

successful. Its assumption that firms maximize profits, or equivalently shareholder value, was falsified when empirically tested in the 1950s. Instead of revising the theory, neoclassical economists argued that managers should be given appropriate incentives to maximize profits, namely, stock options. Thanks in part to their argument, companies adopted this form of compensation, and maximizing shareholder value became a social norm. As a result, short-term profit maximization—as neoclassical theory predicts—is more true today.

A self-fulfilling prophecy is not easy to demonstrate empirically. Only experimental intervention can ensure that actors' beliefs are not influenced by prior reality. To return to the example used at the outset, the investigator can select a few students at random and convince their teacher that they have been diagnosed with exceptional ability. Their subsequent academic achievement should be greater than average, if a self-fulfilling prophecy is to be operative. Such experimentation is limited by the difficulty of manipulating beliefs in human beings, especially when investigation is bound by informed consent. Experimental results will inevitably underestimate the causal impact of belief.

Self-fulfilling prophecies have an abiding fascination because they show how we can be caught in a web of our own making. By reifying social reality, we can fail to understand that we have been responsible for creating it.

Michael Biggs

See also Feedback Mechanisms and Self-Regulatory Processes in the Social Sciences; Retrodiction and the Epistemology of Future Studies

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PSEUDOSCIENCE

The term *pseudoscience* refers to a highly heterogeneous set of practices, beliefs, and claims sharing the property of appearing to be scientific when in fact they contradict either scientific findings or the methods by which science proceeds. Classic examples of pseudoscience include astrology, parapsychology, and ufology; more recent entries are the denial of a causal link between the HIV virus and AIDS or the claim that vaccines cause autism. To distinguish between science and pseudoscience is part of what the philosopher Karl Popper referred to as the *demarcation problem*, a project that has been dismissed by another philosopher, Larry Laudan, but that keeps gathering much interest in philosophers, scientists, educators, and policymakers.

This entry provides the basics of the debate about demarcation, as well as a brief discussion of why it is of vital importance not just intellectually but for society at large.

Popper and the Demarcation Problem

Popper began working on the problem of demarcation between science and pseudoscience (as well as more generally nonscience) as early as 1919. He was particularly concerned with David Hume's famous problem of induction, the idea that there does not seem to be a logically independent way to justify inductive reasoning, the basis for the scientific method. Popper thought he had arrived at a single idea that represented both a solution to Hume's problem as well as a clear-cut demarcation criterion: *falsificationism*. He proposed that science is in the business of advancing falsifiable (i.e., refutable in principle) theories about how the world works. This appeared to have bypassed Hume's issue about induction because falsificationism can be thought of as an application of *modus tollens*, therefore relying on deductive, not inductive, reasoning. At the same time, it seemed to Popper that pseudosciences (among which he counted various schools of psychoanalysis as well as Marxist theories of history) made statements that were not falsifiable, and were thereby unscientific.

While Popper's contribution to both issues remains a fundamental starting point for any discussion of demarcation and induction, there are good reasons to believe that he was a bit too quick in

declaring victory on both fronts. This entry directs the reader to two comprehensive articles concerning the problem of induction and focuses instead on falsification as a demarcation criterion.

It is easy to show that falsification leaves much good science out and allows a significant amount of pseudoscience in. For instance, the history of science is riddled with examples of scientific hypotheses that—when first proposed—were apparently falsified by the data and yet scientists kept them alive because they seemed promising enough. The initial version of the Copernican system, with its circular planetary orbits, was doing no better empirically than the Ptolemaic system it was supposed to replace, and it was not until Kepler realized that the planets move along elliptical orbits that the theory was vindicated. Copernicus's book was published in 1543, but it was not until 1609 that Kepler put out his fundamentally revised version of the theory.

On the other side of the divide, so-called scientific creationism does make perfectly falsifiable predictions, such as that the earth is only a few 1,000 years old. These predictions have indeed been amply falsified by modern geology, physics, chemistry, and biology, and yet there does seem to be a strong sense that we should not simply consider creationism a science, even a failed one (for one thing, because of its appeal to supernatural, by definition inscrutable, forces, which are themselves outside the purview of science).

What the inadequacy of falsification in establishing a demarcation criterion hinted at was something that became progressively clearer in the decades following Popper's pioneering work: Science and pseudoscience are simply not the sort of concepts that admit of being defined by a small set of individually necessary and jointly sufficient conditions, the way classical logicians would want the task to be accomplished. However, it is important to understand that this sort of situation is not limited to the case of the science/pseudoscience demarcation. Plenty of other complex and interesting concepts are too "fuzzy" (in the technical sense of fuzzy logic) to admit of sharp boundaries and clear-cut definitions. Examples include the idea of "game" (as famously pointed out by Ludwig Wittgenstein) as well as the concept of biological species.

Take games, for instance. Clearly, we seem to know what sort of activities reasonably fall into that category (chess, soccer) and which don't (war, philosophizing), and of course, we are aware of borderline

cases (e.g., "games" actually used to solve practical problems, e.g., the 3-D folding of proteins). Yet it is easy to appreciate how difficult it is to come up with a small number of criteria that sharply define what a game is. For each candidate, say, "done competitively," there are both instantiations belonging to the set of interest that fail the criterion (e.g., *solitaire*) and others that meet it while clearly not belonging to the set (e.g., business transactions). So in some sense, it should not really be surprising that the terms *science* and *pseudoscience* are difficult to define exactly and yet still refer to reasonably coherent types of activities that are distinct in important ways from each other.

Laudan and the Alleged Demise of the Demarcation Problem

The philosopher Larry Laudan declared the demarcation problem dead, and the concept of pseudoscience useless and pernicious, in a famous article published in 1983. Laudan pointed to the "failure" of philosophers to agree on necessary and jointly sufficient criteria for demarcation as an indication of the futility of the project. Moreover, he asserted that since *pseudoscience* is an emotionally charged word (clearly always used in dismissive terms), it does not really belong to philosophical discourse. The real issue, Laudan maintained, is to assess the epistemic warrant behind each individual claim to knowledge, regardless of whether it is made from within fundamental physics or astrology.

While Laudan's critique has been important in the history of the debate about pseudoscience, there are several counterpoints to consider, which explain why philosophical discussions of demarcation have been on the rise again during the past decade, with no sign of abating any time soon. Let us start with Laudan's last point, that epistemic warrant should be attached to specific claims, not to broad endeavors. This is much too restrictive and impractical. When a field like astrology has repeatedly, and for a long time, demonstrated its inability to make progress—due to the incoherence of its theoretical constructs (e.g., "constellations" are actually optical illusions) and its failure on empirical grounds—it seems the time has arrived to archive the whole thing as not warranting any more serious investigative efforts. Within a successful and dynamic science, on the other hand, the advice to examine each claim on its own merits makes sense precisely because that

science has established methods and background knowledge against which the epistemic warrant of any new claim can be reasonably assessed. Labeling something as pseudoscience—if called for—serves the same practical shortcut function of throwing an obviously frivolous lawsuit out of court before one invests money and time in something that has no chance of succeeding.

As for Laudan's argument that philosophers have failed at the demarcation task, and that we should therefore move on, it seems to be based on a peculiar understanding of "failure" for a philosopher. It can be reasonably argued that it is precisely through the exploration and criticism of possibilities in logical space that philosophy makes progress. Popper was wrong about having solved the problem of induction, but his attempt based on replacing inductive with deductive reasoning was a potentially good move that had to be properly explored and criticized before we could consider more sophisticated proposals. The same can be said of other areas of philosophical inquiry: Utilitarianism in ethics, as originally conceived by Jeremy Bentham and then John Stuart Mill, has not survived unscathed in the modern philosophical literature; but modern utilitarians like Peter Singer have been able to develop a much more nuanced view of their approach to moral philosophy precisely because they have been confronted with several rounds of criticism. The abandonment of the quest of necessary and jointly sufficient criteria to define science and pseudoscience in favor of, for instance, Wittgenstein-type family resemblance ("fuzzy") concepts constitutes progress, not failure.

Finally, let us consider Laudan's point about the emotional ladenness of the term *pseudoscience*. There is no doubt that this is the case, but Laudan himself argues that philosophy should be able to tell us what is reasonable to believe and what is not, and it is hard to imagine how "unreasonable" is the kind of label that would be much more palatable and emotionally neutral than "pseudoscience." Indeed, here, Laudan actually hits the nail on the head in implying that a major role of philosophy of science is to be prescriptive, particularly when it comes to discussions of science in the public sphere, where the consequences of our views are not merely academic but involve policy and politics.

The Role of Philosophy in Combating Inferential Biases

The current philosophical literature on pseudoscience is exploring some of the alternatives to the classical demarcation approach briefly mentioned above, such as solutions based on fuzzy logic or on making more precise the notion of Wittgensteinian family resemblance concepts. A significant number of papers have come out recently vigorously debating whether supernatural claims (e.g., Intelligent Design [ID] creationism) belong to a separate category of pseudoscience by virtue of their very invocation of the supernatural or whether they are simply another type of unscientific claim along the lines of astrology, ufology, and so on.

This particular discussion has, again, very tangible social repercussions, as was clearly on display during the 2005 trial over the teaching of ID in public schools in Dover, Pennsylvania. During the court proceedings there, both Barbara Forrest and Robert Pennock had the increasingly less rare distinction of being called as witnesses by virtue of being philosophers of science, and hence capable of providing expert testimony on the scientific nature (or lack thereof) of ID theory. As a result, Judge John E. Jones III's decision in the *Kitzmiller versus Dover Area School District* is a nice summary of the philosophical issues surrounding the demarcation problem. The judge came down on the side of philosophers, who were arguing in a prescriptive fashion that ID is a pseudoscience, one of the reasons why it should not be taught as science in the district's public schools (another reason being, as Judge Jones also noted, that ID is no different in substance from classical creationism, which other courts have found to be a religious doctrine, the teaching of which would violate the establishment clause of the First Amendment to the Constitution of the United States).

Pseudoscientific notions will likely stay with us for a long time, as recent literature in psychology shows that human beings are naturally prone to a number of cognitive biases that favor the persistence of pseudoscience. Interestingly, many of these biases find their equivalent in the philosophical literature on logical fallacies (e.g., the post hoc, ergo propter hoc fallacy—by which one confuses correlation with causation—is a major mechanism that we use to

make preliminary inferences about causality). On the positive side, psychologists have shown that an awareness of cognitive biases diminishes one's proneness to perpetuate the mistake. This in turn would seem to suggest that the teaching of critical thinking skills in philosophy classes is a fundamental component of the education of an intelligent citizenry.

Massimo Pigliucci

See also Debunking Social Science; Explanation, Theories of; Falsifiability; Popper's Philosophy of Science; Scientific Method

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PSYCHOANALYSIS, PHILOSOPHICAL ISSUES IN

Philosophical discussions of psychoanalysis have frequently focused on two topics: (1) how well psychoanalytic theories can be regarded as *evidentially supported* by the clinical data they are initially

framed to explain and (2) how far particularly psychoanalytic conceptions of *unconscious mental states and processes* should be regarded as viable. The first of these will be the main topic of this entry, and the second will be briefly considered at the close.

Free Association and Freud's Claim About Evidence

The relevant clinical data arise in the practice of *free association*, as pursued by patients in analysis over the course of months and years. To free-associate is to describe the contents of what is sometimes called the *stream of consciousness*—passing experiences, thoughts, feelings, and so forth, as fully as possible as they occur and without omitting or censoring anything. This leads rapidly to thoughts and feelings that are unexpected even to those thinking them.

The data thus generated enabled Sigmund Freud and his successors to learn as much about what went on in the minds of their patients as the patients were able to put into words and, in addition, to base further conclusions on patterns that could be observed while they were doing so. Thus, there were the patterns relating associations to elements of the manifest contents of dreams, described by Freud in his own case in *The Interpretation of Dreams*. Again, there was the pattern Freud described as *transference*, in which emotions and conflicts felt early in life toward parents and siblings were revived in patients' current experience of the therapist. Since free association and the experiences that emerged in analysis were Freud's main sources of data, he maintained that persons who did not have firsthand experience of them were not in a position to criticize his theoretical conclusions.

Dispute About Freud's Claim: Advocates and a Comparison With Darwin

This claim has been at the core of disputes about evidence in psychoanalysis. Advocates characteristically maintain that the claim reflects the fact that psychoanalysis has a unique and remarkably rich source of data that are otherwise unfamiliar and unexpected. Such data cannot be ignored, but they also cannot readily be communicated, except in small and isolated vignettes. Freud's description of the publishable parts of his associations to elements