American Journal of Sciences and Engineering Research
E-ISSN -2348 – 703X, Volume 3, Issue 3, 2020

Thomas Samuel Kuhn's Conceptual View on the Historical Philosophy of Science through Paradigm Shift

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ABSTRACT: *This study emphasizes the Thomas Samuel Kuhn's concept of paradigm as an intellectual framework. Philosophers and historians of science, including Kuhn himself, ultimately accepted a modified version of Kuhn's model, which synthesizes his original view with the gradualist model that preceded it. Think of a paradigm shift as a change from one way of thinking to another, it's a revolution, a transformation, a sort of metamorphosis. Kuhn's influence has been immense not only in the philosophy and history of science but also in other disciplines. His contributions showed a shift from historical, psychological and sociological approach to a philosophical one.*

Keywords: *Thomas Samuel Kuhn, Philosophy, Psychology, Life.*

I. INTRODUCTION

One very important individual whose contribution to the philosophy of science through paradigm shift is, Thomas Samuel Kuhn, who was born on 18th July 1922 in Cincinnati; to the family of an industrial Engineer, Samuel L. Kuhn. He became one of the most influential philosophers of science of the twentieth century. His book "The Structure of Scientific Revolution" is one of the most cited academic books at all times. Kuhn's contributions to the philosophy of science marked not only, a break with several key positivist doctrines, but also, inaugurated a new style of the philosophy of science that brought it much closer to the history of science (Fuller, 2000). His account of the development of science held that science enjoys periods of stable growth occasioned by revisionary revolutions, to which he added the controversial incommensurability thesis; that theories from differing periods suffer from the failure of comparability.

His idea that the development of science has periods of stable growth caused by scientific revolutions which are based on the cycle of normal science, crisis, and revolution. According to Fuller (2000), regularity in the development of various sciences is a paradigm shift that in his view is a general feature of science.

This study, therefore, aims to analyze Kuhn's concept of a paradigm shift as an intellectual framework that makes research possible. It is debated that the term could globally be understood as a disciplinary matrix, in a sociological context, whereas the term particularly, refers to the concrete puzzle solutions, which could be seen as models of good science. Literature here shows that the process of paradigm shift according to Kuhn, results in the scientific revolution. Kuhn's argument on the incommensurability of competing paradigms and the problem of objectivity are also discussed to show the problematic aspects of the concept.

II. THE CONCEPT OF PARADIGM

Paradigm is the key term in Thomas Kuhn's (1922 – 1996) very influential book, the structure of the scientific revolution (1970). Kuhn took an existing term and gave it a technical meaning just as it is usually practiced during the evolution of new ideas. The term paradigm has now become a commonly used word in every kind of discourse, usually to mean something like "way of thinking" or "approach to a problem". The contemporary application of the term has been credited to Kuhn. However, Nersessian (2003) observed that the manner paradigm is popularly used today, misses a central aspect of his argument. Kuhn (1970) argued that the history of science is best understood as exhibiting stable periods, which he calls normal science. Kuhn used Paradigm as the central concept to argue that a period of normal science is defined by its paradigm and a scientific revolution is a change in paradigm. Furthermore, he believed

 Received- 06-05-2020, Accepted- 21-05-2020

that normal science is typically established by an important book and often by a series of experiments, Kuhn's view was that the idea of a paradigm is a pattern that will be followed very much in mind when discussing the concept.

Paradigm shifts tend to be most dramatic in sciences that appear to be stable and mature, as in physics, at the end of the 19th Century. At that time, physics seemed to be a discipline filling in the last few details of a largely worked-out system.

Kuhn wrote in his book, The Structure of Scientific Revolutions, that, "Successive transition from one paradigm to another via revolution is the usual developmental pattern of mature science." The position of Kuhn was revolutionary at the time, changing the dimension and pattern of scientific discourse by scientists. It will not be out of place therefore, to conclude that the scientific revolution as described by Kuhn was itself part of a "paradigm shift" in the history and sociology of science. Although, people can still use earlier ideas to discuss the history of science in social sciences, because some philosophers do not accept the new pattern and dimension.

Philosophers and historians of science ultimately accepted a modified version of Kuhn's model, which synthesizes his original view with the gradualist model that preceded it. Kuhn himself accepted the modification which states that thinking of a paradigm shift as a change from one way of thinking to another is a revolution, a transformation, and a sort of metamorphosis. It does not just happen, but rather it is driven by agents of change. For example, agents of change are driving a new paradigm shift today in the form of information and communication technology (ICT) revolution. The signs are all around us. The introduction of personal computers and the internet have impacted both private, public and business environments.

III. KUHN'S LIFE AND CAREER

Thomas Kuhn's academic life started in Physics. He then switched to history of science and as his career developed, he moved over to philosophy of science, although retaining a strong interest in the history of physics. He graduated from Harvard Summa Cum laude in 1943. He graduated with a degree in physics. Thereafter, he spent the remainder of the war years (World War II) in research related to radar at Harvard and then in Europe. Returning to Harvard, he gained his Master's Degree in Physics in 1946 and his doctorate in 1949, all in Physics (concerning an application of quantum mechanics to solid-state physics). Kuhn taught science to undergraduates in the humanities as part of the General Education in Science curriculum up to 1956. This course was centered on historical case studies and this was Kuhn's first opportunity to study historical scientific texts in detail. This led Kuhn to concentrate on the history of science. He was later appointed an assistant professor in general education and the history of science.

In 1956 Kuhn was denied tenure at Harvard because the committee thought that his first book, "The Copernican Revolution: Planetary Astronomy in the Development of Western thought" (1957) which was reviewed before publication was too popularly written and not sufficiently scholarly. Kuhn promptly accepted a position as an assistant professor of history and philosophy of science at the University of California at Berkeley.

In 1961 Kuhn became a full professor at the University of California at Berkeley, having moved there in 1956 to take up a post in the history of science, but in the philosophy department, which enabled him to develop his interest in the philosophy of science.

Shortly thereafter, in 1962, Kuhn published his second book "The Structure of Scientific Revolution" in the series "International Encyclopedia of Unified Science", edited by Otto Neurath and Rudolf Carnap. The central idea of this extraordinarily influential and controversial book according to Kaiser (2012) that the development of science is driven, in normal periods of science, by adherence to what Kuhn called a 'Paradigm'. Here, the function of a paradigm is to supply puzzles for scientists to solve and provide the tools for their solution. A crisis in science as opined by Gattei (2012) arises when confidence is lost in the ability of the paradigm to solve particular worrying puzzles called 'anomalies'. Crisis according to Kuhn (1959) is following by a scientific revolution if the existing paradigm is superseded by a rival. Kuhn claimed that science guided by one paradigm would be 'incommensurable' with science developed under a different paradigm. It means that there is no common measure of the different scientific theories. Most of Kuhn's subsequent work in philosophy was spent in articulating and developing the ideas in the structure of scientific revolution although some of these, such as the thesis of incommensurability, transformed the process.

IV. THE DEVELOPMENT OF SCIENCE

Steve (2000) stated that, "Kuhn hoped that his description of an important historical instance of a revolution in science would show that scientific beliefs can be overthrown, that even long-held theories are not immune from criticism and do not last forever". This implies that the work is not skeptical, however, he demonstrates that a fundamental belief is retained even when many important ones are rejected. The major intention of the paradigm was to promote a realistic attitude toward modern science.

It was Kuhn was established that the geocentric view that preceded the revolution was a genuine scientific one and not a religious doctrine, a traditional myth or pre-scientific speculation. This was done to endorse the Copernican revolution that scientific beliefs are subject to radical revision (Naughton, 2012). Kuhn became a popular philosopher of scientific revolutions due to his work and most noteworthy is his work on the role of tradition in scientific thinking. Kuhn presented a picture of an interchange in science between stable periods, in which the leading theories in a particular field are accepted by virtually everyone working in that field and briefer revolutionary episodes in which these theories come under scrutiny and are replaced by others.

Kuhn calls the stable period "normal science", the revolutionary episodes "extraordinary science" or "revolutionary science". He argued that normal science is governed by a paradigm, which is characterized as "puzzle-solving". In normal science, leading theories encapsulated in the paradigm are not tested; and they are not subject to confirmation or falsification. Kuhn (1992), further argued that the state of normal science cannot last indefinitely. Scientists will discover phenomena that, despite their best effort, cannot be explained using the resources of the paradigm; such intractable puzzles he called "anomalies". For instance, Newton's treatment of the orbit of the moon failed to fit with astronomical observations, and his successors found that the orbit of Uranus was not what was predicted by the best application of Newton's laws. Both of these anomalies were eventually resolved within the Newtonian paradigm, first by improving techniques, the second by the discovery of Neptune. Kuhn notes that a few isolated anomalies may be accepted as part of normal science. During normal science, a scientist's inability to solve a particular problem may be attributed to the limited capacities of that individual. An accumulation of unresolved anomalies, however, leads science into its next phase (i.e. crisis).

A crisis occurs when scientists discover that they are no longer convinced about the current paradigm having sufficient resources to provide solutions to the increasing number of serious anomalies. Failure of scientists to resolve the phase of anomalies means the paradigm has failed. The situation automatically leads to the development of a new paradigm, free from these anomalies. The replacement of one paradigm by another is called the "scientific revolution" (Kuhn, 1974). Kuhn's adoption reflects two important aspects of his views. First, it points to the cyclical nature of change in science, the adoption of a new paradigm as the result of a scientific revolution inaugurates a new period of normal science, which will lead to another crisis, another revolution, a new paradigm and so on. Secondly, Kuhn draws an analogy between scientific and political revolutions. The political equivalent to a paradigm is an established mechanism, such as a constitution or traditional lore and political problems. Because according to him, if a political conflict arises that cannot be resolved in the normal fashion, the constitution or traditional practices may have to be replaced by new ones.

Theories based on different paradigms according to Kuhn (1982) share no common measure. The paradigm of one period of normal science may lead scientists to judge one puzzle solution more favourably than another solution, while the paradigm from another period of normal science may lead scientists to make the opposite judgment. Kuhn however, made it clear that the cyclical nature of science does not mean that scientific progress does not occur. It does occur and not only during a period of normal science or relative to a given paradigm, but also from revolution to revolution. Thus the long history of science is a progressive one.

Critics regarded Kuhn as irrationalism because of his stress on paradigm as an arbiter of quality during a period of normal science, who considers all scientific values, including truth, as relative to the paradigm. These misconceptions took him considerable efforts to clear. At the same time, this aspect of Kuhn's work was emphasized by many who claimed to be his followers, including sociologists of science who saw his remark the seed of a new approach to the explanation of the scientific change.

Another feature of 'The Structure of Scientific Revolutions' that attracted charges of irrationalism was Kuhn's emphasis on incommensurability. Here, Kuhn was accused of idealism because his work indicated that scientists

operating in different paradigms observe differently, depending on the perspective from which they are observing. Brad (2011) pointed out that Kuhn's claim is linked to the psychological thesis that experience is theory-dependent. In the 1950s an alternative to logical positivism was becoming popular among practicing scientists. The ***"falsificationism"*** of Karl Popper, according to which scientific theories are not constructed by inductive inference from observations; instead, a scientist makes a tentative, unjustified theoretical conjecture and puts it to an experimental test. If it fails the test, it is rejected and new conjecture is sought, if it passes the test, it is subjected to further testing. One can deduce from the statement above that a theory is never verified, but as long as experiments fail to disconfirm it, it is provisionally accepted.

Alison (2015) and many other scientists, admired Popper's emphasis on rigorous testing. They thought that the depiction of scientists subjecting their theories to tests that might well falsify them was more accurate. Nonetheless, Kuhn is more concerned to explore the precise nature of their differences, for Popper, science progress only when a theory is tested, falsified, and replaced by a new theory, for Kuhn, most scientific advances occur during periods of normal science.

Kuhn's disagreement with Popper was that he failed to recognize the existence of normal science. Popper holds the overthrown of existing theory to be the logical result of testing the theory and finding that it fails the test, while Kuhn argues that revolutions are produced by crises that result from the accumulation of anomalies, hence, revolutions occur in Kuhn's view, without the underlying theory being put to the test.

V. SCIENCE AND PARADIGM

A common misinterpretation of paradigms is the belief that the discovery of paradigm shifts and the dynamic nature of science (with its many opportunities for subjective judgments by scientists) are a case for relativism with the view that all kinds of belief systems are equal. Kuhn vehemently denies this interpretation and states that when a scientific paradigm is replaced by a new one, albeit through a complex social process, the new one is *always better*, not just different.

These claims of relativism are, however, tied to another claim that Kuhn does at least somewhat endorse: that the language and theories of different paradigms cannot be translated into one another or rationally evaluated against one another-that they are *incommensurable*. This gave rise to much talk of different peoples and cultures having radically different worldviews or conceptual schemes—so different that whether or not one was better, they could not be understood by one another. However, Davidson (1974, pp. 5–20), argued that the notion that languages or theories could be incommensurable with one another was itself incoherent. If this is correct then, Kuhn's claims must be taken in a weaker sense than they often are. Furthermore, the hold of the Kuhnian analysis has long been unsubstantiated with the wide application of multi-paradigmatic approaches to understanding complex human behavior. Paradigm shifts tend to be most dramatic in sciences that appear to be stable and mature, as in physics at the end of the 19th century. At that time, physics seemed to be a discipline, filling into the last few details of a largely worked-out system. Philosophers and historians of science, including Kuhn himself, ultimately accepted a modified version of Kuhn's model, which synthesizes his original view with the gradualist model that preceded it.

VI. CRITICISM AND INFLUENCE

Kuhn's work met with a largely critical reception among philosophers. Some of this criticism became muted as Kuhn's work became better understood and his thinking was transformed. That criticism has largely focused on two areas. First, it has been argued that Kuhn's account of the development of science is not entirely accurate (Kaiser, 2012) Secondly, as reported by Brad (2011), "Critics have attacked Kuhn's notion of incommensurability, arguing that either it does not exist or, if it does exist, it is not a significant problem".

Despite these criticisms, Kuhn's work has been hugely influential, both within philosophy and outside it. Kuhn may have tried to distance himself from the strong programme, because of his sensitivity over his reputation as an irrationalism about science. That was why Lakatos (1970) in his paper "Criticism and the Growth of Knowledge" stated that in Kuhn's view, the motor of revolutionary change in science is "mob psychology". It is interesting to observe that, Kuhn though started his professional life as a historian of science, finished it as a philosopher of science.

Unquestionably he was one of the most influential philosophers and historians of science of the twentieth century. His most obvious achievement was to have been a major force in bringing about the final demise of logical positivism. Nonetheless, no characteristically Kuhnian school carries on his positive work. It is as if he brought about a revolution. Indeed part of Kuhn's fame must be because both his supporters and others took his work to be more revolutionary (anti-rationalist, relativist) than it was.

VII. CONCLUSION

In conclusion, the role of Kuhn in the development of the contemporary philosophy and history of science cannot be overemphasized, he received numerous awarded from different academic and professional bodies, such includes; he became a professor of philosophy and history of science at the Massachusetts Institute of Technology (MIT) in 1979. In 1982, Kuhn was awarded the Sarton Medal by the History of Science Society. Two years later he became professor emeritus at MIT.

Kuhn's influence has been immense not only in the field of philosophy and history of science but also in other disciplines. He held honorary Doctorate degrees from Institutions that included Columbia University and the Universities of Notre Dame, Chicago Padua and Athens. Kuhn died at his home, Cambridge, Massachusetts, on 17th June 1996 at the age of 73, to cancer of the throat and bronchial tubes, leaving three children; Serra, Elizabeth and Nathaniel.

The greatest shortcoming of Kuhn, despite his wide influence, is his inability to leave behind anything like a Kuhnian 'school'. This may be attributed to his shift from historical, psychological and sociological approaches to a philosophical one approach.

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