Kuhnian Scientific Method

According to philosopher Thomas Kuhn, scientific practice is fundamentally misrepresented by the textbook concept of the scientific method, which he terms “the methodological stereotype of falsification by direct comparison with nature” (77). In this paper, I will describe this stereotype of falsification, explain how Kuhn thinks it misrepresents science both in how science deals with anomalies and in how it rejects theories, and consider the ways his alternative view characterizes theory choice.

The methodological stereotype of falsification that Kuhn refers to is a common, textbook view of science and will seem familiar, even intuitive. In this view, science works by testing theories against the natural world, discovering objective information about material reality. Scientists propose a hypothesis to explain some phenomena; then they empirically test their predictions. If their predictions are not observed, the hypothesis is shown to be false and is discarded. Hypotheses that have been falsified are not considered scientific because they do not accord with observation. If however the prediction is observed, scientists test the hypothesis further. If it fails one or more of those tests, the hypothesis is falsified and the process begins again. Some hypotheses fail, but others prove to accord with nature and become widely accepted as theory. In this way, science is cumulative and additive, growing with each new discovery.

Thomas Kuhn considers this view to be an inaccurate representation of what science is and how it works. In order to understand why, we shall need some definitions. According to Kuhn, mature science is directed by what he calls a paradigm, that is, a concrete scientific achievement that becomes the model for how to do science while leaving behind questions to guide scientific inquiry and research (11). A paradigm is a specific way of seeing the world that answers fundamental questions about nature, the building blocks of matter, the ways in which elements combine, etc. Scientists agree on a single paradigm and as a result can pursue detailed and specific research under that paradigm, research that Kuhn terms normal science. Normal science research follows a paradigm and relates it to empirical facts; the paradigm is used as a guide as scientists try to fit fact with theory – an activity that Kuhn calls puzzle-solving.

In normal science, the existence of a phenomenon inconsistent with accepted theory does not falsify that theory. Kuhn terms such phenomena anomalies – simply those things that do not fit with scientific fact; they are unexpected or contrary to expectation. Notice how this differs from the stereotypical understanding: in the textbook falsification view, the recognition of such an anomaly is the simultaneous rejection of the theory it violates. But according to Kuhn, this is simply not how science proceeds; there are always discrepancies in a theory, but in fact this is what allows for the puzzle-solving of normal science and the development of theory. Normal science is “an attempt to force nature unto the preformed…box that the paradigm supplies” (24). Once a paradigm has been established, there is no research outside the paradigm; to reject it is to reject science (79). Scientists will do all that they can to devise modifications and articulations of their theory that resolve the anomaly (78). The scientist takes theory for granted in normal science; as such anomalies are not taken to falsify a theory.
While anomalies themselves will not falsify a theory, they can make way for a crisis in normal science that may eventually lead to the invention of a new theory. The persistence and shared awareness of a significant anomaly can lead to a crisis. In times of crisis, the rules of the paradigm are relaxed and the blurring of the paradigm occurs, such that scientists are able to articulate the theory in different ways in an effort to resolve the problem (84). During this time, the paradigm still exists, but scientists are not at all in agreement about what it actually means. Not all anomalies lead to crises, and even those that do may not lead to a paradigm shift. Some problems may be resolved under the existing paradigm, and normal science will resume. Others resist explanation and are put away for later when other tools are available. Still other problems lead to the invention of new theories to make sense of the problem under a new paradigm.

The invention of a new theory is essential to the rejection of the old. Contrary to the falsification method, theories are not rejected unless accompanied by the adoption of a new theory. Without a paradigm to explain the crisis-induced problem and guide normal research, science cannot proceed; research would be entirely random, and there would be no guide for discerning which facts are relevant and related. The shift in paradigm takes place over time, not in an instant, as scientists continue research in both paradigms and gradually come to consensus of one over the other.

This process of choosing which theory to adopt is not an objective judgment of the theory against nature, as falsification suggests. Instead, Kuhn says that scientists choose which paradigm to adopt by comparing both paradigms “with nature and with each other,” and that these comparisons cannot be made on the basis of pure logic (78). First, the comparison of a theory with nature does not necessarily lead to an indisputable, rational conclusion. Data and evidence are observed, gathered, and interpreted in light of the paradigm. Thus the decision is not predicated on objective and universal criteria. Instead, each scientist bases her decision on standards that exist as subjective values rather than as rules, standards that are up for dispute in the scientific community. As such logic and evidence alone are not enough. Second, the decision is partly about which theory will serve the needs of the scientific community better at that time - which theory has greater explanatory power for the problem at hand - even though it may leave previously understood phenomena unaccounted for. This allows for puzzle solving in normal science conducted under the new paradigm. While this view may seem blasphemous to the objective picture of methodological falsification, it allows for something that the falsification stereotype does not: scientists can resist or accept a new paradigm without being considered unscientific or irrational. There is no one rational decision. Once a paradigm is rejected, an entire body of research is renounced; the notion of science as additive ignores this fact. If Kuhn is right, our understanding of scientific progress must be recast from progressing towards more and more objective truth to progressing only towards the convenience and utility of theory for its practitioners.

In conclusion, the method of falsification misrepresents the scientific enterprise as additive and objective, able to work without the guidance of a paradigm. In reality, counterinstances to a theory are not falsifying unless such anomalies become crises and lead to the invention of a new theory to solve the problem. The evaluation of theories is not just an objective appeal to the evidence, but a comparison between two theories and their conflicting ways of seeing the world that ultimately allows for a new paradigm to explain and direct research.