition between naturalists, who take as the starting point for any metaphysics the 'results of science' (a notion that the author finds questionable), and non-naturalists, who pursue metaphysics quite independently from science. Unsatisfied by this opposition, Cláudia Ribeiro opts for a third alternative, arguing that it is possible to construct a metaphysics that is not naturalistic, but also not completely independent from science. This view acknowledges that metaphysics is omnipresent in science, not just in the form of assumptions and background conditions, but also in explaining and interpreting phenomena, in constructing and interpreting theories, and in the desire for unification. In all these aspects, science draws on metaphysics for inspiration – hence, metaphysics should not be disregarded by

philosophers. The author ends with an appeal to philosophers to reaffirm the bond between metaphysics and science.

In their paper *Contrastive Causation in Genetics and Physics*, Erik Weber and Inge De Bal evaluate a contrastive account of causation developed by Jonathan Schaffer. According to this account, causation is a contrastive quarternary relation: a particular event rather than a non-empty set of alternative events, causes another particular event rather than a non-empty set of alternative events. Applying this account to the domains of law, genetics, and physics, the authors argue that the ontology of causation in these fields is indeed quarternary. However, there are also salient differences when it comes to the benefits that explicating these contrasts can bestow. For example, whereas in law, explicating the causal and effectual contrast is useful in that is allows lawyers to focus only on the judicially relevant claims, in genetics, doing so is useful because it broadens the perspective of geneticists, providing them with an overview of the different causal claims that they can make. In physics, on the other hand, explicating the contrast seems to be less useful when the appropriate background knowledge is at hand.

The final contribution is by James A. Marcum. In *Metaphysics of the Cognition Debate: A Plurimodel Theory of Cognition*, he analyses the debate about the so-called dual process theory of cognition. According to this theory, human cognition is realized by two distinct mental faculties: one that is evolutionary old, shared by other animals and does not require working memory, and a more recent, specifically human faculty that is analytic in nature and does require working memory. Adversaries of this theory however, argue that one mental faculty is sufficient to explain cognition. The author shows that the opposition between proponents and adversaries depends on metaphysical notions about cognitive entities and processes, and about the appropriate ways to study and explain them. The debate is dominated by dichotomies between monism and dualism, and between holism and reductionism.

In order for the debate to progress, clarification of all these notions is required. To achieve this, James A. Marcum develops his plurimodel theory of cognition. This theory combines a pluralist metaphysics with a pragmatic approach to studying cognition, and thus constitutes an alternative to some prevalent dichotomies in the literature on cognition.

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