

Pre paradigmatic
science analysis
philosophy essay



**ASSIGN
BUSTER**

"What is Science?" is still a big question. From the general introduction, it is cleared that Thomas Kuhn's focus was mainly placed on science as a process rather than its product. He argued that what the scientists do will answer the question 'what is science?' He shifts from the subject (the product) to the verb (to produce). Kuhn was concerned about what the scientists normally do; the processes they passed through in research's practices. These are the processes he tried to explain using the history of science as facts to support his claims. He tries to see science as a dynamic activity or practice, rather than just focusing on the finished products of science presented in the textbooks or given by scientists. Rouse asserted that Kuhn's philosophical account of science is seen as "a research activity itself" or "science as a practice".

Kuhn argued that the image of science given by textbooks is not the accurate image of science that is now practiced in scientific communities. He compared the textbooks image of science to the brochure of a national cultural tourist center where the brochure will give the very best features of the place for examples, the museums and café cultures and unfortunately they will downplay the buildings for the homeless children.

In this chapter one, I try to focus directly on the first part of Kuhn's book- "Structures of Scientific Revolution", which I consider as 'Pre-paradigm science: the route to normal science'. In this chapter, I first elaborated on Kuhn's most dominant word "Paradigm" which seemed to provoke a lot of misunderstanding among many readers. This pre-paradigmatic science is the route, a passage to normal scientific practices. It begins and describes the journey scientists embarked on when conducting a research. Kuhn

<https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

considered this stage as the first process in any scientific research. It is when different scientists confronting the same phenomena describe and interpret it in different ways. This stage enters into what Kuhn refers to as 'Normal Science', where scientists come up to a consensus on a single paradigm which seems to solve all the problems. Then scientists start to perform their normal duties of defending the paradigm that had been chosen. Normal science involves gathering additional information and observation about the new theory, and trying to eliminate some little problems that may come up within the paradigm. This for Kuhn is solving puzzles in science; sticking to the rules provided by the paradigm. Normal science is what scientists do most of the time maybe for the rest of their lives. There are many interesting arguments that can be drawn from Kuhn's work, including the implications and consequences it has for science. However, I hope to reserve my arguments for now, chapter four of this essay will explain these implications in detail.

1. 1 Understanding Kuhn's Paradigm

The notion of 'paradigm' is one of the most useful concepts articulated to Kuhn's Structure of Scientific Revolutions. As it was meaningful, it began one of the misunderstood concepts underlying his work. The notion of paradigm came under many criticisms by many readers including Margaret Masterman who spotted out twenty one different usages of the term. Kuhn referred to paradigm as a concrete instance of a significant scientific accomplishment such as Newton's Mechanics, Ptolemaic Astronomy (Copernican), Aristotelian Dynamics, the wave optics, etc... Kuhn argued that these are considered paradigms because they served as guidelines in which the methods of any

research or problem will be based for the future researchers. Another reason they are considered paradigm is because their achievements have been recognized by the community but the community cannot easily understand, interpret, grasp or explain its nature.

1. 1. 1 Kuhn's two meanings of paradigm

After all the criticisms on paradigms, Kuhn clarifies that he used the term 'paradigm' in only two ways. 'Paradigm as the constellation of group commitment' and 'paradigm as share examples'. Paradigm as the constellation of group commitment is a more global usage of the term. Scientists may say they share theories or some kind of law in common when making meaningful judgments and decisions, but Kuhn will say they share a paradigm because theory is limited in nature and scope according to Kuhn. Kuhn preferred the term 'disciplinary matrix' for this global use of the term paradigm. 'Disciplinary' because it refers to what the group practice and holds in common and 'matrix' because it is composed of ordered elements... Therefore for example, Newton's laws which were discussed as paradigm or pre-paradigmatic can be considered a 'disciplinary matrix.' The disciplinary matrix consists of skills and methods that have been learnt by scientist in the course of their studies that enable them to conduct research. This is part of what makes a paradigm better than a theory, because the disciplinary matrix contains skills that help the scientists to work, for example usage of the telescope.

Kuhn also emphasized on 'values' as an elements of the disciplinary matrix because the values give a good sense of community to scientists. Values are important to scientists especially when a scientific community is undergoing

<https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

a serious crisis, and making incompatible decisions concerning theory choice that may undermine what they practice. 'Paradigm as constellation of group commitment' or 'disciplinary matrix' " can be seen as a set of answers to questions that are learned by scientists in the course of their education that prepare them for research, and it provides the framework within which the science operates".

But Kuhn also made explicit that paradigm are not only defined in terms of the community concrete achievements, but also in term of its " accepted examples of actual scientific practices, examples which include law, theory application, and instrumentation together which provides models from which spring particular coherent traditions of scientific research".

'Paradigm as shared examples' is the second meaning Kuhn gave for understanding paradigm. Kuhn asked, whether you have ever studied the problems that students in the science laboratories undergo? Can a student solve any concrete problem without first learning the theory and rules? Kuhn argued that " scientific knowledge is embedded in theories and rules, problems are supplied to gain facility in their application". However, he maintained that " lack of standard interpretation or of an agreed reduction to rules will not prevent a paradigm from guiding research". Here Kuhn is not claiming that rules are not necessary for research but rather, rules are not always sufficient for guiding research.

He rejected the picture of science as operating according to rules of logic or method. The paradigm notion is intended to explain how science does function without such rules. Instead of following rules, scientists should

match their work to the paradigm in a way that depends on seeing similarities between their work and the paradigm. Seeing similarities is an ability that cannot be reduced to rules. Paradigm as a model or exemplar would set the puzzles for scientists to solve, give them the tools to solve those puzzles, and provide the standards by which those puzzles could be assessed.

1. 2 Pre-Paradigmatic Science

Kuhn claimed that in every scientific discipline, there are some identified and natural phenomena that are then investigated experimentally and explained theoretically. However, each researcher has his own foundation or purposes from each other; for each researcher often represents a school working from different foundations. Kuhn argued that during these early stages of inquiry, different researchers confronting the same phenomena describe and interpret them in different ways. In time, these descriptions and interpretations disappeared. When this happens, a pre-paradigmatic school appears. Such school often emphasizes a special part of the collection of fact. The pre-paradigmatic school gets in competition for monetary and social resources and for professional recognition. These schools can be compared to various philosophical schools and sub-schools like that of Epicurean, Aristotelian, or Platonic school.

Kuhn being a historian of science traced history as argued that at the end of the 17th century there was no single view about the nature of light. Today's physics textbooks presents to the students that light is photons- that is quantum mechanical which says that light is composed of both waves and particles. However, the composition of light before it was developed by <https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

Planck; Einstein and others had already taught that light was composed of wave motion which was found in the writing of Young and Fresnel in the 19th century. But during the 18th century, Newton's Optics, taught that light was a material Corpuscular. The outcome of these various views concerning the composition of light is that all of them seem equally relevant to the problem at hand. There is often a proliferation of facts and hence little progress in solving problem, under these conditions because of the competitions among various schools. Kuhn stated that the overall result of this pre-paradigmatic situation appears to be " something less than a science, though the field's practitioners were scientists".

Kuhn refers to this state of science as pre-paradigm or immature science. It implies that during this stage, there is no single paradigm that defines the discipline and governs its practices. Pre-paradigmatic science is non-directed and flexible, offering a community of practitioners little guidance. An example given by Kuhn to illustrate pre-paradigm appears within the physical optics of Newton:

" Being able to take no common body of belief for granted, each writer on physical optics felt force to builds his field anew from its foundations. In doing so, his choice of supporting observation and experiment was relatively free, for there was no standard set of methods or of phenomena that every optical writer felt forced to employ and explain. Under these circumstances, the dialogue of the resulting books was often directed as much to the members of other schools as it was to nature".

1. 2. 1 The End of Pre-Paradigmatic Competition

One may be tempted to ask whether there is a point in time when this competition may come to an end. Kuhn will surely answer 'yes'. Kuhn stated that the end the competition of these Pre-paradigmatic schools is when one paradigm emerges as better than the other. The benefit of a single paradigm is critical for scientific practice and the growth of science. Therefore, as one paradigm grows in strength and in its number of advocates, the other previous paradigms fade.

This is the transition from pre-paradigmatic science to a Normal science. The acquisition of a single paradigm is Kuhn demarcation principle. As a single paradigm is accepted, the other schools disappeared because their members are somehow converted to the new paradigm. But there will always be some men who will still hold on their old views. Some of them may join another groups, while some may leave the profession and enter into teaching and some may even abandon the profession altogether.

1. 3 Normal Science

The transition from pre-paradigm to normal science is achieved when, during the competition involved in pre-paradigmatic science, one school makes a stunning achievement that catches the attention of the professional community. This stunning achievement is the acceptance of a single paradigm as already mentioned. Examples of some scientific achievements are Aristotle's *Physica*, Ptolemy's *Almagest*, Newton *Principia* and *Opticks* and Franklin's *Electricity*. All these achievements exhibited two characteristics according to Kuhn before they were considered a Paradigm.

First, these " achievements were unprecedented to attract an enduring
<https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

group of adherents away from competing modes of scientific activity" and secondly, " they were sufficiently open-ended to leave all sorts of problems for the redefined groups of practitioners to resolve". The paradigm when they first appeared is limited in scope and in precision though at the initial stage it offers the promise of success.

However, if the triumph of a paradigm represents the work that has been done, then what is left to resolve? Initially, a paradigm offers a promise of success, but it must be made clear that these same paradigms are limited in scope and precision when they first appear. At their first appearance, the candidate for paradigm status does a far more effective and efficient job in determining the problems worth solving. " To be accepted as a paradigm", Kuhn claimed, " a theory must seem better than its competitors, but it need not, and in fact never does, explain all the facts with which it can be confronted."

As the paradigm is accepted, the community built all their confidence in the paradigm hoping that the problems are solvable with details. " Paradigm gains their status," explain Kuhn, " because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute."

The community's confidence in a paradigm is based on the " conversion" of its members, who are now committed to the paradigm. This is where Kuhn was criticized on the ground that scientists used reason in determining what is right and not on " conversion" or " faith". But Newton, after elaborating on his principles of universal gravitation believed that it was by the help of God

that he was able to come up with such a theory. He held that gravity was a divine action, what he called " the sensorium of God".

1. 4 Normal Science Commences

Once consensus is achieved, Kuhn argued that scientists are now in the position to commence with the practice of normal science. According to Kuhn, 'normal science' means " research firmly based upon one or more past scientific community achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice". Kuhn claimed the contemporary textbooks of science are very good examples that portray what normal science is all about. The pre-requisite for normal science includes a commitment to the shared paradigm that defines the rules and standards by which science is practiced. Whereas pre-paradigmatic science is non-directed and flexible, normal science is highly directed and rigid, this is the reason why scientists are able to make the strides they do.

" Those repetition born from confidence in the paradigm, turn out to be essential to the development of science. By focusing attention upon a small range of relatively esoteric problems, the paradigm forces scientists to investigate some part of nature in a detail and depth that would otherwise be unimaginable."

Most of the science practiced today is exactly what Kuhn refers to as 'normal science'; because they are just based within an established paradigm. " By gathering lots of new observations and accommodating them within the accepted theory, and trying to solve minor problems within the paradigm."

Kuhn and Popper differ on the concept of normal science. Kuhn frowns on Popper method of falsification which holds that a theory can be refuted or must be falsified by a single observational or experimental result. While Kuhn maintains that the paradigm is never falsified by a single anomaly, but a paradigm is abandoned only if another viable paradigm is available to replace it. " Scientists don't give up the paradigm just because it conflicts with some of the evidence". Kuhn added that " the scientist who pauses to examine every anomaly he notes will seldom get significant work done".

1. 4. 1 Mopping Up, a nickname for Normal Science

Kuhn asserted that 'Mopping - up operations is exactly what most of the scientists are engaged in throughout their careers and mopping -up is what normal science is all about. Kuhn defined Mopping - up " as a paradigm based research in which an attempt to force nature into the preformed and relatively inflexible box that the paradigm supplies." In normal science mopping-up scientists are not to make new discoveries or to invent new theories outside the paradigm; rather they are involved in using the paradigm to understand nature in greater depth. In case any anomaly pop-up, they are discarded or ignored. Scientists are also often intolerant with other scientists who invent a new theory during this period of mopping-up. Rather than being a dull and routine activity, however, such activity according to Kuhn is exciting and rewarding and requires practitioners who are creative and resourceful. " Normal scientific research is strictly directed to the articulation of those phenomena and theories that the paradigm already supplies".

1. 5 Normal Science as a Puzzle Solving Activity

If the paradigm provides all that scientists need to know, then why do scientists still carry out research activities? Research in normal science is meaningful because it adds to the scope and precision of the paradigm. In research the information, data, measurement done by the instruments and apparatus designed by the researcher are significant but they are often rejected because they are repetition of procedures that had already been carried out before.

Doing a research as Kuhn says is usually like solving puzzle. Puzzles generally have rules and they have predetermined solutions. Puzzles like jigsaw puzzles and crossword puzzles all shared the characteristics of normal science practiced by scientists. The criterion set for a puzzle does not require that its outcome be very interesting or important. The way to obtain the results usually remains very much in doubt, and this is exactly the challenge of the puzzles and it is this challenge that keeps the scientists working. However, Kuhn was quick to clarify that not all problems in science are puzzles, examples are, the cure of cancer or HIV/AIDS, or the design of a lasting peace. He argued that they are not puzzles because there may be no solution to them, whereas puzzles have solutions and there is also an assured existence of puzzle solutions.

The problems that are to be solved in puzzle of normal science are the only problems that the community will openly admit as scientific or they are the problems that the scientific community usually encourages their members to undertake. Other standard problems are not considered because the

community considered them to be metaphysical, or they concern other discipline, or maybe they are too problematic for now.

Kuhn argued that when normal science try to solve all these puzzles, many considered its solutions as progress. " One of the reasons why normal science seems to progress so rapidly is that its practitioners concentrate on problems that only their own lack of ingenuity should keep them from solving".

1. 5. 1 The importance of rules in solving puzzles

There are always rules attached to every puzzle; to solve a jigsaw puzzle for example is not just to make a picture. Kuhn stated that a child or an artist can do that by using the pieces of the puzzles and form a better picture than the original. But such a picture would not be the solution to the puzzles. To achieve the solution of a particular puzzle " all the pieces must be used, their plain sides must be turned down, and they must be interlocked without forcing until no holes remain".

As in puzzles, so also in a research, according to Kuhn, apparatus and instruments are built in order to correspond to the rules that are already governed by the puzzle. If an apparatus does not correspond to the rules of the puzzles, it becomes vague and useless. For example, throughout the 18th century scientists failed to observe the motion of the moon in terms of Newton's laws of motion and gravitation. Some suggested that they replace the inverse square law with a law that deviated from it at small distances. It sounded easy, but doing this means that the paradigm must be changed and a new puzzle must be defined, that is, it is no longer the old one! Kuhn

argued that "to desert a paradigm is to cease practicing the science it defines. Scientists could not change the paradigm, so they kept the rules until 1750 when one of them discovered how they could successfully be applied".

In concluding on rules, Kuhn warned that normal science is a highly determined activity, but it is not always determined by rules. "Rules, I suggest, derive from paradigms, but paradigms can guide research even in the absence of rules".

1. 5. 2 Paradigm as 'first priority'

Why is a paradigm so important than rules? Paradigm takes priority over rule because rules come from what the paradigm suggests, but the paradigm can still guide the research in the absence of rules. The paradigm of a scientific community is different from the rules. The rules are what the community has abstracted from the global paradigm and are used in research. Paradigms are broader in concept than rules; the search for a rule is more difficult and frustrating than the search for a paradigm. Paradigm helps scientific communities to bind their discipline in ways that will help the scientists to create avenues of inquiry, formulate questions, select methods with which to examine questions and define the areas of relevance. "In the absence of a paradigm or some candidate for a paradigm, all the facts that could possibly pertain to the development of a given science are likely to seem equally relevant". Scientists like Newton, Lavoisier, Maxwell, or Einstein, all had and produced a paradigm, but they however disagreed with each other sometimes without being aware of it about the characteristics and rules that constituted the said paradigm.

<https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

Kuhn still holds that the lack of an agreed rule will not prevent a paradigm from guiding the research. It is the existence of the paradigm that builds the research. The rules used by scientists who share a paradigm are not easily determined because scientists can easily disagree on the interpretation of a paradigm. Another reason is that the "existence of a paradigm does not necessarily imply the existence of a full set of rules". Michael Polanyi stressed similar point arguing that much of scientists' success depends upon 'tacit knowledge' which is acquired through practice but cannot be articulated explicitly. More reasons why rules are difficult to determine are due to the fact that the attributes shared by a paradigm are not always apparent, and finally, "paradigm may be prior to, more binding, and more complete than any set of rules for research that could be unequivocally abstracted from them".

When Kuhn says that paradigms can determine normal science without the intervention of discoverable rules, he simply means it is very difficult to formulate rules that are already governing the traditions of the normal science, that difficult is likely the same when philosophers try to tell what all games have in common. Secondly, scientists never learn concepts, laws and theories in abstract and by themselves. These law, concepts and theories as portrayed in scientific education are learn through application to concrete things. These theories that have been applied are then accepted and placed in textbooks for future generation. The problems that students encounter from freshman year throughout his doctorate program, as well as those they will tackle during their careers, are always closely modeled on previous achievements.

1. 6 Conclusion

So far, we have come to the general understanding of the two different views of understanding Kuhn's concept of 'Paradigm'. First, paradigm is considered as 'constellation of group commitments' is a concrete achievements based on the studies and values required by the community. Secondly, paradigm as 'shared examples' is considered a 'model' or 'exemplar' set by nature that provides the standard for research in normal scientific practices.

Pre paradigmatic science sets the route for any normal scientific practices. It is clear that there is a point in science when arguments must pop up among scientists concerning a certain practice and its method or principles. The pre-paradigmatic stage is when the practitioners do not even agree on the basic propositions about what they are investigating or how to investigate it.

Newton hostility to Hooke on the 'nature of optics' is a good example. Hooke argued that we see light reflected off objects while Newton said that the eye sends out beams that bounce back to the eyes. Newton waited for thirty years for Hooke to die before he concluded his theory on Optic.

After the entire consensus, a triumph of a single paradigm, (like Newton's Optic) normal science begins. The one who succeeded in the competition seemed to solve many outstanding problems than the other. He impresses many people with his new techniques (Galileo's telescope) and wins the approval of other scientists. Kuhn argues that this is when most scientific works actually gets done. This is when scientists solve many puzzles in science. Moreover, the paradigm takes first priority over rules; it is the paradigm that guides research. This is the one of the problems of

contemporary science where students learn rules to apply to the paradigm
<https://assignbuster.com/pre-paradigmatic-science-analysis-philosophy-essay/>

instead of allowing the nature of the paradigm to dictate the rules. Later, when the paradigm imposes its standard on the scientists, he become confused and sees it as an anomaly. Eventually, the scientist discovered again that normal science has some anomalies, some problems pop-up that scientists cannot solve because of the nature of the paradigm. Chapter two of this essay will discuss the anomalies and their nature and how to overcome them.

CHAPTER TWO

ANOMALY AND CRISIS: A TRANSITION FROM NORMAL SCIENCE TO EXTRA-ORDINARY SCIENCE

Introduction

As scientists move ahead practicing their usual activities in normal science by solving puzzles which are determined by the paradigm, they feel confident by sticking to the paradigm since it had been successful in the past and had solved many problems and also because of the time, investments, and resources put in the paradigm at the earlier stage. In practicing normal science, scientists do not intentionally attempt to make unexpected discoveries, but however, such discoveries do occur that affect the paradigm and causes a change. Kuhn argued that " new and successful phenomena are repeatedly uncovered by scientific research, and radical new theories have again and again been invented by scientists".

Causes of Paradigm change

Kuhn argued that paradigm change come about by discovery, or novelty of fact and by invention, or novelty of theory. As scientists made new

discoveries or develop new theories, the paradigm changes. These discoveries of facts and inventions of new theories began with an awareness of an anomaly, that is, " with the recognition that nature has somehow violated the paradigm - induced expectations that govern the normal science". Anomalies then are violations of paradigm expectations during the practice of normal science and can lead to unexpected discovery. Perceiving an anomaly is essential for perceiving novelty although, the first does not always lead to the second (that is, anomalies can be ignored, denied, or unacknowledged).

For Kuhn, unexpected discovery is a complex process because it involves new facts and novel theories. " Discovery as new sort of phenomena is necessarily a complex extent, one which involves recognition both that something 'is' and 'what it is'".