

Teaching the Philosophy of (Pseudo) Science

Written by Sebastian Normandin
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The following is a contribution to the JREF's ongoing blog series on skepticism and education. If you are an educator and would like to contribute to this series, please contact [Bob Blaskiewicz](#) .

“What is science?”

I put this question to freshmen in a science college at a Tier-one research university hoping for some creative comebacks in the form of a paragraph or two. I got confusion. Science, apparently, is: everything, nature, technology, “the scientific method,” and, brilliantly, what scientists do. Faced with a barrage of odd, confused generalities, I was dismayed but not surprised. For what is science? It may be among the most elusive questions in the modern world, motivating scholars in history and philosophy of science to write and reflect endlessly. Though this simple question remains foundational to these fields, most thinkers abandon it at a certain point and move on to more concrete, pragmatic concerns. But the question remains.

One way to develop a satisfactory answer is to turn the question around – “What isn't science?” This was to be my approach teaching an introduction to history and philosophy of science. I would use the concept of pseudoscience to help these budding scientists better understand what it is they think they are getting into. It's logical. After all, how can one know light without darkness, life without death, love without hate, good without evil? And pseudoscience has such pejorative connotations it's often seen as dark, even evil, or at least insidious. Value judgments aside, exploring this concept would be a way to draw my audience in and, without them noticing, teach some fundamental principles in history, philosophy and sociology of science.

Interesting, that idea of value judgments. We see values and the expression of values, (or beliefs, ideologies, or even, one might say, biases) as anathema to science. Science, conventionally understood, is “value-free” or “value-neutral.” It's this kind of neutrality and objectivity that is seen as the hallmark of scientific thinking. But is this valid? In “Objectivity, Value Judgment, and Theory Choice,” the famed purveyor of the paradigm shift, Thomas Kuhn, argues there are no real universal rules guiding choices between scientific theories and the values that inform all thinking are subjective, transcending any ultimately rational framework. Further, there are all sorts of irrational psychological and social forces that influence which theories prevail in a given scientific community.¹

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Kuhn's idea of paradigm shifts has profoundly impacted the way scientific ideas are understood. He said that the development of science followed a pattern – a paradigm develops, and most research is “normal” science that bulwarks the existing paradigm. Eventually, however, anomalies build up to the point of incoherence, forcing the adoption of a new paradigm – something that occurs, historically, almost overnight. He understood how important social context was in the scientific endeavor. In technical terms, Kuhn moved history and philosophy of science from an *internalist* to an *externalist* perspective. His work illustrates how contingent scientific ideas are, and further suggests that the idea of scientific realism – that science accurately describes a world “out there” independent of our subjective experience – is probably untenable. This doesn't mean there is no “dark side of the moon” even if we aren't able to see it. It merely means that this kind of ontological gymnastics is irrelevant to our understanding of science. Rather, we are left with a necessity to acknowledge social construction and a strong motivation to question the supposed objectivity and value-neutrality of science. Science, then, is subject to the same limitations as every other area of human endeavor.

What does this have to do with the teaching of pseudoscience? It reminds students that vigilance about the legitimacy of a scientific idea or theory is more important than ever and all of us, as a society, need to be gatekeepers, wary of poorly constructed science. For any citizen of the contemporary techno-scientific world this critical understanding, and the ability to evaluate a given scientific practice from methodological *and* social perspectives, is an essential skill. It also suggests there are reasons beyond “truth” that prompt us to deny the validity of supposedly scientific claims.

But what are these reasons? This is where pseudoscience proves illustrative. Take astrology. In a classic article, “Why Astrology is a Pseudoscience,” Paul Thagard argues, contrary to many other philosophers, that there is no one clear criteria distinguishing science from pseudoscience (e.g. Popper's idea of *falsifiability*, the notion that all scientific theories need to be open to being refuted). Instead, through a brief but brilliant history, Thagard shows that astrology is pseudoscientific because in its 2500-plus year history, *it has not once changed its basic framework or shown any progressive development at all*. For Thagard, astrology's entrenched nature, the unwillingness of its practitioners to consider alternate theories or adapt their explanations based on new data, is what makes it pseudoscientific.

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At a stroke, this example gives students an instinctual sense of the importance of change and progressive development in science, making the point without understating how much foundational scientific theories remain fairly fixed.

Subjects like cryptozoology or ufology introduce students to the scientist as professional, reminding them that many social criteria – credentials, institutional affiliation and training – go

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into evaluating a scientist's legitimacy and claim to expertise. These fields also force students to think carefully and critically about the nature of proof.

The idea of proving seems an important aspect of scientific practice, but what does this mean? Science requires a level of *demonstration* (proof) and a quality of evidence that differs from unscientific or non-scientific practices. Here students learn the dangers of confirmation bias – selective and subjective use of data and evidence. Though part of all human endeavor, science seeks to minimize its impact as much as possible. The way cryptozoologists become obsessed with their subjects and pursue them with a reckless personal passion also warns us that personally investing too much in research outcomes can undermine credibility and lead to a charge of pseudoscience. Even legitimate practicing scientists can fall victim to this. Discussing the problem of confirmation bias and personal gain, I have the opportunity to ask tough questions about the procedures the modern pharmaceutical industry employs in its clinical trials. The nature of drug development also introduces the limits of contemporary science's compliance with what sociologist Robert Merton argued should be scientific norms, like communalism (openness) and disinterestedness.

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The challenge of bias and the selective use of data are also issues in alternative medicine. Alternative medicine further highlights two other problems of pseudoscience – vagueness and a misinterpretation of, or even unwillingness to recognize, established laws of nature. Most alternative medicine is dependent on the idea of vitalism – the idea of a “life force” that shapes, guides, and heals the living. The problem with vital forces or energies is that they are vague and lack concrete proof. In addition, they run contrary to what mainstream science accepts as the known forces of nature. In this sense, alternative medicine is operating in what a Kuhnian might call a different paradigm. Indeed, many aspects of alternative medicine – its rationales, methods, and understandings – not only run contrary to the conventional scientific worldview, they are actively hostile to it. So much of what pseudoscience depends on – in things like homeopathy, hypnotism, and all sorts of areas where suggestion is important – is *placebo effect*, a poorly understood phenomenon reminding us of the power of belief. But belief does nothing to improve our knowledge – sugar pills or injections of saline may make people feel better, but science differs from pseudoscience in the need to explain *how*.

Problems of belief and what can be invoked as an explanation further illustrate the way science differs from other practices. “Creation science”, for example, prioritizes ancient religious texts (e.g. The Bible) as evidence to argue for an Earth created a few thousand years ago over and above almost two hundred years of observational facts that provide evidence for a very different view – an almost unimaginably ancient Earth and the amazing process of natural selection responsible for producing its startling diversity of life. Not only do creationists valorize different

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facts, they actively ignore facts that contradict their theories. From the point of view of method, this is just not science. They also invoke supernatural forces, violating the dedication science has had to a “naturalistic epistemology” since the practice began in ancient Greece.

At a stroke, the critical investigation of a pseudoscientific domain, like parapsychology and the study of ESP (or *psi* as it's now called) can highlight a number of unscientific elements – anecdotes, coincidence, and the lack of controls and clarity in experimental design. It also shows students that unexplained doesn't mean inexplicable. Without formal historical or philosophical training, students tend to see science as a collection of “facts.” And, indeed, to some degree science is made up of facts. But as the French mathematician Jules Henri Poincaré said, “a collection of facts is not necessarily science.” And what is a fact? Thinking about this question shows us that not all facts are created equal, and that the kind of facts that science prioritizes are better understood as evidence – a word that implies awareness, and thus the idea of seeing or experiencing. This is the kind of *direct evidence* science demands, generated by experiments or garnered by careful observation (and here, even, scientists generally value experimental over observational facts – after all, our senses can so often be deceived).

As an example, consider the largely forgotten Velikovsky affair. Immanuel Velikovsky was a psychiatrist and eclectic independent scholar who wrote *Worlds in Collision* in 1950. Using evidence (facts) found in ancient historical and religious texts, he argued that the Earth and some of the other planets in the solar system had experienced numerous close encounters and collisions with each other (in what astronomers would see as a very recent timeframe) that contributed to their formation and transformation. Velikovsky essentially suggested that references in historical documents were archetypal recollections of these events. His claims generated a hysterical response from the scientific community, and rightly so. For Velikovsky had violated accepted scientific practices – speaking to a subject in which he had no formal training, ignoring existing theories and models, and prioritizing a certain kind of evidence (textual) over and above “better” evidence generated by careful observation and experiment.

Velikovsky's catastrophism and ideas about planetary formation is a cautionary tale.⁵ It recalls the ways in which wild theorizing and speculation are pseudoscientific at their core but, in certain cases, have also served the development of science. In the context of mainstream science, some of Velikovsky's insights about the importance of the catastrophic in astronomy have merit (i.e., the currently accepted theory about the formation of the moon resulting from an object impacting the Earth). Examples of the importance of heresy abound in the history of science. Figures like Copernicus and Galileo were operating outside the purview of “normal” inquiry into knowledge in their respective societies. More recently, Alfred Wegener's theory of continental drift, proposed in 1912 in a paradigm of gradualist geophysics, was labeled pseudoscientific and only finally accepted in the late 1950s as plate tectonics emerged as an

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explanatory framework.

One might ask if these renegade successes justify a kind of chaos without rules in knowledge inquiry, what philosopher Paul Feyerabend called “epistemological anarchism.”⁶ Well, no. For individuals this is often a laudable strategy but, collectively, it quickly leads to complete dissipation and incoherence. When it comes to creating meaning, some structure must apply and looking at pseudoscience reveals inquiry that pushes beyond the boundaries of the structure of science.

In the end, when teaching history and philosophy of science, one needs to be practical; and here science in its modern guise demonstrates its central virtue. If there is “success” in a given scientific endeavor (i.e., what philosopher Imre Lakatos called a *research programme*⁷), if it garners funding, employs researchers, produces peer-reviewed publications and technological byproducts, adds to knowledge of the natural world in a meaningful way, and, perhaps most importantly, is seen as legitimate and having merit in the wider social sphere, then it is “science”. Looking at the ways many theories and ideas have failed to meet these criteria, and ended up labeled as pseudoscience, helps students fundamentally appreciate what we mean by the word.

Notes: 1. Thomas Kuhn, “Objectivity, Value Judgment, and Theory Choice,” in *The Essential Tension* (Chicago: University of Chicago Press), pp. 320-339.

2. Thomas Kuhn, *The Structure of Scientific Revolutions, 2nd ed.* (Chicago: University of Chicago Press, 1970 [1962]).

3. Paul R. Thagard, “Why Astrology is a Pseudoscience,” in *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association, Vol. 1978, Volume One: Contributed Papers* (1978), pp. 223-234.

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4. Robert K. Merton, "The Normative Structure of Science," in Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago: University of Chicago Press, 1973).

5. Velikovsky has been the subject of intense study, most recently in Michael D. Gordin, *The Pseudoscience Wars: Immanuel Velikovsky and the Birth of the Modern Fringe* (Chicago: University of Chicago Press, 2012).

6. <http://www.generation-online.org/p/fpfeyerabend1.htm>

7. Imre Lakatos, *The Methodology of Scientific Research Programmes: Philosophical Papers, Vol. 1* (Cambridge: Cambridge University Press, 1978).

Sebastian Normandin is a Visiting Instructor in Lyman Briggs College at Michigan State University. His research focuses on the history and philosophy of medicine and biology, but he remains ever fascinated by the concept of pseudoscience and the scientific fringe. His forthcoming book, with co-editor Charles T. Wolfe, *Vitalism and the Scientific Image in Post-Enlightenment Life Science, 1800-2010*, will be published by Springer in 2013. You can follow him on Twitter @weirdhistorian.