Metaphysics of Science. Introduction

1 Origins of *Metaphysics*

It is notoriously difficult to define even the word "metaphysics". As far as we know, the word was introduced by Andronicus of Rhodes in his attempt to systematize and thoroughly comment Aristotle's corpus. He called *metaphysics* a collection of fourteen books, just to refer to "the books after the physical ones".[1] This very tradition has survived today. A very well known book in the metaphysics of science is aptly titled: *After Physics*.[2]

Aristotle himself did not know the word "metaphysics". He uses at least four different ways to refer to the collection of topics addressed in the aforementioned fourteen books: (i) "first philosophy", (ii) "first science", (iii) "wisdom", and (iv) "theology". In at least a few places Aristotle himself attempts at characterizing metaphysics through *its subject matter*, or *Content*. He identifies such a subject matter with *being as such*, *first causes*, and *things that do not change*. What is the relation between these notions? This is a vexed question with no straightforward answer. In any event, this broad characterization of metaphysics was mostly fine for the entire Middle Ages.

It was roughly in the XVIIth century that topics that according to the Aristotelean tradition squarely fit into physics, were re-assigned to metaphysics. Arguably, among the most important topics were the relation between body and soul, the problem of free will, and the problem of personal identity over time.

Relatedly, a new science of physics —with a much narrower focus, and a peculiar mathematical and experimental method, was born. All of this, called for a new demarcation of metaphysics from (modern) science. For a certain period, lacking such a new demarcation, the very term "metaphysics" was used as a sort of umbrella-term for whatever philosophical topics did not perfectly fit into epistemology, logic or ethics. It was Christian Wolff that famously distinguished between "general metaphysics" —or ontology[3]— and "special metaphysics".[4] General metaphysics is the study of being as such, or the study of the most general features of being, whereas special metaphysics is the study of being of objects of various sorts, such as material bodies, or souls.

Despite its many detractors Wolff's characterization has proven difficult to discard. Different introductory books still identify metaphysics with the study of

[1] See Cohen (2016) for an Introduction.
[2] Albert, D. (2015).
[3] He is in fact credited for introducing the word "ontology" itself.
[4] See Hettche, (2014).

the most general (and perhaps fundamental)[5] structure of reality. And many of the topics that are hotly debated in contemporary metaphysics would fall under Wolff's "special metaphysics".[6]

2 The Challenge from Science

The characterization above immediately raises concerns. For it seemed clear almost immediately that the newborn (mathematical) science —still called natural philosophy— was also an investigation of the most general (and fundamental) structure of reality. How to distinguish then science from metaphysics, given that —-according to the line of thought we are investigating— we cannot distinguish it by its contents?

The leading answer focused on *Method*: whereas the new-born science used a mixture of a-priori (mathematics) and *a-posteriori* (experiments and experimental confirmations) methods, [7] metaphysics was to use a purely *a-priori* method.

This was responsible for skeptical attacks on the very possibility of metaphysics that are still raging nowadays. In particular two skeptical challenges were mounted against it. Following Van Inwagen and Sullivan (2014) we can label them the "Strong" and "Weak" skeptical challenge.

The Weak Skeptical Challenge Against the Possibility of Metaphysics. According to the Weak Challenge a-priori metaphysical claims[8] that "pretends" to augment our knowledge about the natural world —as opposed to analytic statements that do not augment such a knowledge— are meaningful, yet its truth values can never be established. Accordingly, it is in principle impossible to know whether any metaphysical statement is true or false.

Arguably the most famous example of such a skeptical challenge is Kant's *Trascendental Dialectic* in the first Critique. Following Kant, pure a-priori metaphysics —epitomized exactly by the work of Wolff— was condemned as *dogmatic*. For, an endorsement of any metaphysical claim —-absent the possibility to establish its truth-value— is an endorsement without a reason, i.e. a *dogmatic* endorsement.[9] So the argument goes.

[5] This addendum might indeed play a crucial role for contemporary metaphysicians such as Fine, Schaffer and Sider to mention a few.

[6] As an example, just look to the following, excellent introduction to metaphysics, written by a "pure metaphysician", and a philosopher of physics respectively: Loux (2002), and Ney (2014).

[7] Recall Galileo's infamous words: "certe dimostrazioni e sensate esperienze" roughly "certain demonstrations and sensible experiences".

[8] That presumably presupposes we can —at least in principle— identify some statements as metaphysical statements. This turns out to be far from trivial.

[9] The argument is quite rough, but it will do for an introduction.

The Strong Skeptical Challenge Against the Possibility of Metaphysics. According to the Strong skeptical challenge any metaphysical claim is simply *meaningless*.

British empiricists of various sorts —-from Locke to Hume to Russell— were the front-runners in this respect. Perhaps the most articulated example of such a challenge comes from *Logical Empiricism*. Logical Empiricists famously endorsed the so-called verificationist theory of meaning. To put it roughly —- and unfairly:

Verificationist Criterion of Meaning. The meaning of a synthetic (i.e. non analytic) proposition is given by the method of its verification.

Thus, every synthetic proposition that is in principle non-verifiable is meaningless. Every metaphysical proposition (or at least a lot of them) seems to fit this pattern. Metaphysics is meaningless, the logical empiricists concluded.

(Un)fortunately, some of the main tenets of logical empiricism were widely criticized, and has fallen in disgrace ever since. On the one hand Quine pointed out that that there is no ground for a principled distinction between *analytic* and *synthetic* statements [10] —-a distinction that was in fact crucial in demarcating science from metaphysics. On the other hand, it was (and still is) argued that the verificationist criterion of meaning is self-refuting, i.e. is itself meaningless.[11]

Almost at the same time, new developments in logic and philosophy of language (mainly due to Kripke and Putnam)[12] seemed to open new avenues of metaphysical inquiry that were not immediately recognizable as capable of falling squarely within the domain of any particular empirical science. Direct reference, possible worlds, and a distinctive notion of metaphysical possibility became standard jargon in philosophy —and not only jargon! This prompted a resurgence of metaphysics. Analytic metaphysics as we practice it today —in the English speaking world—- is arguably the foster child of these developments. On the face of this resurgence the question of demarcation and relation between metaphysics and science arises yet again. One natural possibility is to take the lead from our illustrious predecessors and "combine", so to speak, their insights. Maybe the two relevant dimensions for demarcation are still *Content* and *Method*, yet we have to consider both at the same time, so to speak. This is what is done in the next section, following Morganti and Tahko (2017).

[10] See Quine (1951).

[11] Van Inwagen and Sullivan (2014) go as far as claiming that every Strong Skeptical Challenge to the possibility of metaphysics ends up using self-refuting principles as premises.

[12] See e.g. Kripke (1975), and Putnam (1975).

3 Demarcation

The key idea is to focus on two distinct axes of comparison and demarcation of science and metaphysics: *Content* and *Method*, respectively. Four distinct alternatives are possible: (1) No Overlap of Content; No Overlap of Method (or No-No); (2) Overlap of Content; No-Overlap of Methods (or Yes-No); (3) No Overlap of Content-Overlap of Method (or No-Yes); (4) Overlap of Content-Overlap of Methods (or Yes; Yes). It is hard to disentangle the descriptive from the normative claim in presenting such alternatives. Morganti and Tahko make a good case that all the options are non-empty in the contemporary debate. Let us see some examples:[13]

No Overlap of Content; No Overlap of Methods: Metaphysics is the a-priori investigation of what is possible —-in a *distinguished sense of possible*, and the relations of dependence between these possibilia. Science tells us which of these possibilities is actual. Alternatively, metaphysics is the a-priori investigation of the most general categories of being —things such as *substance*, *individual*, *property* and the like— whereas science tells us which one of these categories has representatives in the world, and which representatives it has. (Lowe, Geach).

Overlap of Content; No Overlap of Methods: Moderate naturalistic metaphysics. Both metaphysics and science focus on the fundamental structure of reality, but they employ different methods. This is arguably the contemporary heir to the classical *a-priori-a-posteriori* methodology distinction (Ney, Callender, French, McKenzie, Morganti et cet).

No Overlap of Content; Overlap of Methods: Metaphysics is focused on purely conceptual issues, perhaps it is even *conceptual analysis*, whereas sciences focus on the world. But the method of metaphysics is (or rather, should be) scientific in spirit, e.g. metaphysics should be conducted via experimental methods (Experimental Philosophy, or X-Phy, Knobe, Machery, Stich).

Overlap of Content; Overlap of Methods: Radically naturalistic metaphysics. Either the value of metaphysics resides in its empirical tractability, or in the fact that its questions arise directly (and entirely) from scientific hypotheses: e.g. questions of unification between two such hypotheses (Ladyman and Ross).

4 Metaphysics *of* Science

The seminar is however a seminar on the metaphysics *of* science. What does it even mean? Is there a metaphysics that is implicitly hidden *in* science? Relateldly, should we extract a metaphysics *from* science? Or should we largely

[13]The following is going to be very rough. Yet we will discuss Morganti and Tahko in a session.

introduce some metaphysics by hand in the sciences? On the face of it, both options seem viable. Following Bigaj and Wuthrich (2016), let's call the first option (*discover* the metaphysics in the sciences) *intrinsic* —or "from within", and the second option (*introduce* the metaphysics in the sciences), *extrinsic* —or "from without".

When we do *intrinsic* metaphysics of science we basically ask the question of what the world would look like, were the scientific theory under investigation true. As Bigaj and Wutrich note the main problem here is that of the *underdetermnation* of the metaphysics by science. It is hardly ever the case that science wears a *clear* and *unique* metaphysical picture on its sleeves. In most cases it just *restricts* metaphysical possibilities that are more or less compatible with different scientific hypotheses. Famous examples in the metaphysics of physics include: the compatibility of relativistic physics with A-metaphysics of time, the compatibility of quantum physics with certain notions of individuality —e.g. the ones based on Leibniz's principle of the Identity of Indiscernible, or the compatibility of quantum physics with a broadly Humean thesis of local supervenience.

When we do *extrinsic* metaphysics of science, on the other hand, we put the metaphysics on top of our scientific theorizing. This can be done in the context of *discovery* of the scientific theory at hand —-e.g. Einstein himself admitted that in his formulation of GTR he was guided by Mach's almost metaphysical idea according to which local inertial frames are determined by the large scale distribution of matter —[14], or even after a scientific theory has been well-established. The most eloquent case is probably the *interpretation of quantum mechanics*: some such interpretations have substantive metaphysical commitments —-e.g. many worlds, or are even specifically and explicitly driven by metaphysical considerations in the first place —-e.g. the so-called *Primitive Ontology* interpretations.

5 Topics

In the seminar we will mostly do *intrinsic* metaphysics of science —-as it is presented in §4. In particular we will tackle the following questions, among others:

- Is relativistic physics compatible with the *very existence* of time?
- Is relativistic physics compatible with the claim that we inhabit two distinct manifolds —a three-dimensional spatial manifold and a one-dimensional temporal manifold—- that are both fundamental and do not share any constituents?

[14] It hardly matters that consensus has it that GTR does not completely vindicate such a stance.

- Is relativistic physics compatible with the claim that *the present* is *metaphysically privileged* in any robust sense?
- Is relativistic physics compatible with the existence of three-dimensional objects that persist through time by being *wholly present* at each instant of their existence?
- Is quantum mechanics telling us that there is just one *metaphysically fundamental* object, i.e. the entire universe?
- Does quantum mechanics entail that reality, at the fundamental level, is high-dimensional, and the three-dimensional world is but a *shadow* —a projection into lower dimensions in fact—- of this most fundamental level?
- Is quantum mechanics suggesting that objects are just *relations*, or at least thoroughly dependent on more fundamental relations?

It is immediately clear that these questions are crucial for our understanding of the world.

6 Further Topics

Beside the topics addressed in the seminar, and specific questions and issues that arise in particular scientific contexts —-e.g. the existence of *institutional objects*, or the notion of *social causation* in the social science, the metaphysics of science addresses further questions of broader scope and generality. A recent introduction to the subject,[15] tackles counterfactuals, dispositions, causation, and laws of nature, to mention but a few.

References

Albert, D. 2015. *After Physics*, Cambridge: Harvard University Press.

Bigaj; T., and Wuthrich, C. 2016. Introduction. In Bigaj, T. and Wuthrich, C. *Metaphysics in Coontemporary Physics*, Brill: Rodopi.

Cohen, S. M. 2016. Aristotle's Metaphysics, SEP.
URL: https://plato.stanford.edu/entries/aristotle-metaphysics/

Hettche, M. 2014. Christian Wolff, SEP.
URL: https://plato.stanford.edu/entries/wolff-christian/

Kripke, S. 1975. *Naming and Necessity*, Cambridge: Harvard University Press.

[15] Namely, Schrenk (2016).

Loux, M. 2002. *Metaphysics. A Contemporary Introduction*. New York: Routledge.

Morganti, M., and Tahko, T. 2017. Moderately Naturalistic Metaphysics. *Synthese* 194 (7): 2557-2580.

Ney, A. 2014. *Introduction to Metaphysics*. New York: Routledge.

Putnam, H. 1975. The Meaning of "Meaning". *Minnesota Studies for the Philosophy of Science* 7: 131-193.

Quine, W.V. O. 1953. Two Dogmas of Empiricism. *Philosophical Review* 60 (1): 20-43.

Schrenk, M. 2016. *Metaphysics of Science*. London: Routledge.

Van Inwagen, P. and Sullivan, M. 2014. Metaphysics. SEP.
URL: https://plato.stanford.edu/entries/metaphysics/