**Diagnosing pseudoscience in real life: the symptomatic approach**

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Abstract

For a long time, philosophers of science have shown little interest in the so-called “demarcation problem” that occupied the pioneers of their field. However, recent years have witnessed a revival of interest in that old chestnut, and even the emergence of a ‘philosophy of pseudoscience’. In this paper, building on the work of Sven Ove Hansson, I defend a symptomatic approach for diagnosing pseudoscience. Pseudosciences are theories which mimic science: they are not epistemically warranted, but they are presented as scientific by their adherents. Because of the way the human mind works, however, all pseudosciences have to create a convincing *impression* of epistemic warrant. In particular, they have to evade refutations and critical scrutiny, and invite spurious confirmations. Although there are many ways in which a theory can go awry, there are comparatively few ways to create an *impression* of epistemic warrant. This indirect approach, I argue, provides the clue for diagnosing pseudoscience, and thus for solving the demarcation problem.

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What use is philosophy to society? In the public’s imagination, philosophers are people who contemplate abstruse metaphysical questions from their armchairs that are largely irrelevant to everyday, practical concerns. (And indeed, there is no shortage of academic philosophers who reinforce that stereotype). Philosophy is equated with unworldly alienation, as in the story of Thales of Miletus who stumbled into a well while gazing at the stars (well, at least Thales showed some interest in the cosmos out there). At its best, however, philosophy is firmly rooted in the real world. Philosophy is about with “how things hang together” in the broadest possible sense, as Wilfred Sellars famously put it (Sellars, 1963). Though it deals with problems at a relatively high level of abstraction, it should still be concerned with real-life ‘things’, and how they hang together.

How about the fabric of human knowledge and science? One of the most pressing questions in philosophy of science, with important consequences for society at large, is the following: how to tell apart real science from pseudoscience? How to diagnose the fake and the phony? Philosophers are perhaps best placed to address this question, even though most of them have no scientific education themselves. Scientists are often too wound up with specialized problems in their respective fields to think in general terms about the nature of science. Moreover, most have little time or patience for pseudoscientific nonsense. Astronomers are too busy with genuine astronomical puzzles to dip into astrology, and only a small number of biologists bother to keep up with the latest creationist fallacies and distortions. Philosophers, by contrast, have a bird’s eye view on the science, and can afford to ask these more general questions. What are the characteristics that unite all the different sciences, and how do they differ from pseudoscience?

**Disinterest in demarcation**

Alas, for a long time, the so-called “demarcation problem” has fallen on hard times in philosophy of science. Though the question occupied a number of its founding figures, most notably Karl Popper, by the second half of the 20th century many philosophers had lost interest in questions of demarcation. Most influential in this regard was Larry Laudan’s 1983 paper pronouncing the death of the demarcation problem. Not only have all previous philosophical attempts to distinguish science from pseudoscience failed, according to Laudan, but words like “pseudoscientific” are nothing but “hollow phrases which do only emotive work for us” (Laudan, 1983, p. 125). Many philosophers of science have not dared to touch the corpse of the demarcation problem after Laudan declared it dead. Ever since, to talk about science and pseudoscience was to betray a naïve conception of science.

This admission of defeat is rather remarkable. If philosophers of science can’t even define their own subject matter and distinguish it from forgery – which obviously exist – what use, indeed, are philosophers to society? While philosophers abandoned the term pseudoscience, it continued to be used in the public arena. Education officials use it to justify the expulsion of creationism from the classrooms, skeptics and magicians use it to label belief in telepathy and precognition, and physicians use it to dismiss homeopathy, Bach flower therapy or acupuncture. The list of book titles containing the term “pseudoscience” (and derivatives) continues to grow, and in most wealthy, industrialized nations there is at least one organization of so-called “skeptics” that is dedicated to combating pseudoscience.

Most importantly, when scientists or public health officials are considering the status of specific theories or disciplines, they often reach unanimous verdicts: relativity theory, evolutionary biology and the germ theory of disease belong to the “scientific” side of the divide, while homeopathy, Intelligent Design, and parapsychology are pseudosciences. In other words, ‘pseudoscience’ is not just some term of abuse to dismiss anything you don’t like (although it may certainly be used in this manner). Of course the scientific status of some theories – string theory, evolutionary psychology, neo-classical economics – is hotly disputed, but the level of unanimity is remarkable (Hansson, 2009). It seems that scientists are intuitively deploying similar criteria to judge the scientific merits of a theory, even if they cannot tell exactly what these criteria are. Is it not the proper task of philosophers then to spell out those criteria, to evaluate their merits, and to see if they can be improved upon?

**Revival of demarcation**

Luckily, recent years have seen a revival of interest in the demarcation problem. More and more philosophers believe that we have some intellectual duties to perform vis à vis society. While the followers of Laudan hold up their noses to demarcation, pseudoscience and science denialism are wreaking havoc in our societies. Parents who refuse to vaccinate their offspring expose them to dangerous infectious diseases; creationists indoctrinate their children with pseudoscientific nonsense that hampers their development and education; children in developing countries are stricken with blindness because of rich people’s irrational fear of GM technology (Paarlberg et al., 2009): desperate cancer patients pay inordinate sums of money to charlatans, who sometimes even manage to persuade them to stop their conventional treatments. It won’t do to just throw up our hand in defeat and declare that “pseudoscience” doesn’t really exist.

The philosopher of science who is being honored in this volume, Sven Ove Hansson, has been on the forefront of this revival of the demarcation problem. Dissatisfied with Laudan’s premature obituary, Hansson and others have taken a second look at the demarcation project, often working independently from each other. When I put together a volume entitled *Philosophy of Pseudoscience* in 2013 together with the philosopher Massimo Pigliucci (2013), we were not just trying to call into existence something a new field, but rather capturing an already existing trend. More and more philosophers believe that the demarcation problem deserves a second look, and pseudoscience deserves closer scrutiny. Rumors of its death, it seems, have been greatly exaggerated. Naturally, Sven Ove Hansson could not be missing from a project such as ours, and I am very glad that he contributed a chapter, building further on a number of earlier publications on the subject (Hansson, 2008; 2009). In the remainder of this essay, I wish to discuss Hansson’s proposed solution to the demarcation problem, and explain what I find valuable about his pragmatic, hands-on approach to philosophical problems.

In his 2009 paper ‘Cutting the Gordian Knot of Demarcation, Hansson points out the paradox that, while there is almost complete disagreement about what are the right criteria to demarcate science from pseudoscience, there is nonetheless a wide consensus about where particular theories belong. In order to cut the Gordian knot of demarcation, Hansson returns to the basics. Etymologically, “pseudoscience” denotes non-science masquerading as science, from the Greek word “pseudo” (false, fake). Starting out with three simple criteria, Hansson improves his own working definition step by step, each time testing the waters by bringing in real-life examples. In the end, he comes up with the following definition of pseudoscience (Hansson, 2009, p. 240):

(1) It pertains to an issue within the domains of science (in the wide sense).

(2) It is not epistemically warranted

(3) It is part of a doctrine whose major proponents try to create the impression that it is epistemically warranted.

The wellspring of philosophical disagreement about demarcation is condition (2). Since philosophers of science have different views about what constitutes epistemic warrant, they will also draw the demarcation line between science and pseudoscience in different ways. In his contribution for *Philosophy of Pseudoscience*, Hansson situates his definition of pseudoscience within his larger approach to demarcation issues. Not everything that is non-scientific, he correctly points out, is pseudoscientific. In general, there are three characteristics that we value about science: reliability, fruitfulness, and usefulness. The term pseudoscience, Hansson argues, should be reserved for theories that fail the first criterion, not the other two. A scientist may collect reliable data but fail to develop fruitful theoretical insights. This is a shortcoming, but not the type for which we should use the term ‘pseudoscience’. Likewise, we value scientific work that leads to practical technological applications, but that does not mean that research that falls short of this benchmark is therefore ‘pseudoscience’.

Having established that the relevant borderline between science and pseudoscience is (un)reliability, Hansson then goes on to narrow down the category of pseudoscience. Fraudulent science is certainly highly unreliable, but we do not ordinarily call it pseudoscience. Why? Because fraud is rarely part of what he calls a “deviant doctrine”. Indeed, fraudsters typically operate within the safe confines of established theories, so as not to raise suspicions that might expose them. Likewise, if a scientist is using a malfunctioning measuring device, she may end up with data that are completely unreliable, but still we should refrain from calling such honest errors pseudoscience. In a recent paper, Hansson also situates the phenomenon science denialism within the realm of pseudoscience (Hansson, 2017).

The difference with earlier attempts to crack the demarcation problem is that Hansson’s approach is situated at a higher level of abstraction. In a way, it gives a meta-definition of pseudoscience, leaving open the question of what constitutes ‘epistemic warrant’ or ‘reliability’ in each particular field. This gives his approach wide scope, but as he admits, it also makes it less immediately applicable. You cannot decide where a particular theory belongs without filling in the parameter of “epistemic warrant” (or “reliability”). By contrast, traditional approaches have aimed for specific and readily applicable demarcation criteria, but in doing so have sacrificed generality, with many being tailored to experimental sciences such as physics. In Hansson’s view, traditional approaches have failed because they have tried to have their cake (generality) and eat it too (specificity). As he writes: “one and the same demarcation criterion cannot both be general and timeless and also be sufficiently precise to tell us how to evaluate the scientific status of specific investigations.” (Hansson, 2013, p. 75)

**Creating an impression**

In the remainder of this essay, I would like to suggest that Hansson’s own meta-approach offers some clues for a more substantial solution to the demarcation problem. I think it is possible to side-step the question of epistemic warrant – details of which will indeed vary across fields – and still to come up with specific criteria that are symptomatic of pseudosciences in all domains. If I am right, Hansson’s approach may be even better than he himself – modestly enough – allows.

I think the crux lies in the third criterion. Proponents of a pseudoscience try to “create an impression” of epistemic warrant. Pseudoscience, recall, is a form of cultural mimicry in which pseudoscientists imitate the features of genuine science, hoping that innocent consumers will not be able to tell the difference (Blancke et al., 2017). Now, if you want to make a pseudoscience, it is a relatively straightforward matter to adopt the outward trappings of real science: you establish your own peer-reviewed journals, you organize conferences with attendant bells and whistles, you throw in impressive-sounding jargon or, better still, some mathematical equations. But some things are harder to fake than others, and an “impression of epistemic warrant” may be the hardest of all. Reality, as the science fiction writer Philip K. Dick wrote, is that which, when you stop believing in it, doesn't go away. A belief may be appealing for any number of reasons, but if it flies in the face of reality, it will be psychologically unstable. Any pseudoscience is confronted with the problem of potentially destabilizing counterevidence from the real world, or at least a lack of evidence. This, recall, is just a simple corollary of the first two criteria. If we have good evidence for a theory, we wouldn’t call it “pseudoscience”. As the old joke among skeptics goes: “Question: What do you call alternative medicine that works? Answer: medicine.” This means that each and every pseudoscience is confronted with the problem of surviving on the ‘day when prophecy fails’. For example, in the case of alternative medicine this means the patients who did follow the therapy but failed to recover. This may seem obvious, but people don’t tend to believe in theories that are demonstrably, blatantly wrong. You need to create an *impression* of epistemic warrant. And as it turns out, there are not infinitely many ways to create such an impression, given how the human minds work.

At this point, it is interesting to adopt the perspective of the beliefs themselves, rather than their proponents. Pseudoscientific theories, like other types of cultural beliefs, are subjected to a process of cultural selection. If they create a poor imitation, they will lose adherents and disappear. If they manage to fool a sufficient number of people, they will survive. How do pseudosciences create an impression of epistemic warrant then? By doing either of two things, and often both at once: evading refutations and critical scrutiny, and inviting spurious confirmations. The first, of course, brings us back to Popper’s central insight that genuine scientific theories are empirically bold and open to refutation, whereas unfalsifiable theories are pseudoscientific. The problem is that Popper construed this criterion as a strictly logical relation between hypotheses and observation statements. This logicist straitjacket, alas, obscured Popper’s central insight. As philosophers of science have known since the work of W.V.O. Quine (and even Pierre Duhem in the 19th century), theories are never “falsifiable” in isolation, but are instead always tested in bundles. Moreover, rather than seeing unfalsifiability as a logical feature that some theories happen to have, it is more fruitful to see it as a *strategy* used by pseudoscientific theories to avoid empirical risks. Falsification-evasion is a psychological and sociological phenomenon as much as a logical one.

In my dissertation *Here Be Dragons. Exploring the Hinterlands of Science*, and in a series of papers with my colleagues Johan Braeckman and Stefaan Blancke, I refer to these as ‘immunizing strategies’ and ‘epistemic defense mechanisms’ (Boudry, 2011; Boudry and Braeckman, 2011; 2012; Boudry, 2013; Boudry et al., 2015). These are clever tricks, sometimes embedded within the belief system itself, that serve to protect it from refutation, and to give it a spurious ring of plausibility. For instance, one classic strategy is for a theory to offer a theory-internal explanation for opposition against it. Sigmund Freud famously suggested that the resistance against psychoanalysis bears out one of its main predictions: people are under the spell of the dynamic "unconscious", which is trying repress the shocking truths brought to light by psychoanalysis. Those who attack psychoanalysis, according to Freud, display “the same resistance […] as in our patients”, and this resistance “finds it easy to disguise itself as an intellectual rejection and to bring up arguments like those which we ward off in our patients” (Freud, 1957, p. 39). Thus the “argument from resistance” was born, and became a staple of the psychoanalytic arsenal. Marxists and Scientologists wield their own version of the resistance argument, based on the concepts of (respectively) “false consciousness” and the “reactive mind” (Boudry and Braeckman, 2011, p. 155). It is clever gambit which, like in judo, turns the force of your attacker against himself.

Immunizing strategies such as these abound in pseudoscience. A central immunizing strategy of virtually every pseudoscience is strategic vagueness. Many pseudoscientific claims are ambiguous and amenable to a range of interpretations. Classical examples of these are astrology and assorted forms of fortune-telling. Predictions in horoscopes are typically open-ended, which means that they are amenable to a range of different interpretation. Even if they look bold and specific, they will be deflated or turned into metaphors as soon as they are threatened with falsification. In Freudian psychoanalysis, as the philosopher of pseudoscience Frank Cioffi has shown, many concepts lead a sort of “double life”, expanding and contracting as the occasion demands (Cioffi, 1998).

Parapsychology has a number of built-in *ad hoc* clauses to brush aside unwelcome data. For instance, many parapsychologists believe that the presence of inquisitive minds disturbs psychic phenomena, a phenomenon that is called “negative psi vibration” or “catapsi” (notice the technical jargon). In the words of one of the followers of Franz Anton Mesmer, the famous 19th century magnetizer, ‘never magnetize before inquisitive persons!’. Defenders of alternative medicine have devised another immunizing strategy against overly inquisitive persons who proposed to put their remedies to the test. Every patient, they argue, is radically unique, which means that no two treatments are ever alike. In this ‘holistic’ perspective, it is deemed inappropriate and even impossible to generalize across individuals. Randomized clinical trials are therefore dismissed as ‘crude’ and ‘reductionist’.

Many pseudosciences involve the existence of invisible intentional agents, which opens up a wide range of immunizing strategies. The fairies in the garden may actively evade detection, the secret conspirators may be planting false evidence to throw us off the scent, and the visiting extraterrestrials may have their inscrutable reasons to stay below the radar. In these respects, pseudosciences are little different from traditional religions. In Christian theology, the absence of evidence for God is explained by the concept of a *deus absconditus*, a hidden or unknowable God. And of course, there is also the Evil One to tempts us with disbelief (some creationists believe that Satan himself whispered the lie of evolution in Darwin’s ear).

But, and that brings me to the second aspect, evading falsification is only part of the imitation game of pseudoscience. It is not very difficult to come up with ideas that are completely unfalsifiable, but those usually make a poor impression of epistemic warrant. According to the 19th century theologian Philip Gosse, God created the universe 6.000 years ago at one stroke buy with all the *appearances* of old age, including trees with year rings, fully pregnant mammals, fossils of animals that never existed, and fake signs of erosion in rocks and river beds. And of course – not to forget – a perfunctory belly button for Adam. Gosse failed to impress a lot of people with his Omphalos hypothesis, because his strategy was a bit too powerful for its own good. Such an all-encompassing conspiracy theory strikes many people as *too* convenient and arbitrary. Consequently, a successful pseudoscience needs to steer a middle course between two competing needs: keeping a safe distance from empirical evidence, but also staying close enough to benefit from occasional “confirmations”. It is thus a game of evasion and moving the goalposts. An astrologer will hide behind the vagueness of his predictions for most of the time, but whenever there some event occurs which seems to support them, he will latch onto a more specific interpretation, pretending that *this* is what he had in mind all along. Parapsychologists downplay failed experiments with a variety of ad hoc excuses and immunizing tactics, but they will brandish any finding that raises above levels of statistical significance, in whichever form or direction. And alternative therapists tend to try out different pills and procedures until *something* happens, and then go on to tout that as yet another striking confirmation of their therapy.

**A symptomatic approach**

Whatever other defects pseudosciences may have, I claim that they will *always* exhibit the features described above, for general reasons that ultimately derive from the make-up of our mind. People don’t just believe any crazy idea (Mercier, 2013; Sperber et al., 2010). They critically evaluate beliefs, and they are impressed by apparent confirmations and disheartened by apparent refutations. Strategies for immunization and spurious confirmation are therefore important pieces of *indirect* evidence for lack of epistemic warrant (condition (2) in Hansson’s definition). If a theory had genuine epistemic warrant, proponents would not feel the need to create an impression of such warrant. Real scientific theories have no need of immunizing strategies to survive. They can ‘afford’ to take bold empirical risks, and they can do without spurious confirmations because they already benefit from real ones.

This indirect, symptomatic approach to demarcation allows us to sidestep the direct question of epistemic warrant. What it means for a theory to be epistemically (un)warranted will depend on the methodological and evidential standards relevant to that field of inquiry. Moreover, it is difficult to list all the possible ways in which a theory may *fail* to be epistemically warranted, for the simple reasons that there will always be more ways to do something wrong than to do it right. If my argument is correct, however, there are relatively few ways to create an *impression* of epistemic warrant, and these ways are largely the same across different scientific fields. Different pseudosciences have different epistemic defects, but they all try to overcome them in similar ways.

I see this analysis as an extension of Sven Ove Hansson’s approach to the demarcation problem, but of course it remains to be seen if he will agree with me. Perhaps my take will strike him as too Popperian in spirit, or perhaps he will be reluctant to hazard yet another solution to the demarcation problem that simultaneously tries to have its cake (specificity) and eat it too (generality). In any event, I can say that Hansson’s work on the demarcation problem has helped me to clarify a number of issues, especially the difference between pseudoscience and other forms of failed science and non-science. Rather than discussing the characteristics of science in the abstract, it is more useful to discuss a number of specific cases and examples. Philosophers and scientists already share similar intuitions about what is and what is not ‘science’, which explains the virtual unanimity (Hansson, 2013, p. 61) about the status of specific cases. But just as it is difficult to explain how to ride a bicycle, it takes some effort to determine exactly what drives our intuitions about (pseudo)science. If anything is clear (and here I have no doubt that Sven will agree), distinguishing science from pseudoscience is a pressing matter for our societies. If philosophers want to provide a service to society, this is one of the best ways of doing so.

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