Philosophy and the Sciences

Introduction to the Philosophy of the Physical Sciences

EIDYN

What is this thing called science?

What is the nature of scientific knowledge?
What are the most important debates about the nature of scientific knowledge?

Philosophy of science

This a branch of philosophy that investigates the variety of philosophical questions arising from science, its history, and practice.

It deals with general questions about science (e.g., what is a law of nature? is there a scientific method?; etc.) but also with specific foundational issues arising in different scientific fields.

What is science?

We distinguish genuine science from:

(i) **Pseudo-science** (i.e., fake science which masquerades as genuine science; compare astrology and astronomy); and

(ii) **Non-science** (i.e., types of inquiry which don't even pretend to be genuinely scientific, such as literary theory).

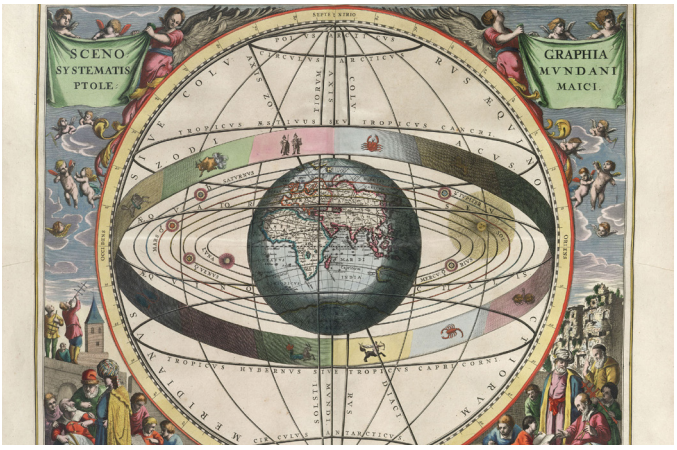
Epistemic relativism

Heliocentrism versus **Geocentrism**

• **Galileo** appealed to a new kind of scientific observation, using telescopes, to argue that the earth orbits the sun, rather than vice versa.

• In contrast, **Bellarmine** appealed to the evidence of scripture to argue that the sun orbits the earth.

Galileo and Bellarmine could both agree that there is an objective fact of the matter which they are disagreeing about (i.e., they needn't be relativists about truth). The point is rather that they disagree about what counts as good evidence for what. If there is no legitimate rational basis to resolve such disputes, this leads to epistemic relativism.



Cellarius ptolemaic system by J. van Loon (Public domain)

Scientific Realism

• The goal of science is to uncover the objective truth about the world around us.

• *Scientific progress* thus occurs if our theories are more likely to be true as we go along in the history of science.

• Contra epistemic relativism, there is an objective epistemic basis for settling scientific disagreements (that's why Galileo eventually won the argument about heliocentrism).

Inductivism

• A *deductive inference* takes us from premises that are true to a conclusion that must also be true. An *inductive inference* on the other hand, does not deduce a true conclusion from true premises, but simply takes us from particular premises to a conclusion that is meant to be universally valid.

• *Inductivism* is the view that the scientific method is essentially an inductive one. Scientists make observations about the world, and on this basis draw inductive inferences about the way the world is. These inferences are fallible, like all inductive inferences, but they are nonetheless rational.

Falsificationism

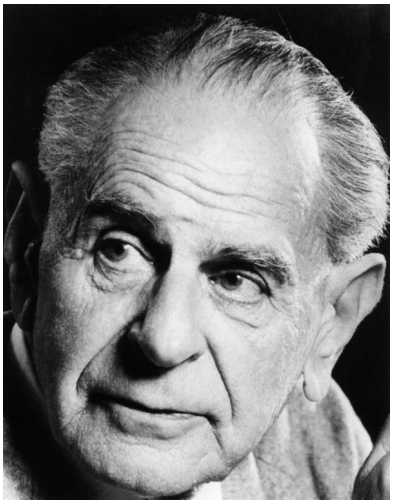
Contra Inductivism

Inductivism is too inclusive. Even pseudo-scientific theorising (e.g., astrology) could employ inductive inferences.

Falsificationism

The scientific method is essentially deductive. It proceeds by making bold conjectures and then trying to find counterevidence that would logically refute (i.e., falsify) the conjecture.

But can we really falsify individual hypotheses?



Sir Karl Popper: a leading proponent of falsificationism

Thomas Kuhn on science

Kuhn argued that science is characterized by three-stage cycles of **normal science, crises,** and **scientific revolutions.** During normal science, a scientific community works on a well-defined scientific paradigm.

A *scientific paradigm* would typically include the dominant scientific theory, the experimental and technological resources and the system of values of the community at a given time.

Moreover a scientific paradigm includes also what Kuhn called 'exemplars': i.e. 'the concrete problem-solutions that students encounter from the start of their scientific education.

Theory-choice in these cases is not determined by the alleged superiority of the new paradigm over the old one. The consensus-gathering process is not determined by the new paradigm being more likely to be true or correct than the old one, but by the increase in the puzzle-solving power of the new paradigm.

The new paradigm should be able to solve more puzzles than the old one, and thus Kuhn redefined scientific progress in terms of increased puzzle-solving.

Scientific paradigms are *incommensurable*: they lack of common measure for rational choice.

Pierre Duhem on testing hypotheses

No scientific hypothesis can ever be tested in isolation, but only in conjunction with other main theoretical hypotheses plus some auxiliary ones.

Scientists never test the hypothesis of gravitation by itself, but always in conjunction with other theoretical hypotheses **H1, H2, H3** (e.g. Newton's three laws of motion) plus some auxiliary hypotheses **A1, A2, A3,** (e.g. A1 says that the mass of the Sun is much bigger than the mass of other planets; A2 says that no other force apart from the gravitational one is acting on the planets; A3 reports that planetary attractions are weaker than attractions between the Sun and the planets)

Pierre Duhem