The Structure of Scientific Revolutions

Normal Science:

Normal science, identified and elaborated on by Thomas Samuel Kuhn in The Structure of Scientific Revolutions, is the regular work of scientists theorizing, observing, and experimenting within a settled paradigm or explanatory framework. Regarding science as puzzle-solving, Kuhn explained normal science as slowly accumulating detail in accord with established broad theory, without questioning or challenging the underlying assumptions of that theory.

Kuhn stressed that historically, the route to normal science could be a difficult one. Prior to the formation of a shared paradigm or research consensus, would-be scientists were reduced to the accumulation of random facts and unverified observations, in the manner recorded by Pliny the Elder or Francis Bacon, while simultaneously beginning the foundations of their field from scratch through a plethora of competing theories.

Arguably at least the social sciences remain at such a pre-paradigmatic level today.

Kuhn considered that the bulk of scientific work was that done by the 'normal' scientist, as they engaged with the threefold tasks of articulating the paradigm, precisely evaluating key paradigmatic facts, and testing those new points at which the theoretical paradigm is open to empirical appraisal.

Paradigms are central to Kuhn's conception of normal science. Scientists derive rules from paradigms, which also guide research by providing a framework for action that encompasses all the values, techniques, and theories shared by the members of a scientific community. Paradigms gain recognition from more successfully solving acute problems than their competitors. Normal science aims to improve the match between a paradigm's predictions and the facts of interest to a paradigm. It does not aim to discover new phenomena.

According to Kuhn, normal science encompasses three classes of scientific problems. The first class of scientific problems is the determination of significant fact, such as the position and magnitude of stars in different galaxies. When astronomers use special telescopes to verify Copernican predictions, they engage the second class: the matching of facts with theory. Improving the value of the gravitational constant is an example of articulating a theory, which is the third class of scientific problems.

The normal scientist presumes that all values, techniques, and theories falling within the expectations of the prevailing paradigm are accurate. Anomalies represent challenges to be puzzled out and solved within the prevailing paradigm. Only if an anomaly or series of anomalies resists successful deciphering long enough and for enough members of the scientific community will the paradigm itself gradually come under challenge during what Kuhn deems a crisis of normal science.If the paradigm is unsalvageable, it will be subjected to a paradigm shift.

Kuhn lays out the progression of normal science that culminates in scientific discovery at the time of a paradigm shift: first, one must become aware of an anomaly in nature that the prevailing paradigm cannot explain. Then, one must conduct an extended exploration of this anomaly. The crisis only ends when one discards the old paradigm and successfully maps the original anomaly onto a new paradigm. The scientific community embraces a new set of expectations and theories that govern the work of normal science. Kuhn calls such discoveries scientific revolutions. Successive paradigms replace each other and are necessarily incompatible with each other.

In this way however, according to Kuhn, normal science possesses a built-in mechanism that ensures the relaxation of the restrictions that previously bound research, whenever the paradigm from which they derive ceases to function effectively. Kuhn's framework restricts the permissibility of paradigm falsification to moments of scientific discovery.

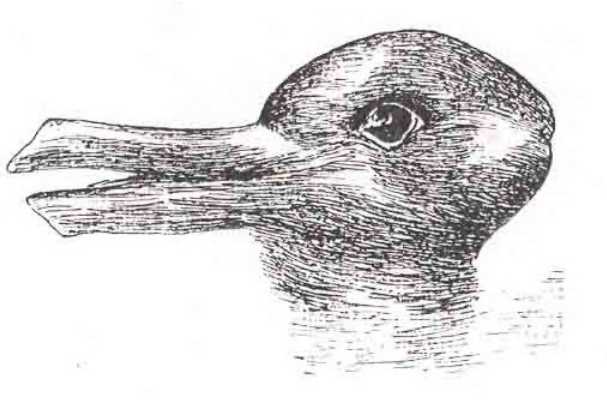
A paradigm shift, a concept identified by the American physicist and philosopher Thomas Kuhn, is a fundamental change in the basic concepts and experimental practices of a scientific discipline. Kuhn presented his notion of a paradigm shift in his influential book The Structure of Scientific Revolutions (1962).

Kuhn contrasts paradigm shifts, which characterize a scientific revolution, to the activity of normal science, which he describes as scientific work done within a prevailing framework or paradigm. Paradigm shifts arise when the dominant paradigm under which normal science operates is rendered incompatible with new phenomena, facilitating the adoption of a new theory or paradigm.

As one commentator summarizes:

Kuhn acknowledges having used the term "paradigm" in two different meanings. In the first one, "paradigm" designates what the members of a certain scientific community have in common, that is to say, the whole of techniques, patents and values shared by the members of the community. In the second sense, the paradigm is a single element of a whole, say for instance Newton's Principia, which, acting as a common model or an example... stands for the explicit rules and thus defines a coherent tradition of investigation. Thus the question is for Kuhn to investigate by means of the paradigm what makes possible the constitution of what he calls "normal science". That is to say, the science which can decide if a certain problem will be considered scientific or not. Normal science does not mean at all a science guided by a coherent system of rules, on the contrary, the rules can be derived from the paradigms, but the paradigms can guide the investigation also in the absence of rules. This is precisely the second meaning of the term "paradigm", which Kuhn considered the most new and profound, though it is in truth the oldest.

Even though Kuhn restricted the use of the term to the natural sciences, the concept of a paradigm shift has also been used in numerous non-scientific contexts to describe a profound change in a fundamental model or perception of events.



Kuhn used the duck-rabbit optical illusion, made famous by Wittgenstein, to demonstrate the way in which a paradigm shift could cause one to see the same information in an entirely different way.