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Why Paradigms Mean Science is Irrational

Scientist and philosopher Thomas Kuhn's idea of paradigms revolutionized philosophy of science because of the many implications it has. Specifically, many philosophers have interpreted it to mean that science is irrational. While Kuhn may not have intended this, certain aspects of his ideas do lead to such an implication. In this paper I will first describe what a paradigm is, including normal science and why it is important to irrationality in science, then I will explain which implications of paradigms support the argument that science must be irrational; namely theory-laden observation and incommensurability in scientific revolutions, including Kuhn's five criteria for comparing paradigms. I will then demonstrate this by looking at an example of a paradigm shift that Kuhn himself studied, the Copernican Revolution.

Although Thomas Kuhn never explicitly stated what he means by the term "paradigm", it is understood to be frame of mind that scientists operate under. Paradigms have two main aspects, the disciplinary matrix and the exemplar. The disciplinary matrix is the information that all scientists are taught as they enter the scientific profession. This includes scientific theories held to be true in the paradigm, as well as knowledge about the technology that is important for science in a particular paradigm. The disciplinary matrix also teaches scientists how to use this technology, and how to interpret the results they get from observations made using this technology. The exemplar is the knowledge about how to perform science, including the problems that scientists are taught how to solve as they are learning how to become scientists.

Both the disciplinary matrix and the exemplar contribute to the theory-ladenness of observation in paradigms, something that I will later argue makes science irrational.

A paradigm includes the knowledge that scientists take as fact and build off of in their work, which Kuhn calls normal science. In normal science, scientists build off of previous theories which they hold to be true because they are a part of the disciplinary matrix of the paradigm. This means scientists gather new observations and add them to the theories already in the paradigm. When a new observation is made and it can't be easily fit into the paradigm, the scientist has to solve a puzzle to make it fit. According to Kuhn, a large part of normal science is this puzzle solving. The techniques for solving these puzzles are also provided by the paradigm, as part of the exemplar. For example, in the current paradigm all scientists operate under the pre-existing belief that atoms are the building blocks of matter. All the normal science that is currently happening assumes this to be true and builds off of it, and all new findings discovered by scientists are assimilated into this paradigm. If a new finding can't be easily assimilated into the paradigm the scientist has to solve the puzzle, using the techniques provided by the exemplar of the paradigm. Another important aspect of normal science is that scientists do not question the paradigm. Scientists in a paradigm are extremely unlikely to doubt parts of the paradigm, and especially not the paradigm as a whole. The idea of paradigms dominating science by influencing normal science with the disciplinary matrix and the exemplar has many implications, several of which lead to the conclusion that science is irrational.

One such implication is the idea of theory-laden observation, which states that because scientists operate under a paradigm, it is impossible for them to observe objectively. Kuhn, among other philosophers, believes that we cannot observe something without interpreting what we are seeing, and our interpretation will be based on the paradigm we are in. In other words, one's observation of something is necessarily affected by our prior knowledge of that thing, which is affected by the paradigm we are in. Theory-laden observation makes science irrational because if a scientist holds any preconceived ideas about what they are observing, which they have to due to being in a paradigm and learning from the disciplinary matrix, it will be impossible to observe completely objectively; they will always be affected by bias. The idea of the exemplar also creates theory-laden observation by affecting what scientists observe in the first place, because the exemplar teaches scientists how to solve problems which includes what to observe and what data to gather.

As science moves into studying more and more complex phenomena the theory-ladenness of observation only increases. In the past science was mostly concerned with things that were observable without much interpretation. For example, it is easy to observe animals and plants without much theorizing as to what one is observing. However, as science advances scientists study things that are impossible to observe without interpreting what they are seeing. When working with unobservables such as atoms, scientists first need to believe that their tools for "observing" these things are accurate, and second that there interpretations of what they are observing are indeed accurate. Both of these are based off of the background knowledge from their paradigm, which means they are affected by bias. When a scientists is using a highly advanced microscope to "observe" atoms, they are not directly observing atoms at all. The exemplar tells scientists how to use the microscope, and the disciplinary matrix tells scientists how to interpret what they are observing. Because they cannot directly observe atoms, their interpretation is completely based off of their paradigm, meaning it is impossible to objectively observe something unobservable.

Theory-laden observation attacks the heart of science, the scientific method. The scientific method relies on observation for scientists to form theories, so if observation is not objective, the theories that come from observation will not be objective either. Using the example of our current paradigm, if a scientist believes in atoms, when observing a new phenomena they will automatically relate it to atoms. In many cases, even if a scientist observes something that would contradict the foundational knowledge provided by the paradigm, they will just ignore it passing it off as an anomaly. Of course, if too many of these anomalies build up a paradigm shift will occur. This paradigm shift is another source of irrationality in science due to incommensurability.

When too many anomalies build up, what Kuhn calls a crisis will occur, which can lead to a paradigm shift. A crisis is when scientists performing normal science are not able to solve the puzzles presented by anomalies gathered from observation. If there are enough unsolved anomalies, a paradigm shift can occur. This is when the current paradigm is replaced by a newer paradigm which is not affected by the anomalies of the original paradigm and even attempts to solve them. Kuhn believes paradigm shifts are a sort of gestalt shift. This means that when your paradigm changes, your entire perception of what you are observing changes. This is important because it leads to incommensurability.

Paradigm shifts in themselves would not lead to irrationality, assuming we had a way to prove that the new paradigm was better than the old one. However, because of incommensurability, this is impossible. According to Kuhn, it is impossible to objectively compare two competing paradigms: this idea is called incommensurability. Because different paradigms often take very different things to count as evidence, it would be impossible to rationally determine which paradigm has more merit. Theory-laden observation also supports the idea of incommensurability because when a scientist observes something they will automatically relate it to their own paradigm, it will be impossible for them to see the other paradigm's point of view. In fact, Kuhn stated that people living in different paradigms were living in completely different worlds. Also, if observation was not theory-laden, objective observation would be a valid way to determine which paradigm is better. However, due to theory-laden observation, this is impossible. Kuhn argues because of incommensurability, when a paradigm shift occurs the supposedly better paradigm is not chosen by any objective standards but often chosen due to social and historical context. This means that scientific progress, and therefore science itself, is subjective and irrational.

In his paper *Objectivity, Value Judgement, and Theory Choice*, Kuhn gives more reasons similar to incommensurability as to why one cannot simply compare paradigms to determine which one is better. Kuhn admits that there are five criteria that in theory would allow scientists to choose one paradigm over another. They are: accuracy, does the theory agree with data; consistency, is the theory internally consistent and consistent with other accepted theories; scope, does the theory explain a wide range of phenomena; simplicity, does the theory explain phenomena as simply as possible; and fruitfulness, does the theory predict new phenomena and allow scientists to research those new phenomena. Kuhn agrees that these could form a basis for rationally choosing a new paradigm in theory. However, he argues that it is impossible to objectively apply these criteria in practice for two reasons. First of all, the criteria are imprecise.

Kuhn argues that different people, when comparing the same paradigms with the same criteria, can still come to different conclusions. For example, when comparing Copernicus' and Ptolemy's ideas about astronomy, many come to the conclusion that Copernicus had the more simple theory. However, in terms of the actual math and calculations involved, both theories were equally complex. The second reason Kuhn gives as to why it is impossible to objectively apply the five criteria is because the criteria often come into conflict with each other. For example, one theory might be simpler while the other is more consistent with other accepted theories. In conclusion, what Kuhn is arguing is that the five criteria for supposedly choosing a better paradigm in the event of a paradigm shift are not actually rules for choosing the better paradigm but values, and that they cannot be applied objectively. This relates to incommensurability because they both demonstrate why paradigm shifts lead to irrationality due to the inability to objectively compare them.

An example of seeming irrationality in science caused by paradigms is the paradigm shift that occurred in the 16th century, the Copernican Revolution. From our current perspective the Copernican Revolution seems completely rational, after all Copernicus and other geocentrists were correct. However, we only believe them to be correct because our current paradigm tells us they were correct, and we have much more data about the solar system than they did. In fact, there were many reasons to believe heliocentrism over geocentrism. For example, astronomers could not observe parallax among the stars, which would support heliocentrism. Also, the "tower argument", which asks the question if the Earth is spinning and you drop a rock from a tall tower, why does the rock not move relative to the tower, seems to directly reject geocentrism. Clearly, at the time the Copernican Revolution was irrational, as there was no way to objectively say why geocentrism should be chosen over heliocentrism. This is due to theory-laden observation and incommensurability.

An example of theory-laden observation in the Copernican Revolution is the moons of Jupiter. When Galileo looked at Jupiter through a telescope he was able to see moons orbiting the planet. However, heliocentrists did not believe that Jupiter could have moons so they claimed that there must be a problem with the telescope. This is because under heliocentrism everything revolves around the Earth, so it would be impossible for another planet to have moons. Clearly, pre-existing beliefs held by heliocentrists, supplied by the disciplinary matrix of their paradigm, made it impossible for them to observe the same phenomena as Galileo, making it impossible for the two sides to rationally agree on which paradigm is correct. Also, heliocentrists never learned about telescopes because it was not a part of their disciplinary matrix or exemplar, leading to their distrust of the device.

The Copernican Revolution is also an example of incommensurability. Each paradigm had different reasons for supporting it, and it was impossible to rationally compare these reasons. For example, heliocentrism was backed by the Church as well as Aristotelian physics. On the other hand, the mathematical model employed by geocentrism was much simpler than that of heliocentrism. Because what counts as evidence for a theory depends on the paradigm, there is no higher standard that could compare these two arguments to determine which one is more valid. Therefore, which one becomes the accepted paradigm is not chosen by any objective means but by other factors, including the historical and social context surrounding the paradigm shift. This is also an example of Kuhn's five criteria not being able to choose a new paradigm. Heliocentrism fulfilled the criteria of consistency because it was consistent with the Church and

Aristotelian physics, while geocentrism fulfilled the criteria of simplicity because the model was more simple, even if the necessary calculations were not. Clearly, when a situation like this arises comparing the paradigms with the five criteria is not sufficient for objectively determining which paradigm is better.

In conclusions, if we take Kuhn's idea of paradigms to be accurate, this means science must be irrational. This is because theory-laden observation and incommensurability, two fundamental aspects of paradigms, lead to subjectivity. Because scientists are affected by theory-laden observation and because paradigm shifts are affected by incommensurability, it cannot be said that science is objective.

Works Cited

Kuhn, Thomas. *Objectivity, Value Judgement, and Theory Choice*. (From supplementary materials)