

PHILOSOPHY OF SCIENCE

What is science?

In discussing the philosophy of science, philosophers generally focus on natural sciences like biology, chemistry, astronomy, physics, and earth science, and examine the implications, assumptions, and foundations that result from this science. Generally speaking, the criteria for science are:

1. The creation of hypotheses. These hypotheses must meet the logical criteria of contingency (meaning logically speaking, they are not necessarily true or false), falsifiability (meaning they have the ability to be proven false), and testability (meaning there are real chances that the hypotheses could be established as true or as false).
2. A grounding in empirical evidence.
3. Use of the scientific method.

THE DEMARCATION PROBLEM

According to philosopher Karl Popper, the central question in the philosophy of science is known as the demarcation problem. Put simply, the demarcation problem is how one can distinguish between science and non-science (this question also deals with pseudoscience in particular). To this day, there is still not a generally accepted account of the demarcation problem, and some even find it to be insignificant or find it unsolvable. While logical positivists,

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who combined empiricism with logic, tried to ground science in observation and claimed that anything that is nonobservational is non-science (and meaningless), Popper claimed that the main property of science is falsifiability.

Philosophical Definitions

FALSIFIABILITY: In order for a hypothesis to be accepted as true, and before any hypothesis can be accepted as a scientific theory or scientific hypothesis, it has to be disprovable.

In other words, for Popper, any scientific claim could be proven to be false. If, after extensive effort, no such proof can be found, then it must mean that the claim is most likely true.

THE VALIDITY OF SCIENTIFIC REASONING

Scientific reasoning can be grounded in many different ways to show that theories are valid.

Induction

It can be difficult for a scientist to state that a law is universally true because even if every test brings back the same results, that doesn't necessarily mean that future tests will also have the same results. It is for this reason that scientists use induction. According to inductive reasoning, if a situation holds true in every observed case, then it holds true in all cases.

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Empirical Verification

Scientific claims need evidence in order to back up theories or models. Therefore, the predictions that scientific theories and models can make must be in agreement with the evidence that has already been observed (and observations are ultimately results coming from the senses). Observations have to be agreed upon by others and be repeatable, and predictions must be specific so that a scientist can falsify a theory or model (which implies the prediction) with an observation.

The Duhem-Quine Thesis and Occam's Razor

The Duhem-Quine thesis states that it is not possible to test a theory or hypothesis in complete isolation because in order for one to empirically test a hypothesis, one must involve other background assumptions. A result of this thesis is the notion that any theory can have the ability to be compatible with empirical information if enough ad hoc hypotheses are included. It is for this reason that Occam's razor (the notion that the simplest of explanations should be chosen among competing theories) is used in science. In agreeing with the Duhem-Quine thesis, Karl Popper shifted from favoring a naive falsification to favoring the theory that scientific theories should be falsifiable, meaning if a hypothesis cannot create testable predictions, it is not considered science.

THEORY DEPENDENCE

Basic observations can be interpreted in different ways based on an individual's theories. For example, while it is common knowledge today that Earth rotates, earlier scientists believed the sun moved

and Earth stayed still. Therefore, when an observation (which involves cognition and perception) is interpreted by a theory, it is referred to as theory-laden. According to philosopher and physicist Thomas Kuhn, it is impossible to isolate a hypothesis from the theory's influence (which is grounded in observation). Kuhn states that new paradigms (based on observations) are chosen when they do a better job than older paradigms in explaining scientific problems.

COHERENTISM

According to coherentism, theories and statements can be justified as the result of being a part of a coherent system. This system can pertain to the beliefs of a particular scientist or to the scientific community.

PSEUDOSCIENCE

Pseudoscience refers to those theories and doctrines that fail to follow the scientific method. Essentially, pseudoscience is non-science that poses as science. While theories such as intelligent design, homeopathy, and astrology may serve other purposes, they cannot be considered a true type of science because they cannot be falsified and their methods conflict with results that are generally accepted. The disciplines used for investigating sciences simply cannot be applied to these types of theories. This is not to say that all non-science is considered to be pseudoscience, however. Religion and metaphysics are two such examples of non-scientific phenomena.