STAR
Research Journal

Available online at www.starresearchjournal.com (Star International Journal)
PHILOSOPHY
UGC Journal No: 63023

OVEREXTENSION OF SCIENTIFIC METHODOLOGY: A STUDY WITH PARADIGMATIC REFERENCE TO PARADOXES

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Abstract

The thriving of science since the industrial revolution and its ability to cater for the material needs of humanity created the sense of authenticity of science over other disciplines. The success of science in various realms of life forced humanity to believe that scientific method alone is the correct method for any inquiry. Can one and the same methodology, the scientific one, is extendable to all realms of human existence? It can be seen that the quest for what is 'scientific' excludes many things that are meaningful in everyday life and beyond. The problem of overextension of a principle beyond its specified scope leads to unacceptable conclusions is established in this paper with the help of paradoxes. Science, in a sense, is aware of these limitations and have been shifting its paradigms throughout its developments from Newtonian physics to relativity theory to quantum mechanics. The imposition of scientific methodology to other disciplines limits the creativity and expression within those disciplines and hinder their growth. The procedure, methodologies and guidelines that are developed in the due course of scientific development are prescribed to other disciplines, which often do not fit within the scientific framework. So, it may be seen that, science is a paradigm of reference, but not the only one paradigm.

Keywords: Science, Methodology, Paradoxes, Paradigm, Limits of Science.

INTRODUCTION

Science is more or less the generalisation of the observed phenomena. These generalisations fall within the hierarchy of hypotheses, theorems and laws. The unproved theorems are hypotheses and the principles that govern theorems are laws. The still higher abstract principle by which these hypotheses, theorems and laws are to be handled is called methodology(Myers, 2004, pp. 18-19). Hence it is necessary for every system of principles, hypotheses, theorems and laws to have a suitable methodology in order to recreate and apply them. The methodology of modern science is the one appealing in this respect for its success. This forced other disciplines to adopt scientific methodology for the development of their own theorems and laws, often leading to grave consequences.

Philosophy of science, in the latter half of twentieth century witnessed the criticisms levelled against the then mainstream psychological theories questioning their scientific status. The thriving of science since industrial revolution and its ability to cater for the material needs of humanity created the sense of authenticity of science over other disciplines. This forced humanity to visualise science as capable of accessing reality (the so believed only reality), as what it is. The belief in the reality as an unchangeable notion led to the search for the *one and the only one* methodology that can lead to that reality. The success of science in various realms of life forced humanity to believe that scientific method alone is the correct method for any inquiry. This belief in science has overthrown many other belief systems, traditions and disciplines of knowledge as pseudo-scientific. In spite of the advancement that science has made in order to satisfy the material needs of humanity, it remains a hard fact that humanity in the present day is not in a better position than their ancestors in terms of the psychological satisfaction.

If it is the case that scientific methodology is the only valid methodology and only science can give authenticity to human knowledge, then it becomes impossible for other systems to exist. The same thing has happened when the then popular psychological theories and the Marxian theory of society were attacked by philosophers of science and side-lined them as unscientific and pseudo-scientific. Obviously, those theories as well as many of the realms of human knowledge do not fit into the criteria of being scientific. The present work is intended to look into the limitations of scientific methodology in its ability to access various realms of human existence. If the scientific methodology is limited in this capacity, then we have to search for alternate methodologies that can suit for those disciplines. In short, the present problem is whether the one and the same methodology, the scientific one, is extendable to all realms of human existence or not.

OBJECTIVES

As stated earlier, the present work is intended to look into the limitations of scientific methodology so as to caution about its over-extension to other disciplines of knowledge such as psychology, social sciences, arts and humanities.

METHODOLOGY

This work is taken up with paradigmatic reference to some of the well-known paradoxes. Some of the paradoxes such as *liar's paradox*, *semantic antinomy* and *Zeno's paradoxes* are examined for the root cause of them being paradoxes. The study analyses these paradoxes and is expected to find that it is the unwarranted extension of the limited mode of application that led to the paradoxical situation. This warns us of using any system or methodology beyond its specified scope and of the intellectual penalty we pay for any such violation.Later, the same principle of overextension of methodology is extended to the case of science so as to see the distortions made by such overextension.

WHAT MAKES SCIENCE SCIENTIFIC?

Science is said to be the systematic arrangement of knowledge about nature. This systematic arrangement includes isolated observed facts, hypotheses, theorems and laws. Hence the scientific status is generally ascribed to the hypotheses, theorems and laws that group the observed facts. It is the theory[i] whose nature is being scientific or unscientific. Initially it was thought that it is through the objective verification of the theory that it can be proved to be scientific. This led to serious consequences as to verify the theories concerning the heavenly bodies in laboratory that may eventually lead to the unscientific status of astronomy. Hence verification is not seriously taken as the criterion for being scientific. The principle of verification gave way in the history of Philosophy of science to the principle of verifiability. According to the theory of verifiability, it is not necessary to be verified for a theory to be scientific, but it must be verifiable if the technological and other limitations are overcome. A drastic change in the notion of scientific status occurred with the introduction of falsifiability by Karl Popper. Karl Popper explains that it is the falsifiability and not the verifiability that determines the scientific status of a theory. On this ground he attacks the Marxian theory of society and all psychological theories especially Psychoanalysis as unscientific. In his view,

> If observation shows that the predicted effect is definitely absent, then the theory is simply refuted. The theory is *incompatible with certain possible result of observation….* When it turned out that the theories in question were compatible with the most divergent human behaviour that might not be claimed to be a verification of these theories(Popper, 1963, p. 36).

Popper's specific attack on Psychoanalysis goes on like this,

> The two Psychoanalytic theories were in a different class [*From that of scientific theories*]. They are simply non-testable, irrefutable. There was no conceivable human behaviour which could contradict them (37).

In the foregoing passages, Karl Popper was explaining the criteria for the scientific status of a theory. Here, within the context of Philosophical inquiry, we are more concerned with the suitability or meaning of the theory under consideration rather than their classification as 'scientific' of 'non–scientific'. A theory is 'an *assumption or system of assumptions, accepted principles, and rules of procedure based on limited information or knowledge, devised to analyze, predict, or otherwise explain the nature or behaviour of a specified set of phenomena; abstract reasoning'*[ii] So within the framework of any discipline, a theory can be seen valid or invalid depending on its worthiness within the '*system of assumptions, accepted principles, and rules of procedure'.*

WHAT MAKES PARADOXES PARADOXICAL?

Paradoxes present intellectual penalties that are hard to bear with. Even though they start with our popular conceptions, they end against our popular conceptions. They introduce contradictions in thought. This chapter is intended to analyse some of the paradoxes for their being paradoxical. The paradoxes examined here are:

i) Liar's paradox
ii) Semantic antinomy and
iii) Zeno's paradoxes

LIAR'S PARADOX

If a person says that 'I am lying', then if he is lying then he is not lying and if he is not lying then he is lying.

To put it in other words, consider the case that someone says 'I am lying'. Now what can we say about the truth of that statement? There are two possibilities; true or false.

i) If the statement is true, he must be lying. This means that he must be making a false statement. This makes the statement false.
ii) On the other hand, if the statement is false, then he is not lying. This means he is making a true statement. This makes the statement true.

The explanation shows that the statement is either both true and false or neither true nor false. This is a logical impossibility. It is against the *laws of thought*.

SEMANTIC ANTINOMY

[The sentence written in the square bracket in this page is false][iii]

According to Logic, any statement must either be true or false and it cannot be both true and false together. But the above statement breaches these rules. It can neither be called true nor false.

i) Consider that the statement is true; then by its content it is false.

ii) Now, consider that it is false; then it is true to say that its content is false. Means, it is false to say that it is false (content). Means it is true.

ANALYSIS OF LIAR'S PARADOX AND SEMANTIC ANTINOMY

The fundamental error in both Liar's paradox and Semantic antinomy are similar. They both are statements. The general nature of statements is to express certain state of affairs. They generally speak something about something, but not about themselves. Here it can be seen in both the cases that the statements are making statements about themselves. This is not generally permitted, for any statement is intended to speak about something else.

No proposition can say anything about itself, because the propositional sign cannot be contained in itself (Wittgenstein, 1922-2003, p. 3.332).

Now it can be seen that it is the overextension of the function of a statement beyond its scope that led to the paradox in both the cases.

ZENO'S PARADOXES

For the present purpose, we may take Zeno's three arguments against motion. They are:

i) In order to travel a distance, a body must first travel half the distance. There remains half left for it still to travel. It must then travel half the remaining distance. There is still a remainder. This progress proceeds infinitely, but there is always a remainder untraveled. Therefore, it is impossible for a body to travel from one point to another. It can-never arrive.

ii) Achilles and the tortoise run a race. If the tortoise, is given a start, Achilles can never catch it up. For, in the first place, he must run to the point from which the tortoise started. When he gets there, the tortoise will have gone to a point further on. Achilles must then run to that point, and finds then that the tortoise has reached a third point. This will go on for ever, the distance between them continually diminishing, but, never being wholly wiped out. Achilles will never catch up the tortoise.

iii) This is the story of the flying arrow. An object cannot be in two places at the same time. Therefore, at any particular moment in its flight the arrow is in, one place and not in two. But to be in one place is to be at rest. Therefore in each anti every moment of its flight it is at rest. It is thus at rest throughout. Motion is impossible (Stace, 1992, p. 54).

ANALYSIS OF ZENO'S PARADOXES

The problem with the present case is that of applying the laws of static states to a dynamic situation. The rules of static state are that of formal logic, but that of dynamic state is of Dialectical logic[iv].The use of formal logic in argumentation and explanation gives the feeling of authenticity. Formal logic makes the distinctions clear, calculations specific and arguments strong. The apparent authenticity of formal logic is derived from its pattern of distinguishing one thing from the other as binary opposites. Things are put in discrete categories; 'is' or 'is not'. This definitely is that conveyed by the 'laws of thought'.

Everyday language seemingly supports this position. We can speak of an animal as either dead or alive. But the question of being dead or alive, on closer examination, turn out to be a complex question. It is "impossible to determine the moment of death, for physiology proves that death is not a sudden instantaneous phenomenon, but a very protracted process"[v]. Formal logic, like linier mathematics can deal only with fixed and unchanging categories (Grant & Woods, 2003, p. 165). Development of differential and integral calculus in mathematics enabled it to account for the continuum of infinitesimally small and infinitely large quantities. In logic too, we are in need of an approach that can account for the changing realities of worldly existence. We cannot put events in discrete categories of "either…or" or "*is* or *is not*". The uncomfortable irregularities and contradictions cannot be neglected while accounting realities. Any such account of nature using formal logic is doomed to fail.

> Any attempt to banish contradiction from nature, to smooth out its rough edges, to subject it to the neat rules of formal logic, as the gardeners at Versailles subjected rude nature to the rules of classical geometry, is doomed to fail. Such efforts may well have a soothing effect upon the nerves, but will prove to be utterly useless to arrive at an understanding of the real world (Grant & Woods, 2003, p. 186).

The approach that can account for contradictions and irregularities is *dialectic*. Dialectic as a revolution in thought pioneered by Heraclitus and Zeno reached its culmination in Hegel (Woods, 2003, p. 5). In dialectic reasoning, the higher levels of reasoning can account for the contradictions of lower realities. It can be seen that it is the overextension of the categories of formal logic to the realm of dialectical logic that led to the paradoxes of Zeno. The paradox of Achilles is not solvable by Linier Mathematics, as attempted in the paradox, but is solvable using Differential Calculus. Here too, it can be see that it is the overextension of Linier Mathematics beyond its scope to that of Differential

Calculus that led to the paradox. In short, the overextension of any theory beyond its scope can lead to paradoxical situations.

THE LIMITS OF SCIENCE

Popper's assertion for the non-scientific status of Behavioural theories presupposes the superiority of scientific theory over the non-scientific. In the field of knowledge, we are often bewildered by the word *scientific*. Whatever scientific is taken for granted, even without considering the fact that within the field of science the theories undergo constant revision and are even rejected. The Textbook study of science gives the impression that reality is 'out there'(Breger, 1981, p. 12). With the advancement of science, the truth is more and more discovered. This, Kuhn says, is because of the unaccountability of the historical development of science. In Louis Breger's words,

> Kuhn argues that the historical study of progress in a variety of scientific field does not support this textbook account. Rather, he finds that scientists are powerfully influenced by their belief structures, the paradigm which is acceptable at the time of their working. …. In short, the scientist work in a world which is narrowly hemmed-in by this paradigm and this narrowness is useful for the progress of what Kuhn calls 'normal science'…(Breger, 1981, p. 12).

It was with the rise of Industrial revolution and with the development of 'Classical Science' or 'Newtonianism' that a deterministic worldview emerged. This was considered to be the scientific one where chance played no role. This explains Universe as a closed system, functioning like *'clockwork'*. Illya Prigogine (1996), the Nobel Prize winner for his work on the 'thermodynamics of non-equilibrium systems', explains the unpredictability of a future event. This is due to the role played by '*chance*' in determining the future position at the revolutionary moment called *'bifurcation point'.* This position, obviously scientific, is with a marked difference from that of Classical Science. The deterministic worldview relied on the principle of causality, which again was found erroneous by modern science.

The traditional conception of cause and effect is one which modern science shows to be fundamentally erroneous, and requiring to be replaced by a different notion, that of *laws of change*(Russell, 1956, p. 93).

When the whole of Universe is concerned, in which of course 'Philosophy' becomes significant, the methodology of Classical Science or the mechanistic explanation, says Alvin Toffler, is doomed to failure. In his words,

> …they hold that while some part of the universe may operate like machines, these are closed systems, and closed system, at best, from only a small part of physical universe. Most phenomena of interest to us are, in fact, *open* systems. Exchanging energy or matter (and, one might add, information) with their environment. Surely biological and social systems are open, which means that the attempt to understand them in mechanistic term is doomed to failure"(Toffler, 1984, p. xv).

Another popular conception about the characteristic of science is about its objective nature. Louis Breger asserts the impossibility of separating the objective observer from his subject matter, the position held by Kuhn and Michel Polanyi. He argues that the developments in modern physics necessitated the abandonment of the conception of a detached observer. According to him,

> Einstein's work in relativity shows how the observer must be taken into account as part of phenomena being studied. Bohr's ideal of complementarity- that it is impossible to separate the behaviour of atomic objects from the instruments used to measure them – and Heisenberg's principle of indeterminacy – that one cannot determine both the location and velocity of an atomic particle because measuring one changes the other – both point to ways in which it is impossible to separate the observer from the observed. … One can in other words, find support for *a critique of the ideology of science within the heart of science itself,….*(Breger, 1981, pp. 32, emphasis added).

Science of course in valid; valid within the realm of scientific knowledge, that is the phenomenal world - Kant. According to Paul Feyerabend 'science is one among many traditions' He argues,

> It is thus *possible* to create a tradition that is held together by strict rules, and that is also successful to some extent. But is it *desirable* to support such a tradition to the exclusion of everything else(Feyerabend, 1984, pp. 19, Author's emphasis)?

The ascribing of scientific ideals and values – the overextension of scientific ideology - to humanistic discipline is bound to distort or misplace them. The concept like value, emotion, feelings and social system are not phenomenal in the sense in which scientific phenomena are. The procedure, methodologies and guidelines that are developed in the due course of scientific development are prescribed to other discipline, which often do not fit within the scientific framework. This tendency of prescribing scientific ideals evolved as a move against religious fundamentalism and

superstition(Breger, 1981, pp. 29-31). During the rise of science, the scientific ideals were contrasted with corrupt religious practices. In the present social context, in which scientists themselves link science with mysticism, (Capra, 1991) and (Illia Progogine-1996), this idea of prescription can be seen as an obvious intrusion to the field where the word *scientific* is no longer valid.

CONCLUSION

In the analyses of paradoxes, it has been seen that the overextension of a specific function beyond its scope is bound to distort the realm to which the function is extended. The paradoxes show the scope of the specific function beyond which the function becomes paradoxical. Every field of inquiry has a collection of facts within a specific scope. There must be some specific method or function through which they can be approached. Even within the realm of modern science, the workability of certain theorems is limited in its scope. Beyond this scope, the theorem becomes insignificant and this necessitates a shift in the paradigm that can explain the phenomenon satisfactorily.

Science is neither a single tradition, nor the best tradition(Feyerabend, 1984, p. 8). There are other ways of looking into the realities of everyday world, which even though not *scientific* are not insignificant and meaningless. The ascribing of scientific ideals and values – the overextension of scientific ideology - to humanistic discipline is bound to distort or misplace them. The concept like value, emotion, feelings and social system are not phenomenal in the sense in which scientific phenomena are. The procedure, methodologies and guidelines that are developed in the due course of scientific development are prescribed to other disciplines, which often do not fit within the scientific framework. So, we may conclude; science is a paradigm of reference, but not the only one paradigm.

We feel that even when all possible scientific questions have been answered, the problems of life remain completely untouched.[vi]

NOTES

1. Henceforth the notion theory, for convenience may include both hypotheses and laws.
2. Article *'Theory'* in Microsoft Encarta Encyclopedia 2009.
3. *Semantic Antinomy*(Dictionary of Philosophy, 1980)
4. Dialectical reasoning starts with a simple judgment (*thesis*). This very simple fact inspires and leads to another judgment, which in its essence the negation of the first one (*antithesis*). The relation between thesis and antithesis may either be of contrary or contradiction. The conflict between thesis and antithesis is resolved in the third judgment that is called *synthesis*. The thesis, antithesis and synthesis together form the triad of dialectical reasoning.
5. Engels quoted from *Anti-Dühring*(Grant and Woods 42).
6. Wittgenstein, *Tractatus Logico Philosophicus* (6.52)

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