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ANALYSIS OF PARADIGM SHIFT AND IRRATIONALITY IN THOMAS KUHN'S PHILOSOPHY OF SCIENCE

Göksel Yıkmış1
Research Assistant Dr., Bingöl University,
Faculty of Arts and Sciences,
Department of Philosophy,Bingöl, Turkey

Corresponding Author*

Göksel Yıkmış

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Abstract: In this article, I will explore Kuhn's arguments concerning his claims of "paradigm shift in science is irrational". First, I will do this by looking into Kuhn's opinions about paradigms, normal science, and revolutions by taking reference to his writings. Second, I will try to understand influences and ideas located in "The Structure of Scientific Revolutions". Third, I will look into the scientific examples that related to Kuhn's claims about paradigm changes as irrational. I considered the paramount importance of historical and well-known examples in science. This is as to why and how Kuhn has concluded and understood the stages and effects of paradigm changes are irrational in the collective thinking of the masses in the science world. To get the bottom of Kuhn's claims in the light of wider scientific changes, I will try to demonstrate relationships between Kuhn's specific notions and these scientific examples. To do this, I came up with the main question and two close objectives so that complete the article in a manner that the article focuses on deeper layers of Kuhn's claims how paradigm changes in science are irrational.

Keywords: *paradigm shift, irrationality, Kuhn, philosophy of science, paradigm*

1- Introduction

In order to understand the true extent of depth of his arguments, we need to examine Kuhn's claims and methods about the structure of science in the context of old and new scientific arguments. These claims state that science walks through paradigm changes, so Kuhn's claims have paramount importance in the science world in the first place. Within the framework of Kuhn's scientific claims, Kuhn is actually opposed to the opinion that science is objective and rational. Until the period of Kuhn, scientific methods and the information obtained by these methods were considered to be rational and objective information. We can show the structure of this period in three stages;

I- The creation and evaluation of the hypothesis should be independent of the scientist's individual opinions because opinions show irrational actions. Thus, the objectivity of scientific knowledge is provided.

[1] Correspondence e-mail: gokselyikmis@gmail.com

II- Scientific knowledge is only provided through experimental ways in science. So, irrational things are meaningless in the science world.

III- The character of science occurs with the cumulative method in scientific works.

On the other hand, Kuhn was against to these ideas. According to Kuhn, the socio-cultural environment and other psychological factors of scientists are directly effective in scientific works. These effects mean that irrationality. So, he rejects the objectivity and rationality of science. Besides that, he refuses cumulative methods in science. Instead of them, his arguments are based on paradigm changes in science. These paradigms meanwhile cannot be compared with each other, because each paradigm includes its own problems and answers. This is called as "incommensurability" by Kuhn. As a result, this article focuses on Kuhn's arguments on whether paradigm changes in science are irrational.

2- The Problem of Whether Kuhn's Philosophy Shows That Paradigm Shift in Science is Irrational

First of all, this is our main question in this article: What is human irrationality and implications for paradigm shift in science? In this context, I will try to describe what the effects of irrationality notion upon paradigm changes. Interlinked with this main question I developed two article objectives. Within the scope of this article; I explored Kuhn's own ideas, arguments and claims with reference to the main question and the objectives "a" and "b." In doing so, in a short summary, I will first describe the notion of irrationality and the link with paradigm shift.

Objective a) How could we detect (or find out) irrational characteristics as the paradigm reaches critical mass?

By concentrating on this objective, I will try to understand what the position of critical mass is within the stages as a paradigm function, and the way it gradually becomes non-functional. And while determining so, I will try to indicate whether if there is an irrational effect.

Objective b) How do we understand irrational elements, if any, in "loss of confidence" in the old science?

Via this objective, I will try to explore the notion of irrationality in the behaviours of scientists. I will also look into the reasons that lead to loss of confidence in the old science, and try to establish links between old science and the "critical point". I will make attempts to link the outcome with the research question.

With reference to the main question and article objective that I set, I will make an analysis. First, I will provide an answer to the objectives then I will try to answer "what is human irrationality and implications for a paradigm shift in science?" by considering the claims of Kuhn about the paradigm shift in science is irrational. Here is our first objective:

3- Objective A:

Under this heading, I am presenting the reasoning of paradigm changes in science, the formation process of critical mass phase, and irrationality effects on paradigms when changing by scientists as argues Kuhn.

I included two arguments below to highlight the stages as paradigm functions that gradually become non-functional in science.

According to Kuhn, we cannot accept that the development and the progress of scientific thought (or a theory) are uniform, because science contains lots of changes in its own, by Kuhn. Therefore, the stages of the scientific transitions can be called "normal science" and "revolutionary science" phases. Also a paradigm, while becoming non-functional, goes through these two stages in science as well. At this point, Kuhn mentioned an extra and ineffective phase before explaining normal and revolutionary sciences. It is known as "pre-paradigm", but Kuhn sees this as an infancy stage where each scientific theory begins in science. According to Kuhn, "*Normal science is work inspired by a striking achievement that provides a basis for further work (a paradigm in the narrow sense). Each scientific field starts out in a state of "pre-paradigm science."* (Godfrey-Smith, 2003: 79).

So, each scientific study likes a claim or an assumption that doesn't include a well-organized consensus in this stage. This period reflects that each scientist, who gathers knowledge at random from nature, has a different sound in their head about a branch of science. In order that the formation of normal science, the best and most consistent theory explaining is distinguished from the others, so a paradigm occurs. It must be stronger than its competitors to be accepted a theory as a paradigm. *"For Kuhn, a scientific field usually has only one paradigm guiding it at any particular time."* (Godfrey-Smith, 2003: 80). For example, mass conservation was a discussed issue in chemistry. Even many different theories were established by chemists, the principle of conservation of mass was expressed by Lavoisier, so Lavoisier's theory has become a paradigm in the field of chemistry. Even today, Lavoisier's theory has not lost its functionality, so it means that this theory was the strongest thought in mass conservation. Thus, it has already become the form of normal science in chemistry field.

When we talk about normal science, according to Kuhn, it is defined as follows*: "…'normal science' means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice."* (Kuhn, 1970: 10). During this stage, scientists work in the specific area that is defined by the paradigm. Each paradigm predetermines questions that can be asked and answers of them in its own scientific system. At this point, scientific studies in the normal science period are called "puzzle-solving" in Kuhn's definition of normal science. He says when describing "puzzle-solving" that; *"While this term suggests that normal science is not dramatic, its main purpose is to convey the idea that like someone doing a crossword puzzle… the puzzle-solver expects to have a reasonable chance of solving the puzzle, that his doing so will depend mainly on his own ability, and that the puzzle itself and its methods of solution will have a high degree of familiarity. A puzzle-solver is not entering completely uncharted territory. Because its puzzles and their solutions are familiar and relatively straightforward, normal science can expect to accumulate a growing stock of puzzle-solutions."* (Bird, 2011: 7).

That is why the task of the scientists is to solve the issues in the normal science - exactly like eliminating problems in a puzzle - in the accepted (agreed) theory in the context of the paradigm.

Having clarified what normal science is according to Kuhn, it is time to mention about paradigm changes. Until this time, the paradigm was functional. Although there are errors (or problems) in each scientific

study, these problems were solving as thought solving a puzzle by scientists. However, when it contains too many anomalies in its scientific structure, it begins to lose its functionality. At this point, it is inevitable to talk about the revolution in science.

"...a piece of equipment designed and constructed for the purpose of normal research fails to perform in the anticipated manner, revealing an anomaly that cannot, despite the repeated effort, be aligned with professional expectation. In these and other ways besides, normal science repeatedly goes astray. And when it does—when, that is, the profession can no longer evade anomalies that subvert the existing tradition of scientific practice—then begin the extraordinary investigations that lead the profession at last to a new set of commitments, a new basis for the practice of science." (Kuhn, 1970: 5-6).

As we see, anomalies lead to revolution. Therefore, the build-up of lots of anomalies in the paradigm reaches "critical mass". Scientific revolutions are based on a great revision -sometimes completely abandon the old scientific studies- In this case, the paradigm is called "the old paradigm". As we know, Kuhn states that science is based on one paradigm called "incommensurable", and this science can be developed under a different paradigm when the old paradigm reaches "critical mass". Meanwhile, this is not only one way to reach revolution. Lose confidence to the old paradigm is another reason for the revolution in science, but I will try to explain this in Objective B.

If the existing paradigm is beaten by a rival paradigm, the scientific crisis is followed by a scientific revolution. The existing paradigm is no longer functional. For example, until the emergence of Copernicus's heliocentric system, Ptolemy's geocentric system has been the paradigm. Here in the example, "critical mass" is in a position of only one or two little steps before to be discussed loudly about the anomalies –in other words, the errors of Ptolemy's geocentric system- of the existing paradigm by scientists. As a result, the position of "critical mass" has a crucial position within the stages as a paradigm function, and the way it gradually becomes non-functional. Kuhn describes irrational effect when it occurs during the change paradigm as follows;

"The man who embraces a new paradigm at an early stage must often do so in defiance of the evidence provided by problem-solving. He must, that is, have faith that the new paradigm will succeed with the many large problems that confront it, knowing only that the older paradigm has failed with a few. A decision of that kind can only be made on faith. That is one of the reasons why prior crisis proves so important. Scientists who have not experienced it will seldom renounce the hard evidence of problem-solving to follow what may easily prove and will be widely regarded as a will-o'-the-wisp. But crisis alone is not enough. There must also be a basis, though it need be neither rational nor ultimately correct, for faith in the particular candidate chosen." (Kuhn, 1970: 158).

As it is seen, if scientific problems become difficult to be solved by any means within the existing paradigm just as the example of Ptolemy's geocentric system, scientists reveal a new paradigm candidate. This issue of nominating is the same as the emergence of Copernicus's heliocentric system. However, this nomination of a new paradigm is based on irrational effects. In other words, this irrationality arises in the step of paradigm change by scientists.

4- Objective B:

Under this heading, I am presenting how and when irrational effects reveal in the behaviours of scientists while passing old science to the "critical point." Besides that, I will explain the relationship between loss of confidence in science and scientists' attitudes with irrational effect by using some actual examples.

According to Kuhn, as we saw in Objective A; paradigm changes occurs when anomalies grow and overcome the solutions of scientists. After this case, it begins a new period called "crisis science". The position of this period reflects the loss of confidence in the old paradigm. At this point, loss of confidence occurs through scientists' attitude toward the old paradigm. In other words, scientists must choose which side to support when a paradigm (or a normal science) reaches the critical point. This critical point includes the dilemma about the old paradigm should be changed, or modified up. In this regard, it will be decided by the scientists. This decision is formed through the effect of irrationality. To explain this effect with an example; if a scientist community base their scientific thesis on the old paradigm, they will definitely oppose the new paradigm at first. After the occurrence of the new paradigm, the scientific community who accept to the old paradigm want to continue its functionality. In this case, the request is not a rational product. The source of these requests is based on irrational things such as the psychological and sociological circumstances of scientists.

According to Kuhn, the scientific development process occurs through a specific transition from the one paradigm (the old paradigm) to another paradigm (the new paradigm). This specific transition refers to irrationality of scientists. However, these irrational effects do not happen immediately in science. So, we can establish links between old science (old paradigm) and the "critical point" (the point of paradigm change) by using irrational effects.

For example; the paradigm shift from Newtonian to Einsteinian physics did not occur in one day. Or, a scientist did not say "I want to change Newtonian physics completely." Of course this change does not happen with a single scientist's efforts. However, it does not mean that a paradigm will never change. For example; when Galileo says; *"... to abandon completely... opinion that the sun stands still at the center of the world and the earth moves, and henceforth not to hold, teach, or defend it in any way whatever, either orally or in writing."* (Finocchiaro, 2014: 102), he probably knew that emergence of Copernicus's heliocentric system will overcome the Ptolemy's geocentric system. Although Inquisition's injunction against him, he continued to work about Copernicus's heliocentric system. So, this is the biggest proof that he knows the paradigm change will occur sooner or later. This faith of Galileo may reflect the irrational effects in scientific studies. Some of these attempts lead to gather many new scientists -in other words, new supporters- around the new paradigm by scientists. Before proceeding on this issue, I need to mention about paradigm changes and the structure of science are interrelated in Kuhn's arguments. According to Kuhn, science is not in a cumulative structure. In this case, neither old paradigm nor the new paradigm reflects accumulation and progress in scientific situations. Kuhn states his views on science by saying; *"The transition from a paradigm in crisis to a new one from which a new tradition of normal science can emerge is far from a cumulative process… Rather it is a reconstruction of the field from new fundamentals, a reconstruction that changes some of the field's most elementary theoretical generalizations as well as many of its paradigm methods and applications. During the transition period there will be a large but never complete overlap between the problems that*

can be solved by the old and by the new paradigm. But there will also be a decisive difference in the modes of solution. When the transition is complete, the profession will have changed its view of the field, its methods, and its goals." (Kuhn, 1970: 84-85).

In this context, cumulative and progressive structures reflect rationality in scientific developments. However, Kuhn argues that irrationality should determine the fate of scientific development such as choosing old or new paradigm, or loss of confidence in the old paradigm. Therefore, the period of "crisis science" continues with years of debate between supporters of old and new. In fact, scientists show that science does not have cumulative structure when debating old and new paradigms under the influence of irrationality. Because no one can give up his scientific experiments easily. Some reasons could be mentioned as follows; sometimes scientists may not resist their own egos. At the same time, they can deny that the old paradigm is wrong. Perhaps they can feel under the pressures of the scientific authority. These scientists who support the old paradigm have already tested it until periods of "critical mass" and "crisis science" maybe two, maybe twenty times. However, they could not find a big anomaly that will definitely cause a paradigm change. Even if they found it, they continued this paradigm by conceding them. In these cases, to talk about the paradigm shift is a critical event in science. About this idea of paradigm change, Kuhn calls this idea as "revolution". When we think about a revolution in a non-cumulative scientific concept, revolution means to rebuild science by using a new paradigm.

I said that I will examine the irrationality and paradigm change issues in the context of science at the beginning of this article. Therefore, I want to show all of these statements in an interesting and actual example by using science as my reference point;

Today, we can accept that scientific studies include many areas about our social life and hobbies, such as sport branches like football. These scientific studies such as computer analysis, statistics, and scientific data have already been located in sports. Many coaches, who want to be successful in sports competitions, are using these scientific supports to get maximum performance from players, to arrange useful training methods, and to create effective game formations. Through these training and tactics created in accordance with scientific research, teams can more easily compete with other teams in the tournament.

I am considering a football team benefiting from the scientific studies. This team, it will be located in the following sentence under the name of Paradigm FC. The manager of Paradigm FC is using these scientific methods to create an effective tactic, for example, "4-4-2". Moreover, he is taking into account some scientific data about the performances of the players. He has faith that his tactic will be successful. He had also been successful in the previous team and won championships thanks to the scientific assistance. In this case, this "4-4-2" tactics is our "old (or existing) paradigm", and "normal science" is until the beginning of the new football season. Also, the manager's confidence towards his tactic is called "irrational effect." Paradigm FC won seven of the first ten games, and it had a draw in three matches. Thereby, the confidence of the manager is gradually increasing. In fact, Paradigm FC won four of the first seven games with last-minute goals and won two matches with a penalty goal. By the way, the most important player was injured during the penalty position, but the backup player could not show the desired performance in this tactic. At this point, many anomalies increasingly reach the build-up. Although Paradigm FC is the leader before the eleventh match, the tactics is not successful as the manager thought. So, the stage of "critical mass" occurs. At this point, the irrational effect means that

Paradigm FC will definitely win the eleventh match. In the rest of the story, Paradigm FC loses the eleventh match, and then they lost two matches more. Therefore, fans and media argue that the manager should change "4-4-2" (old paradigm) and use "4-3-3" (new paradigm) before the derby match. At this point, the tactics of Paradigm FC is in the stage of "crisis science", because the majority of fans and the media have already lost of confidence. When Paradigm FC lost the derby match by using "4-4-2" formation, it means that it is time to paradigm change. However, a paradigm change is too difficult for the manager, because he may still think of the previous triumphs by using "4-4-2".

By referring to all these descriptions, we can mention the importance of behaviours such as every emotion and situation except rational things. At the same time, these references can help us to understand irrational elements in "loss of confidence" in the old science.

5- Conclusions

Within the limits of this article, I did try to explore how and why Kuhn has claimed paradigm change in science is irrational.

We understand now that in the philosophy of science, the claim of why Kuhn says science includes paradigm changes, and they are processed under irrational effects by scientists, perhaps one of the most discussed philosophical issues throughout the scientific academia.

For some scientific claims after Kuhn, this well-known scientific claim is right. When we analyse these scientific changes, such as a paradigm shift from Newton to Einstein, it might seem like science doesn't include a cumulative structure. Or, science is not rational. As a result, we might accept that a new paradigm always brings the idea of change rather than the idea of development. Furthermore, scientific works because it is subjective, we might accept the irrational effects in science. Science-based on whether cumulative progress or paradigm changes, the arguments of Kuhn's bring a new and unusual perspective to the science world.

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