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Ongoing Debate: How Can We Demarcate Science From Non-Science?

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Abstract. This paper deals with the demarcation problem in philosophy of science. In this context, I look for answers from logical positivists to Popper and to nowadays philosophers to the following questions: What makes a text, a theory or a research scientific? How can we demarcate science and scientific views from metaphysical thoughts, ideologies, pseudo-sciences and conspiracy theories? What are the distinguishing characteristics of scientific method?

1. Introduction

How can we demarcate science from non-science? In other words, how can we demarcate scientific explanations, theories and texts from ideologies, metaphysical teachings, pseudo-scientific explanations and conspiracy theories? This problem is known as “demarcation problem” in philosophy of science since Karl Popper.

Popper (1934) defines demarcation problem with the following words: “The problem of finding a criterion which would enable us to distinguish between the empirical sciences on the one hand, and mathematics and logic as well as ‘metaphysical’ systems on the other, I call the problem of demarcation.”

From logical positivists to nowadays, a lot of answers given to the question and a lot of criteria were suggested to demarcate science from non-science. In this paper, I focus on relatively recent suggestions and give a brief presentation of them and finally try to make my suggestions.

2. Some Demarcation Suggestions

As it is known by the followers of the subject, there have been some influential suggestions. We can include Popper’s, Kuhn’s and Lakatos’ suggestions among those. Those suggestions are milestones of the issue. Popper’s criterion of demarcation is falsification. Kuhn suggests puzzle solving skill as the criteria of science. And according to Lakatos science has progressive research programmes which non-science doesn’t have.

As it could be seen easily, all of those suggestions above depend on single criterion.

There are some considerably new suggestions also. Those new ones diverge from the olds by suggesting multi-criteria. According to the new generation of philosophers of science we cannot demarcate science from non-science solely with a single criterion. So there should be multi-criterial approach.

One of the recent philosophers who suggests multi-criteria is Paul R. Thagard. Thagard, in his article “Why Astrology is a Pseudo-Science?” (1978) stated that while logical positivists, Popper and Lakatos trying to demarcate science from no-science, they only look at the inner logical structure of thoughts. On the other hand Kuhn, only take consider the historical process. According to the Thagard both of those approaches are alone insufficient. Thagard stated that in order to evaluate something as scientific we must consider both its logical and historical dimensions but they are also not enough we must additionally consider the community dimension of that thought.²

With the “logical dimension” Thagard means the verifiability or falsifiability of a theory which was successfully formulated before by Popper. About the historical dimension, Thagard follows Kuhn’s explanations and gives two criteria for historical dimension. According to those historical criteria, a theory should (1) have a history of success about explaining the new facts and solving the anomalies encountered and (2) be more favorable according to alternative explanations and theories.

Thagard’s final criterion is about community dimension. According to that dimension, Thagard mentions behaviors and thoughts of adherents or believers of a theory. There are so many things that should be questioned about that dimension. Firstly, are the members of a community give value to remove the anomalies of their theory and measure their theories success by comparing the data of alternative theories? And, do members of a community give effective support to the confirmation or disconfirmation of their own theories?³

From Thagard’s writings we understood that giving decision on what is scientific and what is not, do not depend on solely theories’ logical and semantic content. History of the theories and adherents behavior can change the situation whether they are scientific or not.

Another multi-criterial suggestion about demarcating science comes from a British philosopher P. Kitcher. According to Kitcher, a theory can be scientific if it fulfills three conditions. Firstly, the auxiliary hypotheses involved in the testing of any theory should be independently testable themselves. Second, scientific practices are unified wholes, so a theory -if it is scientific- could be applied not only to some selected examples but a wide range of cases and problems. Third, scientific theories must be fertile in the sense that they open up new areas of research. So if a theory doesn’t have any potential to make or to give rise progress (in the sense that opening up new research areas) it will not be seen as scientific.⁴

German philosopher Gerhard Vollmer (1990), for determining the scientific character of a theory, suggests two criteria: its internal and external consistency. By internal consistency, he understands that a theory should not include circularities and internal contradiction. By external consistency, he expresses the compatibility with the bulk of well-confirmed knowledge. Addition to those, Vollmer states that a scientific theory should contain some extra features: like testability, having predictions, have an explanatory power, reproducibility, fecundity (ability to open us new scientific fields) and simplicity.⁵

A social scientist Robert K. Merton has also multi-criterial approach. Merton thinks that (1973) natural sciences and social sciences –because of they are both called as sciences- have a common “spirit”. According to Merton, that spirit consists of some “ethical principles” which refers to producing and obtaining knowledge. Those principles are also common characteristics of all scientific activities and they sustain us to distinguish science from non-science. Merton thinks that those principles can be classified under four institutional imperatives.

The first one is universalism. Universalism means that “whatever their origins, truth claims should be subjected to pre-established, impersonal criteria. This implies that the acceptance or rejection of claims should not depend on the personal or social qualities of their protagonists.”⁶

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³ ibid.


⁵ ibid.

The second one is *communism* which means that scientific discoveries are the result of social cooperation and because of that they belong to whole society; they cannot be owned by individuals or special groups.

The third principle is *disinterestedness*. It implies that there must be a mechanism of institutional control which can curb the ideological and subjective inclinations that individual scientists may have.

The fourth principle is *organized skepticism*, which tells that all of the beliefs should be interrogated deeply whatever they are held by their adherents dearly.⁷

3. A General Assessment and My Demarcation Suggestions

When we look back to both single-criterial suggestions and multi-criterial approaches we see some common points that are accepted by all of the philosophers. So we can make our suggestion by checking those common points.

Firstly, we should declare that “truth of a proposition” -which can be *prima facie* thinkable as criteria of demarcation- is not a suitable criteria. This is a common point among almost all the philosophers. In other words, the claim that science consists of truth claims and non-science consists of false claims is not true. Scientific theories would be false and they can be falsified. On the other hand, some pseudo or non-scientific explanations -for example some metaphysical or ideological theories- could be true. Being false does not make a scientific theory non-scientific as well as being true does not make a non-scientific theory scientific. Most important thing to be scientific is how that claim is achieved; in other words, its methodology.

Another point which should be mentioned here about demarcating science is, ‘depending on observation and induction’ is not a sufficient feature for regarding a theory scientific. Popper shows us that pseudo-scientific explanations could also depend on observations and experiments. If someone wants to justify a theory it is not difficult for her to find justifying evidences from somewhere. By selecting the justifying evidences of a theory, by ignoring falsifying ones and not testing the theory seriously as a whole, every theory can be justified. Actually it is commonly seen in pseudo-scientific explanations. Instead of testing theories sensitively according to factual data, such explanations produces fictive reasons in order to make the factual data in harmony with the assertions or ideological discourses that have been accepted in advance. For that reason, pseudo-scientific theories contain a lot of *ad hoc* propositions. But science consists of ‘simple explanations’ which are supported firmly by experimental data. Putting differently, while science is sensitive to observable and experimental facts, pseudo-science is not.

So testability is the one of the main features which demarcates science from non-science. Nowadays testability is used instead of Popper’s falsifiability as a broader concept by most of the philosophers of science and it is regarded as one of the necessary features of being scientific. Testability means that a scientific knowledge achieved by that method can be checked publicly (independently from the ones who put forward that knowledge and by the methods which are not depending on individual inclinations).

According to our previous explanations, another point that should be taken into consideration is that single criterial approaches couldn’t solve the problem. In order to comprehend different examples and satiations there should be more than one criterion. Additionally most of the philosophers think nowadays that those criteria aren’t essential and necessary attributes of scientific theories/explanations but are some indicators of them.

So let’s give some indicators of scientific:

1. Firstly, we should count openness to the change or changeability. In other words, the truth claims which a theory contains can be criticized, changed even can be totally removed according to new empirical evidences. Many philosophers express this criterion with different words, e.g. Popper states it by openness to falsification, Kuhn and Lakatos used the words “theoretically and empirically progressive”. If a theory or explanation does not change in accordance with new evidences, this is an

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⁷ ibid.

accurate sign for that it is not science but it is ideology, mere belief or pseudo-science. Science is always open to changes and progressive.

2. Another indicator of scientific is having problem-solving capacity. Theories or explanations which are constantly encountered with anomalies and cannot overcome them, also which have comprehensive and testable alternative explanations (like astronomy alternative of astrology) aren’t scientific.

3. One important indicator of scientific is fertility of the provided knowledge. According to this indicator, any opinion or theory in order to be scientific should open doors to new knowledge fields, new investigations and new horizons. Having the capacity of providing new and undiscovered predictions is one of the important features of scientific theories/ explanations. Instead of opening new horizons, trying to accord every new situation and data to existing theory by using ad hoc explanations is an important distinguishing characteristic of pseudo-scientific.

4. Another important indicator of scientific is that documents and evidences which support a theory shouldn’t be limited by the publications that are only made by believers and adherents of that theory. Documents and evidences can be checked publicly and have an independent and transparent review processes.

5. A scientific theory does not contain internal contradictions and circularities. It should also be incorporated into the existing network of the established sciences without destroying them. In other words, it uses the same strategies of established sciences in solving problems. Pseudo-sciences don’t have that feature.

Before ending this paper it should be noted that in many cases demarcating science from non-science is not related to only the structure of a theory/ explanation but also community’s even individuals’ intends and beliefs who holds it. So we can’t give decision either something is scientific or pseudo-scientific by only looking at its logical structure. We should also look at individual’s attitudes whether they are scientific or not. If individuals or communities who hold a theory /claim in unscientific ways like as fans of that theory/ claim then we cannot say those individuals or communities are in a scientific attitude even though their theory or claim is scientific.

References