

## Philosophy of Science

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Philosophy of science is the study of assumptions, foundations, and the implications of science.

It investigates the different branches of science and its underlying structure. Central questions are "What is science?" and "What is not science?", as well as "What characterizes science?" and "How to achieve scientific progress?".

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## History

The history of the philosophy of science <sup>[1]</sup> has its roots in philosophy, and emerged as an autonomous discipline sometime in the nineteenth century.

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# History

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Auguste Comte and John Stuart Mill can be seen as important people during its origins, even though philosophers like Copernicus, Bacon, Galileo and Kepler had developed thoughts regarding related issues.

## Truth and Reality

Philosophy of science [2] can be viewed as a way of describing how research [3] is conducted, and a way of deciding how it should be carried out.

How do the real world, empirical data [4], models and theories relate to each other, and what can be done to improve their relationship?

The relationship between truth and theory [5] is at the very heart of science, determining when, and if, a theory becomes accepted as reality. The realism and antirealism-debate [6] is a philosophical debate, which explores the basis of commonly accepted scientific truth.

Scientific reductionism [7] is a much debated idea in philosophy of science, where science reduces complex interactions and entities to the sum of their constituent parts.

## Paradigms

A scientific paradigm [8] is a framework containing all of the commonly accepted views about a subject.

The philosopher, Thomas Kuhn [9], suggested that scientific research does not progress towards truths, but is subject to dogma and a futile clinging to old theories.

Scientific revolution, a shift that completely changes the way in which science looks at the world, is often referred to as a paradigm shifts [10]. One example of a paradigm shift is the discovery of the relativity theory, which revolutionized the way that humans understand physics.

## Constructing Theories

Occam's razor [11] is commonly described as 'the simplest answer is most often correct'. It is the process of paring down information to make finding the truth easier. Using Occam's razor helps the researcher to investigate the simplest theory first.

It is natural to gather data that supports the theory when conducting research. Sometimes researchers are so busy verifying their theory that they forget to look at observations that contradict the theory. This is often referred to as verification error [12]. It can happen when a scientist feels too attached to a theory, often because they "invented" it.

It is often seen as better to try to falsify <sup>[13]</sup> the theory. The scientist tries to develop the theory with bold predictions, which are testable <sup>[14]</sup>. Scientists are more likely to try to falsify their theory and tend to adapt the theory to reality, instead of "adapting the reality to their theories". When doing the latter, you often end up with theories which are formulated in such a way that they confirm "everything".

Researchers often use a research hypothesis <sup>[15]</sup> to make their science testable. An ad hoc analysis <sup>[16]</sup> however, is an extra type of hypothesis added to the results of an experiment to try to explain away contrary evidence.

When researching, it can be useful to remember that the accuracy of a theory does not depend on the researchers' beliefs - it is not more or less true, no matter how much you believe it.

## What is Science?

Philosophy of science tries to distinguish science from religion and pseudoscience. The methods above (such as Occam's Razor, falsifiability and testability) are all attempts to separate the science from "non-science".

The religion vs science debate <sup>[17]</sup> has in recent years started to dominate the news more than ever before. The schism between science and religion <sup>[18]</sup> began in the 17th century. It was a necessary stage in the advancement of human knowledge.

Fringe science <sup>[19]</sup> is a branch of science that departs from the established scientific theories. Unlike pseudoscience <sup>[20]</sup>, it still uses the scientific method, but is highly speculative, at least for the common beliefs of the time. Junk science <sup>[21]</sup> is the anti-thesis of fringe science, often practiced when politics and businesses influence research too much.

Misconceptions <sup>[22]</sup> in science are a common belief, where a semi-truth or falsehood is perpetuated as scientific fact.

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