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A Review of Lakatos's Rational Progress Theory on Rationality of Science

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Abstract: *The rationality of science is debated by contemporary and recent philosophers, and the debate turned vibrant in Popper, Kuhn and Feyerabend. Lakatos's rational progress theory adopts the best parts of Pooper's hypo-deductive method and Kuhn's revolutionary approaches to provide a comprehensive framework of justification of science. By designing negative and positive heuristics for scientific rationality, he refutes Humean scepticism that proven knowledge is an untenable ideal. The paper objects "anything goes" principle concerning scientific progress and argues that Lakatos's framework is a better approach to scientific research and progress, and demonstrates the justification of scientific theories if triangulation, internal justification, and external verification are considered integral parts of scientific rationality.*

The rationality of science, progress and methodological debate involving scientific knowledge are crucial problems in the philosophy of science. In this regard, various approaches have been proposed at different times. For example, induction is considered a valid scientific method and provides rational grounds for believing scientific theories. The debate has evolved throughout history. In this paper, presenting a historical introduction, I critically examine and argue for Lakatos's rationality of science and its progress with additional conditions, such as "triangulation" (Babbie, 2020)**, to justify sciences.

Historical Introduction of the Rationality of Science Debate

In *The Problem of Philosophy*, Bertrand Russell (1998) reduced the rationality of science to custom and habit, as did Hume (1987) in *An Enquiry Concerning Human Understanding* in the modern period. Later, the logical positivists attempted to design a demarcation criterion named *verifiability* by proposing a direct verification principle to outlaw metaphysics and similar ideas to affirm the rationality of science. Later, an indirect verification principle was proposed by Ayer (1946), considering the limitations of applying a direct verification principle. In this context, Karl Popper (1972) introduced an alternative proposal/principle: fallibility.

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** A useful method applied in social sciences similar to rationality demonstrated on agreement among scientists.

In contrast, Thomas Kuhn (1970) added a different principle- social justification for the rationality of science. Popper's logic of scientific discovery and Kuhn's psychology of research theory draw much more attention to the methodological debate on scientific rationality than logical positivists. Imre Lakatos (1965) tried to resolve scientific rationality issues by elucidating Kuhn and Popper's crucial arguments and extending the meaning of scientific progress further in detail to understand them (Kuhn and Popper). For him, both Popper and Kuhn have made substantial progress in the philosophy of science to save sciences from sceptics. However, some limitations remain in their understanding and methodology of the scientific research programs to be illuminated. Lakatos was reluctant to admit Kuhn's theory of scientific rationality. Lakatos argued as it seems that Kuhn interpreted scientific rationality as a type of religious conversion that depends on the approval of the scientific communities. Nevertheless, in Popper and Kuhn's arguments, he has found some crucial features of scientific research programs dedicated to demonstrating the rationality of science.

Presenting a critical discussion of Popper and Kuhn, Lakatos tells us about the negative and positive heuristics for scientific progress and justification. Paul Feyerabend (1975) also investigated Lakatos's scientific research program's methodology and proposed counter-induction for the methodological solution, and *anything goes* as principles of scientific rationality. Adopting a critical approach to the philosophical investigation of sciences, Lakatos attempted to demonstrate justification for believing scientific theories as *rational per excellence* (Newton-Smith, 2002). The question is: whether Lakatos's theory of justification of science can resolve the rationality debate[***]. In this following section, I examined Lakatos's arguments and argued that his critical discussion illuminated the problem of justification of science and scientific theories. Although the puzzle is unresolved, Lakatos has made the royal road of science further stronger and more precise through his powerful arguments and by defeating sceptical arguments against the progress of sciences.

According to Lakatos, there is a tendency among some philosophers that evidence cannot prove a theory but disprove it. Lakatos labelled this type of approach as dogmatic falsificationism. According to falsificationism, a scientist invents an idea and discovers its rationality by testing the hypothesis. In this process, empirical evidence plays a vital role. Admitting the role of empirical evidence, Lakatos has placed himself in a position analogous to externalism[****]. However, Lakatos rejects dogmatic falsificationism for the rationality of science because this

*** Larry Laudan in his book Progress and Its Problems-Towards a Theory of Scientific Growth, published in 1977 has demonstrated different meanings of rationality concerning acceptance of science and progress. However, I will not here discuss those issues to develop my paper.

**** Externalism as a set of theories of justification generally argue that without external impute, for example, data gathered from the experience of external world nothing can be justified.

method of justification "rests on two false assumptions and to a narrow criterion of demarcation between science and non-science (Lakatos,1970, p.97)." For Lakatos, psychology testifies against the first and logic against the second assumption. And methodological judgement testifies against the demarcation criterion (ibid, p. 98). Lakatos further critically examined Popper's methodological falsificationism as he highlighted its merits and demerits in detail. For him, methodological falsificationism has a sophisticated version, which is different from naïve falsificationism. These two methods differ in acceptance rules and elimination of scientific theories. For Lakatos, if a theory is experimentally falsifiable, then the theory is scientific and acceptable.

Lakatos, like Popper, argued that a theory is acceptable or scientific if it has "corroborated excess empirical content over its predecessors (ibid, p.116)." That is, it leads to the discovery of novel facts. Lakatos's this type of argument has resemblances with probabilism. According to Lakatos, sophisticated methodological falsificationists (SMF) offer a new standard of honesty. The SMF admit what is proven and what is unproven. Neojustificationists, conversely, accord with the demand that probability based on empirical evidence can be the determinant of the justification of a hypothesis. The naïve falsificationists demand to test for falsifiable hypotheses and reject the unfalsifiable and falsified hypotheses. The SMF suggests looking at different perspectives to put forward new theories with anticipated novel facts and rejects theories that a more powerful one has suppressed. The SMF draws from different approaches, such as empiricism, Kantian activism, and the conventionalism methodology. Lakatos adds this to Popper's idea of excess corroboration (Lakatos, 1970, pp.122-123).

If learning is a prerequisite for justification, meaning meeting requirements to be considered scientific knowledge, then the inductivist's demand for evidence confirming the hypothesis is reasonable. In this regard, from a refuted theory, one learns nothing, according to Lakatos. For dogmatic falsificationists, learning about a theory is about whether it is refuted or not; about confirmed theory, one does not learn anything, about refuted theory, one learns that it is disproved. For Lakatos, the SMF claim learning about a theory means learning anticipated novel facts. Lakatos advocated for the only relevant evidence that is evidence anticipated by the theory, i.e., "*empiricalness (or scientific character) and theoretical progress are inseparably connected* (Lakatos, 1970, p.123)."

Lakatos was interested in developing the methodology of scientific discovery (also the method of justification of metaphysics); our learning program can be continued, and justification of scientific theories and hypotheses can be obtained. In some respect, he was convinced by Popper's theory of conjectures and refutations and utilized some crucial aspects of Kuhn's philosophy of science. Thus, he attempted to devise methodological rules (negative and positive heuristics), drawing and blending Popper's best parts and Kuhn's methodological innovation. Lakatos's rules tell us what path to avoid in research, and some rules tell us what way to pursue. The first part is called negative heuristics, and the second is named positive. For Lakatos, the negative heuristics "specify the 'hardcore' of the program, which is 'irrefutable' by methodological decisions of its protagonists (Lakatos, 1970, p.135)."

On the other hand, "the positive heuristics consists of a partially articulated set of suggestions or hints on how to change the 'refutable variants' of the research program, how to modify, sophisticate, the refutable protective belt (Lakatos, 1970, p.135)." For Lakatos, "the positive heuristics is thus in general, more flexible than negative heuristics (Lakatos, 1970, p.137)." For Lakatos, in a research program, the creative shift in positive heuristics may save it from degenerating shift and push forward innovation research. According to Lakatos, every scientific research program has a hardcore. The negative heuristics tell us to avoid employing *modus tollen* (the logical rule p implies q, not q, therefore p.). Instead, we must employ our intellectual capacity to articulate auxiliary hypotheses that can form a *protective belt* around this hardcore. Then the modus tollen will be employed against this auxiliary hypothesis to defend the hardcore. The protective belt may get adjusted, readjusted, or wholly replaced in defence of hardcore. These negative heuristics of Lakatos, to some extent, rationalize but are not likely classical conventionalists, for example, Poincare, by not authorizing "'refutations' to transmit falsity to the hardcore as long as corroborated empirical content of the protecting belt of auxiliary hypothesis increases (Lakatos, 1970, p.134)." Such a decision is based on *logical and empirical* reasons instead of the *aesthetic* ground advocated by Duhem (Lakatos, 1970, p.134).

The approach to scientific research, for example, positive heuristics, rescues the scientists from the ocean of anomalies that confuse them to arrive at conclusions. And then, the scientist sets a program that lists a chain of ever-most complicated models (A model is a set of initial conditions bound to be replaceable during the further development of the program), simulating reality. In this process, the scientist disregards actual counterexamples, i.e., data available to refute the theory and pays attention to building his models considering instructions provided in the research program's positive part. Here Lakatos referred to how Newton first developed his planetary system with a fixed point like the sun and one point-like planet. However, Newton's third law became a counterexample and was replaced by any observation or anomalies but by a theoretical difficulty in developing the research program. Moreover, Newton continued to develop more research programs amending the initial model after facing mathematical challenges, and Newtonian puzzles were foreseeable when the first model was developed. According to Lakatos, this example of the Newtonian model shows that 'refutation' is irrelevant in any specific research program's variant (Lakatos, 1970, p.136).

One of Lakatos's aims of the scientific research program is to refute Kuhn's theory of anomalies in scientific revolutions. As Kuhn argued, for Lakatos, not the anomalies but the research program's positive heuristics determine which problems the scientist chooses to address. The anomalies are solved aside from assuming that they will turn into corroboration. When the positive heuristics run out of steam and anomalies work in degenerating phase, the scientist pays more attention to anomalies.

Lakatos furthermore argued that he sees the rationality of science as Popper has persuaded this. However, he was partially in debt to Lee Roy and Popper for borrowing from their conventionalism, and he thought that ignoring the counterexample was not irrational. He also agreed with Popper that it is good, progressive normal science and imperfect generating normal science if we keep the determination to eliminate some research programs under objectively defined conditions (Lakatos, 1970, p.177).

One of the main reasons for approaching deductivism is the failure of induction and accumulation. However, is it possible to measure theories without induction based on excess empirical content? There are arguments that Kuhn and Lakatos have a similar attitude towards scientific progress as both had rigid paradigm adherence mentalities to suppress alternatives (Walker, 2010, p.436). I think this is not a fault if anyone employs stringent criteria to justify science. Researchers spend an enormous time developing their hypotheses and doing pilot studies to test them. All possible hypotheses are tested, employing reason and experience. Such an approach to scientific research helps to economize the scientific research program.

Besides differences, they have similarities, while Lakatos notes, "Where Kuhn sees paradigms, I also see rational research programs." Walker further noted that

> "Kuhn devotes relatively little attention to measuring a paradigm's progress in a rational manner. Lakatos, however, introduces ways of evaluating a research program's progressive nature, and this remains one of his most important contributions. Though difficult to sort out, his discussions of positive heuristics and progressive problem shifts help fill a large void left by Kuhn's limited depiction of progress in normal science (Walker, 2010, p.437)."

I agree with Walker that Lakatos has contributed to fulfilling the gaps left by Kuhn and Popper. However, Tversky and Kahneman (1974, see also in Goldman, 2017, p. 24) are against heuristics theory, which needs further justification. They have termed heuristics a "quick and dirty" method of forming a belief that is error-prone and biased towards error. Camille and Jenkins, in this regard, contended that following heuristics, "[i]n fact, most of our decisions are made subconsciously and are biased by our emotions, intuitions, and our cognitive constraints and limitations (2017, p.68)." These researchers draw examples from social sciences, a developing branch of science, and talk about humans' political and economic behaviour. On the other hand, Lakatos did not specify whether his negative and positive heuristics are confined to physical sciences, excluding social sciences. Rather, Lakatos has seen a possibility of success if his methodological framework is employed in social sciences. For example, he notes (See also in Court,1999, p.215) that his methodological recommendation

> is not about a mere technical point in epistemology. It concerns our central intellectual values and has implications not only for theoretical physics but for the underdeveloped social sciences and even more for moral and political philosophy. If even in science, there is no way of judging a theory, but by assessing the number, faith and vocal energy of its supporters, then this must be even more so in the social sciences: truth lies in power. (Lakatos, 1965, p. 93).

A defence for Lakatos can be found in Court (1999[*****]). For Court (1999, p.226), methodological concepts such as "hardcore", "protective belt", "progressive problem shift", and "empirically progressive series of theories" employed by Lakatos help interpret education research. Therefore, criticisms against Lakatos's scientific research program method can be refuted. Court also assures us that Lakatos's theory of heuristics will not result in too many theories' uncritical proliferation.

Feyerabend (1975[******]) also examined Lakatos' method and methodology of the scientific program and described its usefulness in defeating scepticism. For Feyerabend, the methodology of the scientific program has some faults. Nevertheless, it is much more consistent than Kuhn's and has explanatory power to answer scepticism. Lakatos outlined what he meant by heuristics, hardcore, and protective belt and their application in scientific investigation and justification. These are useful for progress in sciences and scientific methodology.

The epistemic norm to govern the growth of scientific knowledge formulated by Lakatos liberates us from Popper's strict fallibilism. Lakatos did not accord with Popper that a piece of scientific knowledge can be discarded if a researcher experiences a negative instance. He favoured a methodological approach to scientific investigation and excess corroboration for selecting from competing theories instead of holding Kuhnian group rationality, although researcher communities practice it. Whether Kuhn has recommended group rationality without measuring corroboration or group rationality is a further step of justification based on the measurement of corroboration. Theory X may have more remarkable corroboration than Y. But this may happen for some other errors committed in research. The scientific community may detect this. This is a kind of triangulation or bird's

***** Lakatos Revisited Author(s): DEBORAH COURT Source: *The Journal of Educational Thought (JET)* / Revue de la Pensée Educative, December 1999, Vol. 33, No. 3 (December 1999), pp. 209-229

****** Feyerabend, Paul.(1975). Imre Lakatos, *The British Journal for the Philosophy of Science*, Vol. 26, No. 1, pp. 1-18.

eye view selecting among competing sciences theories. Kuhn did not undermine the logic of discovery by adding another criterion, "measuring rationality by the scientific community". This external criterion of justification has explanatory power to justify believing scientific statements and theories. It is helpful to meet the criterion of reliabilism. Knowing and justifying are complex processes that require fulfilling various criteria. The brute possibility of "anything goes" makes us aware and leads us to examine our beliefs, test our cognitive process, reflect on them, and find testing methods for these beliefs. The model advanced by Lakatos serves the best towards the progress and rationality of science.

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