Philosophy and Physics

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Philosophical Perspectives on the Exact Science and their History

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Physics…

"How can we understand the world in which we find ourselves? How does the universe behave? What is the nature of reality? Where did all this come from? Did the universe need a creator? Most of us do not spend most of our time worrying about these questions, but almost all of us worry about them some of the time.

Traditionally these are questions for philosophy, but **philosophy is dead**. **Philosophy has not kept up with modern developments in science, particularly physics**. Scientists have become the bearers of the torch of discovery in our quest for knowledge."
(Stephen Hawking)

Physics…

"[philosophy] is **not a productive contributor** to our understanding of the natural world."
(Neil deGrasse Tyson)

Physics…

"The insights of the philosophers I studied seemed murky and inconsequential compared with the dazzling successes of physics and mathematics. From time to time since then I have tried to read current work on the philosophy of science. Some of it I found to be written in a jargon so impenetrable that I can only think that it aimed at impressing those **who confound obscurity with profundity**."
(Steven Weinberg)

(Some) Philosophy…

"**What reality is like is the business of scientists**, in the broadest sense, painstakingly to surmise; and what there is, what is real, is part of that question. The question how we know what there is is simply part of the question … of the evidence for truth about the world. **The last arbiter is so-called scientific method**, however amorphous"
(Quine)

(Some) Philosophy…

If they [philosophy, history, etc] don't follow the scientific method, then "**they are fun, not knowledge**"

(Alex Rosenberg)

Scientific Naturalism

- All these quotes somehow endorse what's been called ***Scientific Naturalism*** (or, more radically, **Scientism**).

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> The *philosophical* Doctrine that holds that **(a)** there only exists the natural world, **(b)** and that science (i.e., the scientific method) is the best (or only way to know it)

Scientific Naturalism

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Philosophy = a priori/conceptual analysis Science = a posteriori/ empirical

- It just happens that an a posteriori/empirical methodology is **more successful** (or **effective**) to know nature. That's why science overcame philosophy…

Scientific Naturalism

Natural Philosophy

[Transition Period]

"Shut up and calculate!" Period

Scientific Naturalism

Natural Philosophy

[Transition Period]

"Shut up and calculate!" Period

- The period of Galileo, Newton, Descartes, Leibniz, Pascal, Lavoisier, etc.,…
- Period XVI-early XIX
- No differentiation among philosophy, science, theology, etc. All was useful *and necessary* in the pursuing of truth
- Science brought about technological innovation, but its main aim was to know nature –many paths to knowledge!

Scientific Naturalism

Natural Philosophy

[Transition Period]

"Shut up and calculate!" Period

- The period of Boltzmann, Maxwell, Mach, Einstein, QM's fathers
- Period: late XIX – 1930
- Greater differentiation among science, philosophy, and theology. Certain autonomy of physics and biology, for instance.
- However, science was strongly influenced by philosophy (Einstein, Mach by Hume; QM's fathers by Kant, phenomenology, etc.)

Scientific Naturalism

Natural Philosophy

[Transition Period]

"Shut up and calculate!" Period

- The period of Feynman, Hawking, Weinberg; but also Quine, Rosenberg, many others. The period of *scientific naturalism*
- 1940 onward…
- Complete **autonomy** of sciences from philosophy. Science is the **overcoming** of philosophy
- Philosophy should give up on looking into the nature of the world, since that's now science's task.

Scientific Naturalism

- So, one of the possible relations between science and philosophy is mediated by a philosophical doctrine –**scientific naturalism**.
- Philosophy should **defer to** science or being just eliminated. Science has **overcome** philosophy.
- Philosophy and science (physics in particular) share the same aim = to know nature; but have different methodologies. Science was just more successful in pursuing such an aim

An alternative view (my view and of many others)

"It is often said that the objective of physics is the explanation of nature, at least of inanimate nature. What do we mean by explanation? It is the establishment of a few simple principles which describe the properties of what is to be explained. If we understand something, its behavior, that is the events which it presents, should not produce any surprise for us. We should always have the impression that it could not be otherwise…

An alternative view (my view and of many others)

….It Is clear that, in this sense, physics does not endeavor to explain nature. In fact, the great success of physics is due to a restriction of its objectives: it only endeavors to explain the **regularities** in the behavior of objects"

(Wigner, Nobel Lecture 1963)

An alternative view (my view and of many others)

- One could say that, in the line of Wigner's words, that philosophy and science share the same aim just very broadly.
- **Physics** (and **the sciences in general**) restricts itself to know the **regularities** of physical systems and to formulate general principles based on those regularities. But only very controversial assumptions can take us from there to the scientific naturalist dogma that science is about knowing the nature of things (i.e., that the nature of things are just their regularities; or that they are things we can know by only looking at regularities)

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An example

- *Which* are the laws of nature is an empirical question. It will depend on the experimental investigation of the regularities we find in the world. On this question, philosophers have no take (at least substantially).

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- "*Which* are the laws of nature?" is an empirical question. It will depend on the experimental investigation of the regularities we find in the world. On this question, philosophers have no take (at least substantially).
- "*What* are the laws of nature?" is *not* an empirical question, but a conceptual/philosophical one. Do the laws *govern* the phenomena? Do they *supervene* upon things' properties and behavior? Are they just *theoretical principles* in axiomatic systems? No scientist endeavor to reply to these questions!

An alternative view (my view and of many others)

An example

- So, *there is* a difference, but is it important?

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An example

- So, *there is* a difference, but is it important? It depends on **for what…**

  …for building quantum computers, it is probably of none relevance

  …but for knowing the nature of the world, in this case the nature of laws, it is crucial!

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- Would you equally accept as **explanations** of the nature of the world **(a)** that the laws of nature (e.g., Schrödinger's equation) is a *thing* that governs phenomena or **(b)** just a conventional theoretical postulate?

An alternative view (my view and of many others)

- So, science and philosophy just partially share the aim. Both are epistemic enterprises seeking to know what the world is like. To know nature we need to know, for instance, which are the laws of nature; but we also need to know *what* are the laws of nature. Science provides us with the former, philosophy with the later.

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- So, this goes against one of the scientific naturalist's tenets –science cannot overcome philosophy since **the aim is not exactly the same**.

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What about **methodology**?

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Science	Philosophy
▪ **(a)** an empirical enterprise, purely descriptive and **(b)** free of any a priori, valuative or normative content. ▪ Succesful theories are choosen (and assessed) in virtue of their empirical value (e.g., empirical adequacy).	

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What about **methodology**?

Science	Philosophy
▪ **(a)** an empirical enterprise, purely descriptive and **(b)** free of any a priori, valuative or normative content.	▪ An arm-chair enterprise, seeking to know the world from a priori, conceptual arguments
▪ Succesful theories are choosen (and assessed) in virtue of their empirical value (e.g., empirical adequacy).	▪ Good philosophical doctrines are accepted/rejected in virtue of coherence, people's intuitions, etc…

An alternative view (my view and of many others)

What about **methodology**?

This is a mischaracterization of how science and philosophy work!

An alternative view (my view and of many others)

What about **methodology**?

Science

- Scientific theories are frequently assessed (accepted or rejected) in virtue of **aesthetics reasons**, why? **We need a philosophical argument!**

An alternative view (my view and of many others)

What about **methodology**?

Science

- Scientific theories are frequently assessed (accepted or rejected) in virtue of **aesthetics reasons**, why? **We need a philosophical argument!**
- Scientists don't simply accept empirical data blindly, but **they *judge* which empirical data is relevant and which one is not**, which one they accept and which one they reject; we need non-empirically grounded constraints on data!

An alternative view (my view and of many others)

What about **methodology**?

Science

- Scientists usually adopt some **a priori principles** (regulative/constitutive principles) for theory construction (e.g., some symmetries). So, it is not true that science is purely a posteriori!

An alternative view (my view and of many others)

What about **methodology**?

Science

- Scientists usually adopt some **a priori principles** (regulative/constitutive principles) for theory construction (e.g., some symmetries). So, it is not true that science is purely a posteriori!
- In a more general vein, scientific theories adopt **metaphysical assumptions** that are not always explicit. But they are there! These metaphysical assumptions don't rely on just data and empirical confirmation.

An alternative view (my view and of many others)

What about **methodology**?

Science

- Scientific theories suffer from **"metaphysical underdetermination by data"** –different pictures of the world are equally compatible with the same set of data (empirical data). So, to single out one theory (among many) we need non-empirical criteria (e.g., simplicity, intertheoretical connection, etc). Then, we need some philosophical arguments!

An alternative view (my view and of many others)

What about **methodology**?

Philosophy

- It is **not true that philosophy is purely a priori** –it is also regulated by empirical discoveries (no philosopher defends today the theory of four-humours, or Empedocles' doctrine of four elements!)
- It is true that the "space of possibilities" of philosophers is wider than the scientists'; but it is also empirically constrained.

An alternative view (my view and of many others)

What about **methodology**?

Philosophy

- So, philosophy's methodology is actually mixed –a priori and a posteriori. E.g., what is a property is an a priori question; which properties are compatible with current science will have some empirical constraint.
- There is also **progress** in philosophy

An alternative view (my view and of many others)

- So, it is not accurate that science's and philosophy's methodology can be so sharply separated

An alternative view (my view and of many others)

- So, it is not accurate that science's and philosophy's methodology can be so sharply separated
- To explore a broader space of possibilities philosophy needs a priori methods. Philosophers also care about in-principle arguments, transcendental arguments, conceptual clarity, and exposing hidden assumptions. But it is incorrect to assume that all knowledge must be a posteriori knowledge! This is not true –some scientific principles must be assumed without any clear empirical background (otherwise, science would be impossible)

An alternative view (my view and of many others)

- You cannot escape from philosophical arguments either –To make a case in favor of purely a posteriori arguments as justification of beliefs, you need an a priori argument! (e.g., verificationist theory of meaning, or something of the sort)

An alternative view (my view and of many others)

Philosophy

Science

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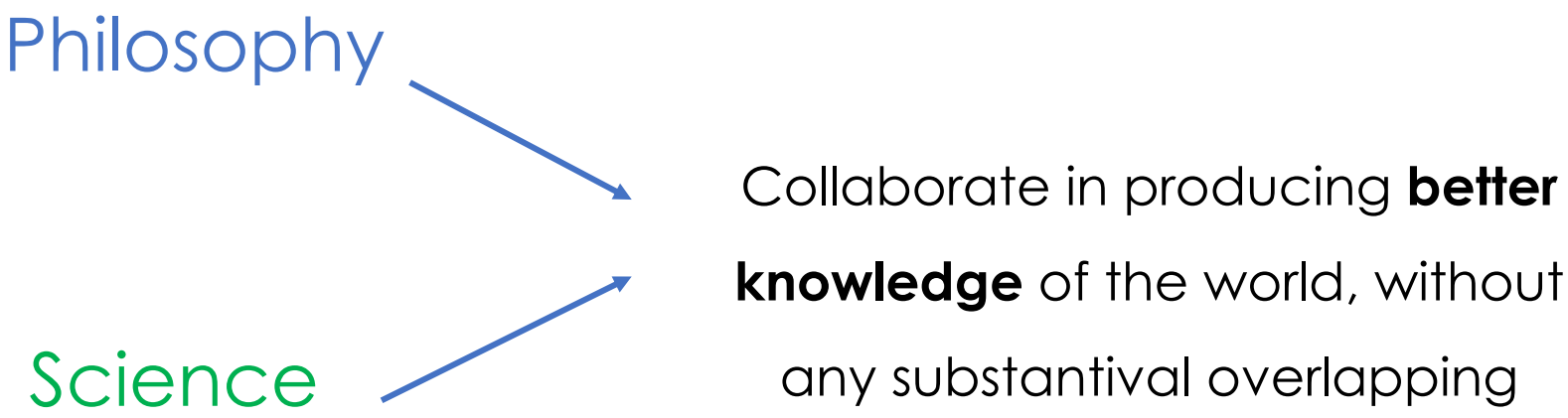

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Philosophy

Science

Collaborate in producing **better knowledge** of the world, without any substantival overlapping

A description

(of its regularities)

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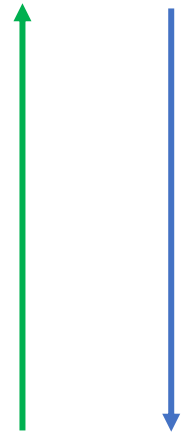

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