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Defining and Diagnosing Pseudoscience

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Ceci est une réponse à un article de Stéphanie Debray (Lato Sensu 10(1):2:13–23, 2023) sur la définition proposée par l'auteure de la pseudoscience. Les sujets abordés incluent la distinction entre la démarcation et la définition de la pseudoscience, la nécessité d'une expertise scientifique spécialisée pour diagnostiquer la pseudoscience, l'utilité d'une définition large de la science, la relation entre religion et science, ainsi que les relations entre pseudoscience et autres écarts par rapport à la science légitime.

This is a reply to an article by Stéphanie Debray (Lato Sensu 10(1):2:13–23, 2023) on the author's proposed definition of pseudoscience. The topics discussed include the distinction between demarcating and defining pseudoscience, the need for specialized scientific expertise in diagnosing pseudoscience, the usefulness of a broad definition of science, the relation between religion and science, and the relations between pseudoscience and other deviations from legitimate science.

Mots clés : pseudoscience, démarcation, définition, fraude, science institutionnalisée, religion et science.
Keywords: pseudoscience, demarcation, definition, fraud, corporate science, religion and science.

1. Introduction

I am most grateful to Stéphanie Debray (2023) for her in-depth analysis and discussion of my proposal for a definition of pseudoscience. Her article serves as an example of philosophical discussions that are constructive, in contrast to the adversarial style that too often dominates in our discipline (Moulton 1983). I will attempt to continue the discussion in the same constructive spirit.

Debray rightly points out that there are three major approaches to clarifying what pseudoscience is, namely (in historical order of appearance) (1) "the search for a unique and ahistorical criterion of demarcation", (2) "the search for lists of multiple criteria, based either on elements supposed to correspond to signs of science… or on indicators that are evidence of different ways to diverge from good science", and (3) "the search for a definition of pseudoscience" (p. 13).[1] The first of these approaches is the dominant one in philosophical tradition. Major demarcation proposals were put forward by Karl Popper (1962) in terms of falsifiability, Thomas Kuhn (1974) in terms of puzzle-solving activities, and Paul Thagard (1978) in terms of attempts at progress. Debray is right in emphasizing the ahistorical nature of demarcation in this tradition. Ahistoricity is an implausible feature, since science is a social activity that is continuously transformed, both through its inner workings and in coevolution with other social developments. Over the centuries, science has changed dramatically, not only in terms of specific claims and theories but also in terms of methods of investigation and criteria of endorsement. To mention just one example, it would be unthinkable today for a chemist to rely on the best methods of chemical analysis that were available in the early 19th century. They were the best science of their time, but relying on them today would be scientifically unacceptable.

Another feature of this approach is also worth mentioning: The various criteria of demarcation that have been proposed by philosophers presuppose that the classification of claims or activities as science or pseudoscience can be based on characteristics that are easily accessible to philosophers. The possibility that the demarcation can require specialized competence in the relevant scientific discipline(s) does not seem to have occurred to the philosophers working in this tradition. For instance, Popper does not seem to have considered this possibility. In what seems to be his last statement of his position, he said that falsifiability is a both a necessary and a sufficient criterion for something to be scientific. He also stated that falsifiability "only has to do with the logical structure of sentences and classes of sentences"

1 *All quotes from Debray have been translated from French to English by the author.*

(Popper [1989] 1994, p. 82). In other words, analysis of the logical form of a hypothesis would suffice to determine on what side of the border between science and non-science it falls.

The assumption that pseudoscience can be identified with ahistorical criteria that are accessible to philosophers also had a crucial role in a much quoted article by Larry Laudan (1983). The major claim in that article was that "the problem of demarcation between science and non-science is a pseudo-problem (at least as far as philosophy is concerned)". Laudan based this conclusion on the lack of "epistemic invariants" in science (Laudan 1983, p. 124). An invariant is a feature that does not change with time, i.e., it is ahistorical. Although Laudan does not define what it means for such a feature to be epistemic, it is clear from his examples that he refers to criteria that fall under the purview of philosophy rather than that of the sciences relevant for the claims to be evaluated. (He refers for instance to testing of theories, predictions, ad hoc hypotheses, and inductions.)

The claim that philosophical competence is sufficient for diagnosing pseudoscience can easily be falsified. For instance, considerable efforts have been made to promote the claim that the HIV virus does not cause AIDS. This claim is completely false, and it can certainly be classified as pseudoscientific. However, it cannot be refuted on the philosophy-of-science level of discourse. Its refutation was, and had to be, performed by experts in clinical and microbiological science (Kalichman 2009; Nattrass 2008). Another example is the claim that people of African origin form a special biological "race". This claim is wrong for the simple reason that the genetic variation among humans is small and does not follow the dividing-lines of the traditional races (Templeton 2013; Yudell et al. 2016). Today, claims about biological races are known to be pseudoscientific. (Racism exists, but human races do not.) However, we know this only through modern knowledge about DNA and a considerable amount of gene sequencing. Previous generations had no means of knowing it, not because they lacked philosophical expertise but because they did not have access to modern genetic knowledge.

Debray rightly points out another assumption that is commonly made in the tradition of philosophical demarcation. It is (tacitly) taken it for granted that the task of diagnosing pseudoscience consists solely in demarcating it from science (p. 14). No attention is paid to the distinction between different types of deviations from science, such as the distinction between pseudoscience and scientific fraud. This omission seems to follow from the focus on demarcating pseudoscience, as distinguished from defining it. To demarcate A from B means to find criteria by which you can determine for anything known to be either A or B which of these it is. To define A means to find necessary and sufficient criteria for something to be A. Therefore, undertaking to define a concept means that you search for a more complete characterization than if you merely attempt to demarcate it from a particular other concept (Hansson 2006).

Debray and I seem to agree that defining pseudoscience is a much more promising approach than just demarcating it from science. Pace Laudan (1983, pp. 118 and 124), when we give up the quest for an ahistorical and expertise-denying demarcation in favour of a search for a full definition, we do not make the task less philosophically interesting. To the contrary, as illustrated by Debray's article, this move opens up a whole series of interesting philosophical issues that do not arise in the traditional demarcation approach. Somewhat loosely speaking, philosophers of science should take the lead in the definition and general characterization of pseudoscience, whereas the diagnosis of specific pseudoscientific claims, teachings, and practices is mainly a task for scientists who are experts in the relevant subject areas.

2. The territorial criterion

In Hansson (2013) I treated pseudoscientificity as primarily a property of statements, and proposed a set of three necessary and jointly sufficient criteria to characterize pseudoscientific statements. Debray (2023) discusses each of them carefully. The first criterion for a pseudoscientific statement is:

> 1. It pertains to an issue within the domains of science in the broad sense (the criterion of scientific domain). (Hansson 2013, p. 70)

This criterion clarifies that pseudoscience is false science, not false something else. For instance, inaccurate claims about how to play the violin are not pseudoscience, for the simple reason that violin playing is not a science. However, the English word "science" has problematic limitations that corresponding words in many other languages do not have. In particular, the German word "Wissenschaft" and the corresponding words in Dutch and the Nordic languages cover not only the natural sciences but also all the social and humanistic disciplines, some of which are not covered by the English "science". If we stick to the standard usage of the English word "science", then false claims in archaeology cannot be called pseudoscience, although they can be called Pseudowissenschaft. We would then have to introduce additional categories in English, such as pseudoarchaeology (including claims about ancient astronauts), pseudo-history-of-literature (including deviant claims about Shakespearean authorship), etc. However, the relation between spurious claims and legitimate research is essentially the same in these areas as in the areas called "science" in English. I have therefore proposed that in the context of defining

pseudoscience, we should use the term "science" in a broad sense that corresponds to Wissenschaft. Interestingly, Debray provides support for this proposal by emphasizing its consistency with French-speaking culture (p. 15).

She also has a comment on what this definition implies for religious statements:

> "The first condition could perhaps, for instance, exclude statements that belong to the religious domain. The difficulty is that even statements on supernatural entities (such as ghosts, angels, God) can in some cases satisfy the first condition: their existence, alleged potential interactions with these entities, and their psychological effects on the individual, are questions that may be of interest to psychologists, neurologists, and philosophers." (pp. 15–16)

There is a need for clarification on this point. As I see it, a crucial distinction has to be drawn between those religion-related claims that have implications for what we can observe in the natural world (in short: empirical implications) and those that do not have any such implications. Human beliefs in supernatural beings and phenomena have empirical implications, and the study of such beliefs is therefore part of science in the broad sense. However, it is much less clear if the supposed supernatural phenomena per se (as distinguished from human beliefs in them) have any empirical implications. If a supernatural being is supposed to act in the natural world, then the effects of these actions will fall under the purview of science. The contents of religious statements that lack such empirical implications are not topics of science (contrary to those statements themselves, which can be studied like any other statement made by humans). But admittedly, this is a distinction that is often difficult to draw, due to the difficulties in clarifying the exact contents and implications of religious beliefs.

3. The criterion of unreliability

My second criterion for a statement to be pseudoscientific is as follows:

> 2. It suffers from such a severe lack of reliability that it cannot at all be trusted (the criterion of unreliability). (Hansson 2013, p. 70)

This criterion contradicts the ahistorical and expertise-denying approach that has long dominated discussions in philosophy about pseudoscience. Debray quotes my statement that our criteria for diagnosing specific pseudosciences "will have to refer to methodological particulars that differ between subject areas and change with the passage of time" (Hansson, 2013, p. 74). She assumes quite correctly that the need for specialized and up-to-date competence in determining the reliability of statements "is not, however, considered by Hansson to be a failure or a mistake to be corrected". (p. 17) She also notes that this feature of the definition is the point at which it manages to "avoid the pessimistic induction argument (Laudan)". (p. 17) The crucial step, as I see it, is to cast off the rather conceited philosopher's opinion that all such assessments can be made by philosophers, irrespective of subject area. Like other scientific judgments, assessments of what is and isn't legitimate science have to be made by experts in the relevant fields. Once this has been realized, the futility of searching for a simple criterion that applies to all areas of science will also be obvious.

4. The criterion of a deviant doctrine

The third criterion is as follows:

> 3. It is part of a doctrine whose major proponents try to create the impression that it represents the most reliable knowledge on its subject matter (the criterion of deviant doctrine). (Hansson 2013, pp. 70–71)

As Debray points out, this is the criterion that distinguishes between pseudoscience and other types of deviant or deficient science, such as fraud, honest mistakes, and inappropriate bias (pp. 17–18). I should perhaps also mention that this criterion is intended to cover an important but rather elusive feature of pseudoscience, namely its durability. Other types of deviant or deficient science can usually be weeded out once they have been discovered, but pseudoscience is impervious to the usual self-correcting mechanisms in science. This imperviousness seems to be closely connected with the presence of some deviant doctrine that makes its adherents resistant to scientific criticism. Such a deviant doctrine is characteristic of pseudoscience, but we do not usually see it in connection with honest mistakes or pure cases of fraud.

The third criterion is the part of the definition that Debray is most critical to. She writes that due to problems in this criterion, "the definition of pseudoscience proposed by Hansson (2013) on the one hand excludes some sure cases of pseudoscience, and on the other hand includes other types of misconduct from which it should be distinguished." (p. 19) I will first discuss her objection that the definition excludes claims that it should include as pseudoscientific. She presents it with the following example:

> ”A person claims that it has been scientifically proved that under certain conditions, homeopathic capsules have a therapeutic effect better than that of a placebo, and that they can therefore be an alternative to other medical treatments.” (p. 19)

Debray and I agree that this example should be treated as a case of pseudoscience. However, she claims that it will not qualify as a case of pseudoscience according to my criteria. For this she offers two arguments, namely that (i) “the subject does not say that homeopathic remedies are *better* than other medical treatments”, and (ii) “no opposition to conventional medicine appears in the example”. (p. 19) As far as I can see, this is a misinterpretation, and the example does in fact satisfy my criteria for pseudoscience. The first criterion is satisfied since the effects of drugs is surely an issue for (medical) science. Concerning the second criterion, it should be noted that (like the other two criteria), it is explicitly specified as referring to statements (Hansson 2013, p. 70). It cannot be applied to physical objects such as drugs in the way that argument (i) indicates. In the example, a claim is made that “it has been scientifically proved that under certain conditions, homeopathic capsules have a therapeutic effect that is better than that of a placebo”. This claim is false and seriously unreliable, and it clearly satisfies the second criterion. Turning to the third criterion, it does not refer to opposition against conventional science (or conventional medicine), which is what argument (ii) refers to. Instead, the third criterion says that for a claim to be pseudoscientific, it has to be part of ”a doctrine whose major proponents try to create the impression that it represents the most reliable knowledge on its subject matter”. A claim that homeopathic drugs are better than placebo expresses a core homeopathic belief, promoted by all major proponents of homeopathy. Therefore, it satisfies the third criterion. Hence, all three criteria are satisfied.

In spite of the problem with this example, Debray is right that my third criterion could run into difficulties if proponents of some deviant doctrine conceded that their doctrine is less reliable than mainstream science. However, in the absence of a clear example of such half-hearted advocacy of a deviant doctrine, it does not seem worthwhile to adjust the criterion to deal with such a case.

5. Combinations with other deviations from legitimate science

In addition to pseudoscience there are other forms of deviation from science: honest mistakes, fraud, corporate or political bias, etc. It is important to distinguish between these various forms of deviation, not least since they require quite different forms of countermeasures. Equally importantly, they are not mutually exclusive. One and the same statement can be both pseudoscientific and based on fraud. Similarly, a statement can be pseudoscientific and at the same time emanate from corporate bias.

The combination of fraud and pseudoscience is well known from parapsychology. Quite a few experiments that seemingly provided evidence of phenomena such as telepathy or clairvoyance were in fact the result of fraud perpetrated by an experimenter or by experimental subjects (Alcock 1981; Reber and Alcock 2020). Another example is the claim of a causal connection between common childhood vaccines and autism, which was put forward by Andrew Wakefield. These claims were based on fraud, and they are therefore examples both of fraudulent research and pseudoscientific anti-vaccinationism (Deer 2011a; 2011b).

There are also plenty of examples of pseudoscience that is also biased corporate ”science”. The tobacco industry’s denial of well-proven deadly effects of their products is a prime example of this; another is the climate science denial that the fossil fuel industry has paid large sums for developing (Bero 2005; Dunlap and McCright 2011). I have myself investigated a case of deviant occupational medicine that combined all three types of deviation: pseudoscience, bias for corporate interests, and use of fraudulent data (Hansson 1988).

As I see it, it is important to recognize that these categories of deviant science are compatible. If we treat them as mutually exclusive, then a person who is paid by a company to promote incorrect claims in scientific issues would be protected by the corporate connection against otherwise justified accusations of perpetrating fraud and advancing pseudoscience.

In Hansson (2013, p. 68) I wrote that ”we tend to treat fraud and pseudoscience as different categories. Fraud in otherwise legitimate branches of science is seldom, if ever, called ‘pseudoscience’ (but it can certainly be called ‘unscientific’).” Unfortunately, this was interpreted by Debray (p. 18) as meaning that pseudoscience and fraud are incompatible. That was not intended, and I should obviously have expressed this more clearly. Some fraudsters aim for success in mainstream science. They usually do not promote a deviant doctrine, since doing so would increase the risk of being exposed. Other fraudsters aim to obtain credibility for pseudoscientific claims. These two categories of fraud should both be taken into account.

In discussing this issue, Debray introduces the following example:

> ”A scientist distorts the results of his or her study (for financial or other reasons), and concludes that the study proves homeopathy to be more effective than placebo. (S)he reports that in comparison to a group of patients that received another treatment against the same disease, the patients treated with homeopathy had a similar clinical development but fewer complications.” (p. 19)

As she rightly points out, this example satisfies my three criteria for pseudoscience (p. 20). In my view, this is as it should be. However, she is of another opinion since she considers pseudoscience and the distortion of science for commercial interests to be mutually exclusive categories. In an otherwise very valuable list of ten desiderata for a definition of pseudoscience she includes the following item.

> ”Since there are other types of scientific misconduct (such as research corrupted by commercial and/or industrial values, and research corrupted by political values) as well as other types of irrational behaviour, the definition should not in general include other types of misconduct as pseudoscience.” (p. 21)

We seem to have a difference of opinions on this aspect of how pseudoscience should be defined. But as far as I can see, we agree on the general direction that philosophical research on pseudoscience should take in order to provide better guidance for the socially important task of diagnosing and counteracting various forms of disinformation.

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