

If you think of yourself as at least somewhat a scientific person, you may believe that science is an objective thing. It ought to be, because isn't one of the most defining aspects of science that it paints an *objective* picture of reality through its methods, hypotheses, and conclusions? Most things that ought to be objective, when they enter the social sphere, become subjective. When something is discussed with others, it is necessarily open to interpretation; when you say words about science, I may glean an entirely different message from the one you were trying to convey. In the realm of discussion of science, some camps consider creationism science, some consider astrology science, and some consider only the most empirical and believable studies to be scientific. Amidst this chaos, how can we know which "sciences" are really sciences? We need to be able to trust some scientific information, because it informs so many aspects of our life, such as our health, our culture, and our technology. How can we decide which sciences are truly sciences, and which are merely pseudoscience or ideology?

First, let us discuss why this question matters. Beyond the relevance to our personal lives, science matters to a culture's progression. What has and has not been considered science has had large historical effects on cultures. Those cultures that historically rejected certain "real" sciences have been forced to adapt to maintain any global power. For example, during the cultural revolution, China had to reform its culture of anti-Westernism to embrace the "real" Western sciences that it was falling behind in. A culture that differentiates between science and pseudoscience accurately, and progresses its own sciences, will have more chance at survival than one that does not.

Now that we have established the importance for a criterion of distinguishing science from pseudoscience, let's see what other philosophers have to say about this. One philosopher of science, Imre Lakatos, made his own demarcation criteria. He begins by

addressing one popular theory that if enough people believe a science to be credible, then it is truly a scientific science. However, Lakatos thinks this is incorrect. For him, believing in something does not affect whether that thing is scientific in the slightest. His first notable claim is that the “...scientific value of a theory is independent of the human mind which creates it or understands it” (21). In other words, scientific value only depends on whether there are enough facts to back up a certain theory.

Lakatos then grants that the problem of induction still exists, that “...there can be no valid derivation of a law of nature from any finite number of facts” (21). This is a known fact and still leaves the question of what makes science *science* up in the air. Lakatos goes on to say that Popper’s falsification theory—that a method is scientific if and only if it is falsifiable—is also wrong, because scientist “have thick skin” and are not always willing to abandon their theory, even when falsified (23). Finally, Lakatos arrives at his main point, that good science is marked by a progressive research program.

A research program is a set of theories about a certain discipline, such as physics. They typically entail core tenets, such as Newton’s laws, surrounded by a ring of auxiliary hypotheses and theories. With this structure, a science may have some of its theories disproven while keeping its status as a mainstream science.

After defining research programs, Lakatos describes two types: progressive and degenerative. Progressive research programs predict novel facts. In other words, their theories lead to new knowledge and discoveries. The internal thought of the scientists, which create their hypotheses, eventually come to be contextualized in the external world. The theories flow from the internal to the external. On the other hand, degenerative research programs make theories that flow in the opposite direction: from external to internal. Their theories come from observations of the outside world and are made to

justify their own beliefs against the external. These are the programs such as Marxism, where nothing new is ever postulated. The only work is to respond to the events of the external world by making Marxist theories that can be justified with those events. These theories do not predict the future but are born from past.

Lakatos' theory is elegant, yet it fails at a few steps along the way. First of all, Lakatos argues that science is independent from human minds and human belief. This is a fair argument, as this is how it seems that science ought to be, but it is wrong under the new theory I will propose later. He goes on to discuss the problem of induction, saying that no finite number of facts can ever prove something to be true or false. In other words, all of science may be incorrect, and we can never know with absolute certainty, because all science relies on temporal observation. What does he do about this problem? He acknowledges it by saying that all scientific theories are equally unprovable, then move on to his own theory of demarcation.

So, Lakatos has postulated that 1) science is independent from human belief and 2) science faces the problem of induction. Nothing can be proven as true, and it doesn't matter if we believe in science. This seems to imply that it is impossible to know what science is and is not. I believe that Lakatos would agree, but his lack of acknowledgement of this seemingly important implication weakens his article.

Then we get to theory itself. Science is marked by a progressive research program. Is this true? It runs into a problem. What if someone were doing science in isolation, without a surrounding, peer-reviewed research program? Lakatos would probably say that it would eventually lead to a research program, so we may not be able to call it science when it is just one practitioner with a couple theories, but once it grows beyond that it will be obvious. For example, Einstein conducted science before he published his first papers

in 1905, but we wouldn't be able to tell that he was doing science until his theories predicted novel facts.

Also consider: what if a science was wrapped within a degenerative research program? What if a creation scientist (creation science is, surely, not science) were to accidentally create a theory that led to a novel fact? For example, creation scientists believe in the Bible, and that Jesus will one day be reincarnated. If that were to happen, the creationists' theory will have predicted a novel fact, and creationism would become a progressive research program in the same way that Einstein's theories did.

The point that these questions are leading to is this: there is a temporal nature to Lakatos' demarcation theory. Each theory's scientific validity is dependent on the historical context of its time, such that the measurement is only valid when looking to the past. Even then, new facts may be discovered that will cause even our judgements of past sciences to change. Therefore, a new theory is needed.

What distinguishes science from pseudoscience, *right now*? Contrary to Lakatos' argument, science is marked by the support and appraisal of preestablished scientists. In this way, it directly contradicts Lakatos' idea that science is independent from human belief. The obvious counterargument to this support theory is that, if every science is marked in this way, then how could the first science have been marked in this way? In other words, if every science must be supported by a science before it, how was the first science supported?

First, let's establish physics as, maybe not the "first" science (but maybe so), but certainly the most fundamental. The reason for this is that all other sciences: astronomy, chemistry, biology, geology, etc. use instruments and reasoning that assume physics to be

true. All methods of physical measurement, for example, rely on physics, such that every scientist seems to be certain of physics.

So, what I really meant by science needing to be supported by preestablished scientists, it really needs to be supported by physicists. It needs to be compatible with the most accepted version of physics at any given time. This doesn't give a solid answer to how the first science could have been known in its time, but we don't need to worry about it. As long as one assumes that modern physics is true, as all scientists do, then one can use it as a benchmark for measuring other disciplines scientific value.

For example, creationism is commonly understood as a pseudoscience. That is, some of its proponents view it as scientific, while the rest of the scientific world does not. Is it truly scientific using the new criterion? Well, one of their beliefs is that evolution did not take place. Now ask, which theory is more supported by modern physics: creationism or evolution? Since creationism refutes evolution, if evolution is scientific, creationism cannot be. Clearly evolution is compatible with physics, so it is scientific. Therefore, creationism is not scientific under the support theory of science.

Choosing which sciences are valid and which are not is important not only for personal wellbeing, but the health of the larger culture within which you live. Believing that real science is that which is supported by physics is one valid method of distinguishing between science and pseudoscience.