Science without inductivism

(Karl Popper's view)

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Abstract

The paper aims to expound on the issue of science being different from non science or pre-science in the form of the scientific methodology used. Popper's method of falsifiability ensures the aim of science to be successful. The aim of science which also needs a critical attitude, can enable scientific progress by rejecting inductivism as its scientific methodology. Popper's view on what the aim of science is and why and how inductivism fails in the case of science, along with examples from history of science besides its impact on philosophical foundations of science, has been stressed in the paper.

Introduction

Science and its significance grew rapidly due to Einstein's theory of relativity and its difference from the nature of the works of Freud and Adler which made Popper to expound on the notion of allegedly scientific psychoanalysis of Freud and the revolutionary work on relativity of Einstein which was also experimentally proved by Eddington in 1919 showing the deflection of light by solid massive gravitational bodies. The debate of what science is and what non science could be, the notion of what science should do or can do or precisely ,the aim of science have made the 20^{th} century a breeding moment of thoughts for philosophical foundations of science ,thereby influencing the development of philosophy of science. Popper who is also influenced by Hume's skepticism on inductivism has made his notion of being scientific very strong in terms of being falsifiability through repeated tests. Popper's methodology is deeply scientific which believes in not giving any certainty or fixity to any natural law of science, thereby accepting a space for the development of science in future.

Aim of Science

The aim of science is essentially to give an unbiased scientifically tested satisfactory explanation which must be ready to change if it gets falsified when the scientific explanation undergoes a series of tests. Thus , for a scientific theory to be developed, it must have a criterion of falsifiability or refutability or testability. Scientific theory can not remain dogmatic like Marxist theory of historicism which is precisely done by the followers of the theory by making the theory blanketed or kept immune to repeated testability for falsification. What is scientific needs to have passed tests and if it fails the tests, then there is a need for a change which is a scientific development. Psycho-analysis or psychologism or historicism are not good examples to illustrate the aim of science as there is a lack of tests and refutability in them.

The satisfactory scientific explanation is done in terms of the explanation of the known by the unknown , meaning the explicandum which is the conclusion, is explained through explanation by using the explicans or premises comprising of universal law and specific initial conditions. Independent testing for falsifiability or refutability when applied on such a scientific explanation could result into either universal law was wrong or initial conditions were wrong or both were wrong , hence , there would be a need to re-work on the scientific hypothesis to further change or develop into a better one by either changing the initial conditions or the universal law (which is a complex task) or by changing the both. Strictly speaking , the notion of a rigid and fixated scientific theory can not exist in Popper's science as any scientific theory has to go through repeated tests in due course of time ,which thereby may result into either rejection of the old theory or the development of the old theory into a newer and better one.

The point of satisfactory scientific explanation also raises an issue of how much the satisfaction would be, and the reply to it would be that the degree of satisfaction depends on the degree of testability on the theory whether the theory is rich with content or with higher degree of universality or precision. But, the dilemma comes when there is a question, are their ultimate scientific explanations, to which Popper would reply, there can not be ultimate scientific explanation as, if that happens ,then there would not be any further growth in science to test to refute the old existing theory and hence, such a static state does not give rise to a growth of genuine science.

Popper's view on explaining scientific theory is neither based on essentialism nor instrumentalism but a third view namely 'modified essentialism' which depends on two factors i,e. rich content and certain coherence or compactness of the theory. He cites an example of how Plato's solution was rejected by Aristotle, which also signifies that no solution can remain static in the domain of science if it is tested false.

The aim of science is also to accept the principle of correspondence which means that a new theory is not going to out rightly reject the old one but instead incorporate the old one approximately or the variables required for appropriate values of the parameters in the new theory. Such a principle of correspondence is used in the growth of Newtonian law of gravitation from Kepler's laws of motion via collecting Tycho Brahe's observations of the planetary motions. The series of scientific development through different independent testing for falsification from Brahe to Newton could not be possible without the scientific works of Galileo. Hence , whether in the case of the development of Periodic table

from Mendeleev's periodic table based on atomic mass to the present modern periodic table based on atomic number, the principle of correspondence is used in scientific theory development.

Science in order to be different from pre-science must have observations and not experience, hence Popper is not in strong agreement with Bucket theory of science or mind – a kind of bucket where perceptions and knowledge accumulate, thereby not going in a way of Bacon's 'pure wine of experience' or naive empiricism, or Kant's view though which can be interpreted as closer to Popper's. Despite observation being an important parameter in the aim of science, it does have problems in the case of inductivism which can be found in Hume's problem. Contrasting to the Bucket theory, Popper has 'Searchlight theory' which admits that observations are secondary to hypothesis , unlike the other way round in the case of the Bucket theory.

Having critical attitude also plays an important role in developing scientific theory and such critical attitude which was shown by Anaximander, the disciple of Thales, who encourages his student Anaximenes (the disciple of Anaximaner) to criticize his master's theory, precisely because the founder of the school himself challenged his students to criticize his theory, has pave the way to the growth of genuine science. Another such historic example which can be best exemplified from the famous lines of Xenophanes showing the critical attitude of Greek philosophy is,

> " Yet if cattle or horses or lions had hands and could draw
> And could sculpture like men, then the horses would draw their gods
> Like horses ; and cattle like cattle ; and each would then shape
> Bodies of gods in the likeness, each kind, of its own."

Such critical attitude has developed critical methodology which stands against the dogmatism of any theory if at all if that theory has to be called 'scientific'.

The task of science besides being theoretical which is explanation , also has a part of practicability in terms of its prediction and technical application. The derivation of predictions and technical application though have helped in the growth of science but , in reality , the direct deduction or induction can not work in science as Newton's law can be deduced from Kepler's law but only after approximation and in a similar way, Maxwell himself gave up the idea of explaining electromagnetic field in terms of ether, because inductivism has a deep problem in genuine science.

The search for the aim of science is not a royal road but nevertheless, through a series of repeated independent testing and falsification, a theory becomes more strongly scientific and hence, it becomes nearer to the scientific knowledge which leads to the knowledge of reality.

Inductivism – a wrong method for scientific methodology

The problem of induction became an area of interest to Popper in 1923. The problem has a closer connection with the problem of demarcation (which is a key to the solutions of fundamental problems of philosophy of science) which also accepts that falsifiability is its criterion. It was Hume's problem of induction that captured Popper's mind by his (Hume) view that induction can not be logically justified.

Whether repeated observations (criticized vehemently by Hume) or so called valid induction by Max Born in his Natural Philosophy of Cause and Chance , induction howsoever infinitely repeated it could be, can not give an ultimate scientific explanation, hence , there is no possibility of logical deduction that from a given few or some set of observed parameters or conditions, a generalization can be made and even if such generalization is made, it has to stand through many tests for not only verification but also for falsification, so that the theory remains scientific and not dogmatic like in the case of historicism or psychologism or sociologism or Marxist theory.

History of science has best examples to illustrate that induction fails as a scientific methodology. Newton's law as normally understood that it can be derived from Kepler's law, is in fact not possible , because in a strict sense, not only Newton's law contradicts Kepler's law but also Galileo's law.

Kepler's 3rd law which relates with Newton's law of gravitation is not valid in strict manner if the gravitational attraction between planets is accounted to. Hence, in deriving Newton's law from Kepler's 3rd law of planetary motion, approximations have been made in order to enable the derivation. There is a deep contradiction if one goes to both Kepler's 3rd law and Newton's law of gravitation.

Newton's law of gravitation gives :

$$a^3/T^2 = m_0 + m_1 = \text{constant} ,$$

Kepler's 3rd law of planetary motion gives :

$$a^3/T^2 = \text{constant} ,$$

where , a = acceleration of a planet , T = time period of the planet , m_0 = mass of sun & m_1 = mass of the planet .

In this case, in order to enable the derivation of the Newton's law from the Kepler's law possible, the mass of all the planets is considered to be zero compared to the mass of the sun. It has reduced $m_1 = 0$, which has resulted to a serious scientific problem, because Newton's law of gravitation works with two massive bodies and not with one massive body and another zero mass body, as the gravitational force is

directly proportional to the product of the mass of the two gravitational bodies. Thus , a direct derivation of Newton's law from Kepler's law can not be possible.

Galileo who asserted that a projectile moves in a parabola except in the case of free fall, when the projectile is thrown above the surface of the earth. But, Newton's law contradicts it by saying that Galileo's work is meant for short range of projectile and in long range of projectile, the shape of the trajectory is elliptic and not parabolic. The trajectory approximately becomes a parabola only when the total distance of the flight is negligible compared to the radius of the earth. In order to solve the problem in derivation, a false initial condition has to be added in the form of infinite length of the radius of the earth, thus , correspondence principle is saved.

The problems of induction in getting the derivations done have compelled to introduce some false initial conditions for the approximation to be done. Hence, to have a genuine science, relying on induction is only going to create contradictions . Observations which are important in the Bucket theory which have been made secondary to hypothesis in Searchlight theory , have brought a notion of historian's dogmatism of accepting the given initial conditions or parameters ,out of which, a failed generalization would be produced. Simply by observing the planetary motions in solar system, the whole motion of different gravitational bodies in the universe can not be generalized and even such generalization fails to explain the motion of electrons in an atom. Thus , Descartes' mechanical model (in Descartes' contact physics) which has restricted every model to push or pressure , has been rejected by Newton's non contact mechanics through his (Newton) gravitation. The point is, Descartes who tried using induction to derive his general theory of mechanics has failed in the light of Newtonian mechanics. Even, Newtonian mechanics whether observed profoundly in many parts of the universe, it has been challenged by Einstein's law of general theory of relativity. Einstein's law, also can not be the sole ultimate law , as Popper would say that every scientific law has to be subjected to a series of repeated tests in order to survive falsifiability,so that the theory becomes more scientific. In fact, Popper would call theory as conjectures as it is highly complex and difficult to formulate a scientific theory in the manner of a fixed , well determined, universally accepted scientific theory.

Inductivism as a scientific methodology is a myth because the actual procedure in science is to deal with conjectures which get changed from time to time due to the advancement of the level of tests. The repeated observations in inductivism can not yield scientific knowledge which is truth and such scenario recalls the story in Theaetetus – a dialogue between Socrates and Plato , that how many times a truth is repeated , it does not become true because of its repetition as truth is truth even without stating it twice. The problem of inductivism can be solved by finding solutions to the problem of demarcation as the problem of inductivism is an instance of the problem of demarcation. Thus, from a set of singular statements known by experience or through observation, it can not be generalized to form a universal statement, hence, inductivism fails in science.

Conclusion

The notion of science which is different from that of pre-science or pseudo science, has its aim in the form of the aim of science, which is to do with falsifiability or refutability of scientific conjectures or hypothesis through repeated tests which can not be stopped ,so that dogmatism in science fails to rise. In using the method of falsifiability, the method of inductivism has failed to be a scientific methodology to be used in understanding both science and its aim. Hence, Popper's view of rejecting inductivism and accepting his method of falsifiability have impacted not only philosophy of science but also the growth of science.

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