Science vs pseudoscience

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Pre-historic flat earth human giant remains in Bulgaria, covered up by Vatican

Reuters fact checking

https://www.reuters.com/article/uk-factcheck-giant-skeletons-hoax-idUSKCN2AV20V

The demarcation issue...

...attempts to define what distinguishes science from non-science and pseudoscience.

Curd and Cover (1998,2):

> *[Demarcation criteria] are necessary conditions which any discipline must satisfy in order to qualify as science, and can thus be used to "differentiate science from its counterfeit: if a discipline fails to meet one of these conditions, then it is judged to be nonscientific."*

Martin Curd and J A Cover (eds.). *Philosophy of Science: The Central Issues*, New York: W W Norton (1998).

Demarcation science vs. non-science

Challenge

Define such a set of conditions which is neither too narrow in that is excludes valuable science, nor too wide in that it includes activities generally not considered scientific.

Question

But why would this be an important issue (outside, say, of philosophy lectures)?

The case of parapsychology

Characterisation (Parapsychology)

Study of extrasensory perception and paranormal powers such as telekinesis ('distant movement'), telepathy, clairvoyance, and precognition.

In 1969, the American Association for the Advancement of Science (AAAS) admitted the Parapsychological Association as affiliate member.

$\Rightarrow$ 'official recognition' as science

John A Wheeler's reaction:

Letter to the President of the AAAS in 1979

> *We have enough charlatanism in this country today without needing a scientific organization to prostitute itself to it. The AAAS has to make up its mind whether it is seeking popularity or whether it is strictly a scientific organization.*

The Parapsychological Association is still an affiliate member of the AAAS.

The case of alternative and complementary medicine

Characterisation (Alternative medicine)

"A catch-all phrase for a long list of treatments or medicinal systems including traditional systems such as Chinese or Ayurvedic medicine, homeopathy, various herbals and other miscellaneous treatments that have not been accepted by the mainstream, or Western, medical establishment." *Online Medical Dictionary, published at the Dept. of Medical Oncology, University of Newcastle upon Tyne, 3 January 2007*

Characterisation (Complementary medicine)

Alternative medicine used in conjunction with conventional medical treatments.

Other famous and notorious cases

- astrology
- Sigmund Freud's psychoanalysis
- Erich von Däniken's (*Chariots of the Gods?*) theory of extraterrestrial influence on human culture since prehistoric times ('paleocontact')
- flat-earth theory
- creationism, intelligent design
- climate denialism
- anti-vaccination movement

Relevance of demarcation issue

Distinguishing science from non- or pseudoscience matters in very tangible ways:

- allocation of (public and private) resources such as research grants, positions in universities, access to facilities of learning
- (science) curriculum in public schools
- political response to climate crisis
- public health
- responsible citizenship and democratic participation

Marianna Spring: Coronavirus, the human cost of virus misinformation

`https://www.bbc.com/news/stories-52731624`

In philosophy of science, we don't want to know so much whether particular traditions are considered scientific or pseudoscientific, but rather why they are so considered.

Theory of evolution

Characterisation (Theory of Evolution–roughly)

The basic mechanisms of the evolution of species are the individual variation with respect to certain traits among the members of a population, the heritability of these individual variations from a member to its offspring, and the differential selection of individuals based on the fitness of their individual traits.

The fact that this is a theory (= set of hypotheses, usually about natural phenomena) does not say anything about its truth or falsity. This issue is entirely separate.

Intelligent design

Characterisation (Intelligent Design)

"The theory of intelligent design holds that certain features of the universe and of living things are best explained by an intelligent cause, not by an undirected process such as natural selection." (Discovery Institute, `http://www.discovery.org/csc/topQuestions.php` *)*

Essentially, intelligent design is a edited version of creationism with all references to the Book of Genesis, the Christian religion, God, etc removed.

The Scopes trial (1925)

[Criminal Court of Tennessee]

- 13 March 1925: Butler Act passed in TN (prohibits teaching of evolution in public schools in TN)
- prohibited to teach in public schools "any theory that denies the story in the Divine Creation of man as taught in the Bible, and to teach instead that man has descended from a lower order of animals"
- 21 July 1925: high school teacher John T Scopes found guilty of teaching evolution and fined
- case later dismissed on technicality

Epperson v. Arkansas (1968)

[Supreme Court of the United States]

- in 1928, AR adopted law which prohibited any public school to teach evolution
- no one ever prosecuted
- AR law was challenged in 1960s
- Supreme Court rules that AR law unconstitutional because it violated the Establishment Clause of the First Amendment to the Constitution of the United States
- majority of court held that a state is prohibited from requiring "that teaching and learning must be tailored to the principles of prohibitions of any religious sect or dogma"

Establishment Clause

The Establishment Clause of the First Amendment states that:

> *"Congress shall make no law respecting an establishment of religion"*

Together with the Free Exercise Clause, ("or prohibiting the free exercise thereof"), these two clauses make up what are commonly known as the 'religion clauses'.

'Separationist' or 'no aid' interpretation: prohibition of establishment of national religion

'Non-preferentialist' or 'accommodationist' interpretation: prohibition of preference of one religion over others or of religion over non-religious philosophies in general

Kitzmiller v. Dover Area School District (2005)

[US District Court for the Middle District of PA]

- first direct challenge in federal courts against a public school district that required the presentation of 'intelligent design' as an alternative to evolution as an "explanation of the origin of life"
- plaintiffs successfully argued that intelligent design is a form of creationism, and that the school board policy thus violates the Establishment Clause

McLean v. Arkansas Board of Education (1982)

[US District Court for the Eastern District of AR]

- Arkansas Act 590: requires teachers in public schools to give a "balanced treatment" to both evolutionary theory and creationism in biology classes
- in fact, it stipulated that if evolution is taught, then creationism is to be given equal time
- ruling: Act is unconstitutional
- defendants did not appeal decision

Judge William Overton's Opinion I

US Supreme Court's interpretation of Establishment Clause has evolved into three-part test of which each condition must be satisfied for the constitutionality of any legislation involving religion, applied by Overton:

- "statute must have a secular purpose"
- "its principal or primary effect must be one that neither advances nor inhibits religion"
- "statute must not foster 'an excessive government entanglement with religion' "

William R Overton, "Opinion in *McLean v. Arkansas*," *Science, Technology, and Human Values* 7(1982): 29.

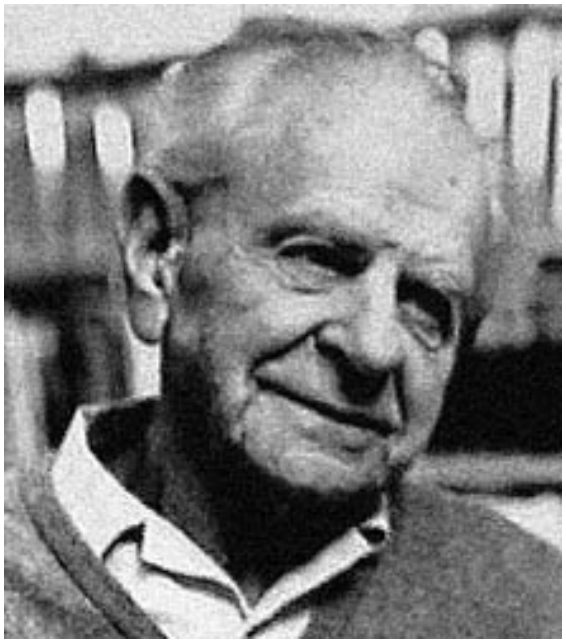
Ruse: 'Creation-Science Is Not Science'

Characterization of science:

- you know it when you see it [?]
- "empirical enterprise about the real world of sensation"
- "involves a search for order... for unbroken, blind, natural regularities (laws)"
- "involves the use of law to effect explanation"
- prediction
- testability (confirmation v. refutation/falsification)
- science is tentative, revisable
- other features include: simplicity, unification
- often presupposes attitude of professional integrity

Verdict: creation-science has none of these features

Sir Karl Popper (1902-1994)



- falsifiability (= possibility of being shown to be false in light of empirical tests) as criterion of demarcation
- too weak: would allow any number of claims that are testable in principle
- too strong: rules out many good scientific theories in history of science
- Kuhn, Lakatos et al: historical and social dimension to judgments concerning scientific status

Judge William Overton's Opinion II

Characterization of science:

- is guided by natural law
- has to be explanatory by reference to natural law
- is testable against the empirical world
- its conclusions are tentative
- is falsifiable

Verdict: creation-science has none of these features

Laudan: 'Commentary'

- Creationism does make testifiable and falsifiable (and falsified) assertions
- Creationism has revised its assertions, e.g. regarding the variability of species
- attitude of advocates irrelevant
- lawfulness of observed criteria not necessary condition [but I oppose his argument]
- "If we set very weak standards for scientific status [such as testability, revisability etc] then it will be quite simple for Creationism to qualify as 'scientific'."
- "the real question is whether the existing evidence provides stronger arguments for evolutionary theory than for Creationism."

Ruse: 'Response to the Commentary'

- Constitution does not bar teaching of weak science, but only of religion
- robust core beliefs of creationism are not the testifiable and revisable assertions discussed by Laudan
- lawfulness and explanatory strength important, although true that not all of science always follows this precept
- science, insofar as it is science, must seek lawful regularities in natural phenomena

Conclusion

The demarcation of science is tricky, even though it obviously has important practical consequences.