

Summary

This Element presents and critically examines the relationship between metaphysics and the sciences. Section 1 provides a brief introduction. Section 2 looks at the methodological issues that arise when metaphysics and science get into contact, which is a much-debated aspect of the larger dispute concerning philosophical ‘naturalism’ and ‘anti-naturalism’. A taxonomy of possible views is offered. Section 3 looks more specifically at milder forms of naturalism about metaphysics, which attempt in various ways to make it ‘continuous’ with science while preserving some degree of autonomy for it. Section 4 adds some reflections on what might be regarded as the most pressing open problem when it comes to doing scientifically oriented metaphysics (but also when practising metaphysics or science in isolation): the problem concerning theory choice and the value of non-empirical factors in determining which explanation of certain phenomena should be preferred.

1 Introduction

Although there is no single shared definition, it is relatively uncontroversial to describe metaphysics as the study of reality based on the most general concepts and categories – reality being understood as broadly as possible, hence not limited to actually existing physical entities. As such, metaphysics investigates the nature of things intended in the widest sense (material objects, numbers, space, time, persons, propositions . . .), the features these possess or seem to possess (qualities, freedom, individuality . . .) and the relations that hold among them (causality, identity, truth-making . . .). In so doing, the metaphysician typically employs discipline-specific notions such as substance, trope, universal, essence, ontological dependence, grounding, fundamentality and the like, which are themselves subject to analysis.

Whether conceived as a ‘top-down’ enterprise starting from first-principles, or as a ‘bottom-up’ activity aiming to identify fundamental, general truths departing from particular matters of fact figuring as the initial explananda, metaphysics has traditionally been regarded as an activity based essentially on ‘a priori’ methods, that is, on reason alone, independently of the input coming from experience. More precisely, while it is not denied that experience loosely understood is the necessary point of departure for philosophical inquiry about the way things are (or could be), it has often been assumed in the past that metaphysicians go about formulating their hypotheses without seeking further support from the empirical domain: almost by definition, one could say, there is nothing like a metaphysical experiment.

Understood and practised along these lines, the metaphysical enterprise has long been firmly at the top of the hierarchy of human knowledge. This primacy, however, became progressively more problematic starting from the fifteenth to sixteenth centuries, and ultimately came under severe scrutiny in the last century or so. In particular, while it is undeniable that metaphysics and science have a common origin and share their historical development at least until the eighteenth to nineteenth centuries, in the last two centuries or so what was known as ‘natural philosophy’ has been steadily replaced by two distinct, and increasingly different, activities. Science and metaphysics appear today as sharply separated disciplines, not only with respect to their domains of application, questions and methodologies, but also in terms of their perceived relevance – science being almost inseparable from valuable technology and practical application, and metaphysics being regarded instead as irredeemably speculative and lacking actual usefulness. The origin of this process was, of course, the birth of modern science and the definition of a rigorous, and fruitful, scientific methodology of an essentially ‘a posteriori’ nature. Indeed, the ability of scientists to establish a systematic contact with reality through observation and experimentation, so lending a crucial factual support to the workings of reason, eventually led science to supersede natural philosophy by redefining its central goals and questions. In particular, the abovementioned aim of metaphysics, that of inquiring into the fundamental structure of reality in its most general features, was gradually replaced by something seemingly less ambitious, but at the same time much more tractable. Whereas metaphysicians have historically sought answers to big, allegedly fundamental interrogatives only to find that these systematically eluded them, one could say, scientists have instead identified manageable questions and realistic research aims in various fields, and regularly come up with productive ways of dealing with those questions and pursuing those aims.

To summarise the issue in the form of a (slightly strained) question, on what basis could one expect to discover something about reality by simply thinking about it, albeit in logically rigorous fashion, rather than by (also) directly interacting with it? The point becomes especially clear when it comes to philosophical inquiry that concerns things that are also dealt with by the sciences. Think about, for instance, the nature of space and time, or of material objects, or the origin of the universe. The thought certainly appears legitimate that in these cases the a priori methods of metaphysics had better leave room to the ‘a posteriori’ procedures of science, especially physics, which are based on abstract thinking but also, crucially, on observation and repeatable experiment. For, it seems undeniable that science turned out to be enormously more successful in providing answers to our questions about reality than metaphysics has ever been.

As a paradigmatic (albeit, again, deliberately tendentious) example, consider the following contrast between a typical metaphysical question (or set of questions) on the one hand, and a scientific one on the other. Material objects have properties, that is, qualitative aspects that we can get acquainted with through the senses, or with the help of instruments, or maybe only conjecture on the basis of experience. Now, starting at least with Plato, philosophers noticed that different objects sometimes share some of their properties, that is, bear qualitative similarities with one another. Based on this, they went on to concoct explanations for such similarities. Plato claimed that worldly things ‘participate’ in the natures of certain unchanging, perfect entities, called ‘Forms’, the separate existence of the latter making it possible for the former to exist as the sort of things they are, and to exemplify certain features to varying degrees. All horses, for instance, participate in the form ‘Horsehood’, which is the ground for their all being horses, similar to one another. Aristotle agreed with Plato on this but preferred to put these ‘universal’ forms directly into things rather than in a separate realm. Later philosophers continued to debate the issue, especially during the Middle Ages: some of them sided with Plato and/or Aristotle, perhaps modifying their theories in some detail. Others disagreed. So-called nominalists, in particular, denied that universals exist, and claimed that the universality of qualities is only a feature of our language, not of reality. The most radical among them rejected the idea of property altogether, arguing that only things exist, and their qualities – more precisely, the qualitative predicates that we use to talk about them – are a by-product of our classifications. Yet another group of nominalists proposed the hypothesis that properties exist, but they are not universals: rather, they are particular, non-repeatable ‘tropes’. On this construal, every entity with some property P exemplifies its own specific P trope, and the similarity among all P tropes is a primitive fact, not determined by anything like a Form or a universal. Without venturing further into this so-called ‘problem of universals’, it should already appear clear that, interesting as they may be the various philosophical hypotheses as to the nature of properties that we just sketched do not seem to lend themselves to a discussion that can be significantly grounded (also) on empirical evidence – apart, obviously enough, from the very facts that constitute the relevant explananda.

Compare this with the development of elementary particle physics in the last century or so. After the shift from classical to quantum mechanics in the early twentieth century, physicists gradually came to agree on the fundamental description of the basic constituents of reality in terms of entities exhibiting both the characteristic features of particles and of waves, and exhaustively described by mathematical objects (called ‘wavefunctions’) that provide probabilistic information about their properties. After that, starting from the 1940s

and 1950s, they progressively defined a coherent description of all particle types, the basic laws that govern them and their specific qualities. As for the latter, in particular, not only did the so-called Standard Model provide an elegant summary of all known particles; it also led to the successful prediction of the existence of more particles with specific properties. Indeed, the explanatory and predictive power of the Standard Model is one of the main reasons for physicists to take it seriously, and perhaps even to claim – as suggested by philosophers that endorse ‘scientific realism’ (more on this later) – that it is true or close to the truth about reality. Regardless of the issue of truth, at any rate, for present purposes it is sufficient to compare the generality and abstractness of the metaphysical debate about universals, and the complete lack of agreement about it among philosophers, on one side, and the level of success with which physicists have first conjectured and then discovered the properties of what are unanimously regarded nowadays as the fundamental constituents of reality, on the other. In spite of the fact that scientific hypotheses are in any case fallible and there are many important questions that remain open in contemporary elementary particle physics, the contrast between, so to put it, the metaphysics and the physics of fundamental properties should appear manifest. One could summarise it by saying that while scientists focus on the empirically tractable question ‘Which properties are found in nature?’, metaphysicians are interested in deeper, but much more abstract, questions having to do with the nature of properties themselves.¹

In view of the foregoing, it is easy to see why, more often than not, reflection on the relationship between metaphysics and the sciences – a hotly debated topic nowadays, even though mostly if not exclusively among philosophers – tends to emphasise the differences and the potential conflict between them rather than to try to provide a picture of at least potential unity, convergence and complementarity. In a gradual but steady process, starting from the period of the scientific revolution and culminating in the central decades of the twentieth century, science has come to be regarded as a special, privileged activity: the systematic enterprise of gathering information about the world through observation and formulating testable hypotheses and full-blown theories on the basis of that information, so obtaining knowledge of the relevant domains in a way that is amenable to intersubjective check and systematic correction and improvement. This distinctive, and certainly

¹ As Maclaurin and Dyke put it, while ‘[s]cientists are interested in how various properties are distributed across the world [. . .] the question of what the metaphysical nature of properties is has no bearing whatsoever on the actual instances of properties out there in the world’ (2012, 304). For a related discussion, concerning scientific and philosophical questions about laws of nature, see Hildebrand (2023, especially section 1).

virtuous, methodology has been put into contrast – by scientists but also philosophers – with that of philosophy, especially metaphysics. Beginning at least from the early twentieth century, the latter commenced to look like an activity which manifestly lacks a solid connection with reality, as well as clear procedural criteria and guiding principles. More generally, in stark comparison with the rigour and fecundity of science, metaphysics came to be regarded as almost completely detached from reality, and certainly short of well-defined standards of good practice. Especially within empiricist circles, as is well-known, science became a model, a paradigm that should ideally inform philosophy itself, promoting a change in the old ways of doing it and, if needed, the abandonment of at least some of them. In the case of philosophy as metaphysics, interpreted as seeking knowledge of the most fundamental and general facts about reality without having recourse to anything like an established and well-defined experimental methodology, it does not come as a surprise that – as recommended, in particular, by neopositivists in the first half of the twentieth century – it has often been regarded as an activity to be simply discontinued. As we will see in more detail in the next section, although metaphysics survived the neo-positivist campaign based on the thought that metaphysical questions are strictly meaningless, the idea that it has nothing to offer in addition to science is indeed alive and well. Putnam (2004), for instance, takes the question ‘How many objects are there in a mini-world with exactly three point-particles?’ to be a paradigmatic metaphysical question, and then attacks metaphysics by arguing that there is simply no way of tackling questions of this sort properly: after all, what could possibly give us an indication as to whether or not the sum of two things itself counts as ‘one’ (further) thing? In a similar vein, Van Fraassen (2002) discusses the question ‘Does the world exist?’ and ends up declaring that ‘metaphysics is dead’, as questions of this type may be endowed with meaning, but can only appear relevant from a very abstract, non-scientific perspective, and attempting to answer them is a waste of time. Other recent manifestations of this kind of scepticism towards traditional metaphysics include Ritchie (2008) and, less critically, Ladyman and Ross (2007). As we will see, some non-philosophers also joined enthusiastically the anti-metaphysics (in fact, in their case, anti-philosophy) camp. Something like the well-known Kantian point about those assertions that ‘lay claim to insight into what is beyond the field of all possible experiences’ [Critique of Pure Reason; A425/B453] is no doubt in the background here.

On the other hand, many thinkers in the more or less recent past adopted a symmetrically opposite stance, harshly criticising the idea that what is not amenable to scientific inquiry is in fact irrelevant if not meaningless.

Husserl, for instance (see Husserl 1970[1936]), famously argued that the development of modern science and technology led to a decline in Western culture, as it determined the inability to aptly engage with whatever does not present itself as an external object – that is, to interact with and get a grasp of the ‘Lebenswelt’, the fundamental domain of human experience is related to conscience, intentionality, etc. More generally, metaphysicians sometimes attempt a counterattack, and reject the key assumption according to which all questions about reality are best tackled based on the scientific method. The most radical among them go as far as to affirm the autonomy and priority of philosophy, especially metaphysics, and to consider science and the scientific method basically irrelevant for metaphysical inquiry (see Bealer 1996, 1998).

In between these two extremes – metaphysics dismissed in favour of science on the one hand, and metaphysics kept fully autonomous and prior to the sciences, on the other – several intermediate positions emerged, some of which constituted attempts at reconciliation and compromise between science and traditional metaphysical investigations. A well-known figure in this context is no doubt Wilfrid Sellars, who notoriously urged philosophers to seek some form of integration between the ‘manifest image’ of the world related to common sense and its ‘scientific image’, produced by scientific theorising (Sellars 1962). An important point to make in this context is a well-known Popperian one. As Popper pointed out, it is far from clear that a sharp demarcation can be identified between science and metaphysics. Moreover, to the extent that clear cases of scientific and metaphysical conjectures and theories can be identified, it is in any case plausible to think that extra-scientific, philosophical assumptions are routinely, and inevitably, made by practising scientists when they formulate their hypotheses. Following this route, proposals for a scientifically aware reformulation, rather than elimination, of metaphysics have been put forward more recently.

Faced with this complex net of interconnected problems and opposing perspectives, it is undoubtedly useful, if not necessary, for people interested in metaphysics to reflect carefully on its relationship (or lack thereof) with science. The present Element aims to help readers to do exactly this. Rather than by focusing on specific examples of metaphysics applied to science², or of the way in which science alone may, or may not, provide plausible answers to traditional philosophical problems, this will be done by keeping the discussion mostly at the general level, and proposing further reflections on the methodology and

² The label ‘metaphysics of science’ has become popular in recent years and is used to denote the philosophical study of genuinely philosophical concepts that turn out to play a key role in, or at least appear to be potentially relevant for, science in general as well as specific scientific disciplines and theories.

essential nature of the two activities. The first task will be (in Section 2) to present the various available views of metaphysics in connection to the sciences in as exhaustive, systematic and informative a way as possible. The guiding thread will be constituted by *naturalism* – which can be defined, at least at a first pass, as the request that non-science, in this case, philosophy as metaphysics, be made ‘as continuous as possible’ with the sciences.³ Indeed, views on the methodology and content of metaphysics and its relationship with the sciences occupy a multiform spectrum going from ‘extreme anti-naturalism’ to radical, ‘eliminative naturalism’. Our next step (in Section 3) will be to discuss in more detail the prospects for ‘moderate’ forms of naturalism, aiming, on the one side, to acknowledge the uniqueness of the methodology of science, which guarantees that our hypotheses and explanations always have the necessary anchoring to reality; and, on the other side, to preserve the ambitious nature of metaphysics as an enterprise the purpose of which is to define larger conceptual frameworks, tackle more general and deeper questions and provide the broadest possible understanding of the nature of things.

As we will see more clearly in the course of the discussion, a key point (if not THE key point) in one’s assessment of metaphysics in connection with the sciences concerns explanation. To be sure, both metaphysics and the sciences aim to provide explanations of particular phenomena.⁴ However, they do this in different ways, asking largely different questions and employing significantly different conceptual categories. This makes it natural to ask based on what criteria distinct, competing explanations should be critically assessed in science and in metaphysics, respectively, and when science and metaphysics meet. For reasons that will become clearer later, but essentially have to do with ‘under-determination’ (i.e., the fact that, at least in principle, there are always several competing explanatory hypotheses that are compatible with the available empirical data), the issue of theory choice crucially revolves around the role of extra-empirical factors and criteria in the assessment and evaluation of competing hypotheses and explanations. In the last section of this Element (Section 4), therefore, we will look at the dynamics of theory choice and the role of extra-empirical elements in metaphysics and in science.

While it was stated a moment ago that most of our discussion will move at a very general, mostly methodological level, it is no doubt useful to also zoom in

³ Obviously enough, it is crucial to specify precisely what this continuity amounts to, and the amount of autonomy that should be acknowledged to metaphysics for it to become non-naturalistic. More on this later.

⁴ This is by no means intended as a rigorous definition, of course. The aims of science, in particular, have been defined in rather different ways: scientific realists, for instance, would agree that science aims at the truth, while empiricists would instead claim that scientific theories have the function of accounting for and systematising known empirical data.

as much as possible and look at examples. For this reason, various points of the following sections of this Element will be devoted to the concise presentation and discussion of some sample disputes with respect to which both scientists and metaphysicians seem to have something relevant to say.⁵

2 Metaphysics and Science: A Taxonomy

As hinted at in the previous, introductory section, a fundamental issue that arises when one looks at metaphysics in connection to the sciences concerns its very credibility and usefulness as an autonomous discipline. Should we keep doing metaphysics given that science is so successful? Or is it reasonable to continue regarding metaphysics as more fundamental than, say, physics? Is there some way of establishing a fruitful interplay between the two? Several different answers to these questions, and consequently several philosophical positions concerning metaphysics and science, are available. These range from varieties of eliminativism and scepticism towards metaphysics that echo the dismissal recommended by the logical empiricists of the Vienna Circle, to the uncompromising denial of the view that empirical data and scientific theories may have an import on metaphysical theses, a priori tools of logical and conceptual analysis being autonomous with respect to, and more fundamental than, those that characterise scientific inquiry.

As mentioned, an attempt to present and discuss these views in a systematic fashion may usefully be based on the idea of naturalism. That is, the thought that philosophers should pay attention to the indications coming from the sciences, and philosophy as a discipline be made as continuous as possible with science. As already noted, talk of continuity (and discontinuity) between philosophy and the sciences is as widespread as irredeemably vague. Indeed, it allows for several nuances and, consequently, different forms of naturalism and anti-naturalism about metaphysics. To get things started, let us just assume for now the minimal sense of continuity according to which, whenever possible, the methodologies and results of the sciences should be taken into account by metaphysicians and be given some form of priority over those of traditional, a priori philosophical analysis.

It is important to emphasise that there are two components to this: a *methodological* component and an *ontological* component. With respect to the former, naturalists sometimes go as far as to recommend that metaphysics

⁵ It is worth making explicit something that readers will have already noticed. Given that our focus here, as in most of – if not all – the recent literature on metaphysics, science and naturalism is on empirical knowledge, we will not consider case studies coming from non-empirical scientific disciplines such as mathematics or geometry. More generally, the discussion to follow will be concerned mostly if not exclusively with metaphysics in connection to the natural sciences.