Does Lakatos' methodology of scientific research programmes offer the best of Popper's and Kuhn's philosophies of science without their weaknesses, or does it combine the weaknesses of both?

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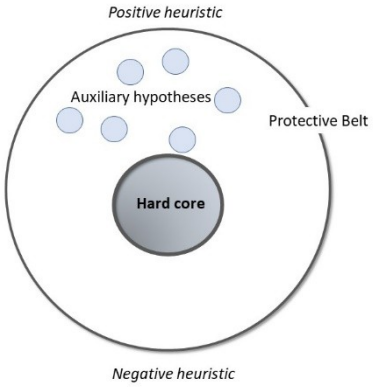
To address this question, I will split this paper into three sections. Firstly, I will provide an overview of both Popper's and Kuhn's philosophies of science whilst highlighting both strengths and limitations of these theories to draw on later. Secondly, I will discuss Lakatos' Methodology of Scientific Research Programmes (MSRP). Finally, I will evaluate Lakatos' theory in the context of Kuhnian and Popperian critique.

Popper's principle of scientific method is based on the premise that good science is concerned with falsification of hypotheses and not verification of them. Popper used falsification as a demarcation criterion to separate science from pseudoscience, as documented in his work, *The Logic of Scientific Discovery,* which held that no theory could ever be irrefutably confirmed, but that robust science is that which is able to withstand falsification. Popper saw science as an evolving process, requiring scientists to constantly challenge their theories and question current dogma through continuous falsification. There are, however, many criticisms of falsification theory: scientific hypotheses don't exist alone; therefore, to disprove one would affect related theories; falsification doesn't consider subjective factors which might influence the scientific process; and lastly, some theories cannot be falsified due to failures in methodology.

Kuhn was highly critical of Popper and sought to construct a different approach using social process and in context of history and socio-psychological perspective. In his thesis *The Structure of Scientific Revolutions,* Kuhn postulated that scientific progression is cyclical, with periods of **'pre-science'** (when a scientific paradigm is being established),**'normal science'** (the status quo), **'model drift'** (when anomalies become prevalent), **'crisis'** (uncertainty in the field) and **'revolution'** (where new thinking emerges from the crisis) - leading to the **'paradigm shift,'** (Kuhn, 1962). Kuhn's thesis allows for scientific anomalies without fully discrediting the associated theory, addressing perhaps one of the most fundamental problems of falsification. Kuhn's work also discussed scientific progress in the context of society, psychology and history, a process which we still use today, although perhaps in different ways[1]. Despite these merits, Kuhn's theory has met with staunch criticism from his contemporaries, mostly due to its perceived lack of applied logic, high degree of relativism and absence of demarcation criteria. These criticisms are echoed in Lakatos' work, and his response to improve on these is recorded in his paper *'Criticism and MSRP'* (Lakatos, 1968).



Representation of Lakatos' Scientific Research Programme

Lakatos is often perceived to have found a middle ground between Popper and Kuhn, avoiding the demarcation pitfalls of the former and the perceived relativistic approach of the latter. From this Lakatos formulated his MSRP, often viewed as a logical methodological approach juxtaposed to Kuhn's

xt of *implicit bias,* which is rooted in a socio-psychological
rently trying to unravel to understand its impact on scientific

sociological methodological approach. Fundamentally, Lakatos' Scientific Research Programmes (SRPs), are a series of theories comprised of key elements: the ***'hard core'*** consists of the fundamental principles, without which there would be no viable programme, and is shielded from falsification by the ***'protective belt'*** – a series of auxiliary hypotheses or ***'bridging concepts',*** which can be falsified without altering the core of the SRP. Lakatos' SRPs adhere to what he termed the ***positive*** and ***negative heuristics***. The former are applied to the 'protective belt' and act to direct scientists towards improved approaches and to formulate novel opportunities through revisions of auxiliary hypotheses in light of new evidence. The latter forbid the modification of the 'hard core' – this cannot be re-tested and must stay unaltered for the SRP to remain intact. Lakatos attempted to formulate a demarcation criterion between so termed "good science" and "pseudo" science through the lens of progressiveness. Indeed, in his works, Lakatos evaluates SRP success in terms of either ***'progressing'*** or ***'degenerating.'*** Criteria for successful progress exist in the context of how a SRP deals with anomalies within these auxiliary hypotheses. If anomalies bolster the SRP through increasing the predictive power and providing opportunity for maturation, then Lakatos considered this *"empirically and theoretically progressive."* If anomalies cause the SRP to stunt programme growth, then it is considered 'degenerating.' This is a cyclical process, and over time the success of the SRP will become apparent. A continuously degenerating SRP will impact the hard core over time, resulting in this theory eventually being rejected. In this case, another progressive SRP may supersede the degenerating programme - thus bringing about 'scientific revolution'.

To determine the strengths of Lakatos' work, we can draw on the weaknesses of both Popper and Kuhn to ascertain how Lakatos sought to improve on these characteristics. The problems of falsification highlight the need for a different approach to demarcation, which Lakatos' methodology goes some way to resolve. By incorporating hypotheses into a framework and establishing core and auxiliary components, Lakatos lessens Popper's discrete falsification and protects the 'core' of a theory from being rendered "pseudoscience" through only exposing auxiliary hypotheses to falsification. Through this methodology, Lakatos achieves to an extent some resolution of the Duhem-Quine problem. In his work, the '*Criticism and Growth of Knowledge,'* Lakatos further evaluated Popper's theory and split the problems of falsification into three subcategories: dogmatic, naïve and sophisticated falsificationism. Lakatos held that the very history of scientific progress was evidence to refute so termed "naïve falsification", which indeed fits with many examples of scientific progress throughout history[2]. This is perhaps a fundamental strength of Lakatos' philosophy, acknowledging the importance of falsification in scientific method, but in a way which can improve and develop a scientific theory, rather than rendering it a failure or obsolete.

As we can see from their descriptions, Lakatos' SRPs are very similar to Kuhn's paradigms. Indeed, Lakatos himself conceded his work was a modification of Kuhn's theory of scientific method when he wrote *"where Kuhn sees paradigms, I see rational research programmes"* (Lakatos, 1971), although noting the emphasis on ***rational,*** this perhaps also highlights the biggest difference in their work too**.** Both Kuhn and Lakatos agree that scientific progression is evaluated more efficiently when

[2] E.g., the discovery of Neptune.

considered as part of a framework. They also treat anomalies in a comparable way, not through falsifying the whole hypothesis, but by either discounting anomalies or using them to drive a theory forward. Lakatos' testing of auxiliary hypotheses is akin to Kuhn's solving 'puzzles' within the framework, both aiming to strengthen the overarching framework in which they exist. Kuhn and Lakatos also placed importance on the role of history and historical context in the philosophy of science[3]. However, Lakatos approached the history of science differently to Kuhn, believing that historical cases should be re-rewritten to appear more rational and could be presented as 're-constructions.' [4]

Aside from these similarities, there are fundamental points of contrast between the philosophical methods of Kuhn and Lakatos. Firstly, Lakatos is considered through his MSRP to be restoring a degree of reason to the evaluation of scientific methodology, rejecting the sociological influence of Kuhn, which he judged to be a subjective, relativist approach. Secondly, Kuhn established his thesis of incommensurability, which held that because of conceptual variance it is not possible to compare paradigms, as they are by nature monolithic and overarch the entire field in which they are concerned. Lakatos' view was opposite to this, as his SRPs exist simultaneously, and a shift towards scientific revolution occurs when one SRP becomes more progressive and thus overtakes other degenerating programmes. This is in stark contrast to the *Gestalt-switch* change in trajectory reported in Kuhn's 'paradigm shift'. Perhaps this could be considered one of the fundamental concerns of Kuhn's approach, as, when reflecting on the history of science, these paradigm shifts do not occur as suddenly as Kuhn describes, but exist as a cumulative approach - something which is better described by Lakatos' MSRPs. Finally, Lakatos was clear in his disdain for the value Kuhn placed in the scientific community, and held that *method* was more robust and trustworthy than the *community*. Kuhn responded to this criticism by stating that paradigms were indeed grounded on universally recognised scientific achievements. However, Lakatos did not agree with this subjective, community-led approach.

Despite highlighting the strengths of Lakatos' work, which were formed in part from both Kuhnian and Popperian concepts, I will conclude by discussing the outstanding questions surrounding Lakatos' approach. Whilst Lakatos' theory is considered more rational, it is still lacking an absolute demarcation criterion for degenerating SRPs. Indeed, Lakatos critiqued Kuhn's paradigm shift as a *bandwagon effect* (Lakatos, 1978, p91). However, he does not provide any sound logical alternative for shifts in SRPs. Thus, demarcation here could equally be perceived as relativist[5]. Lastly, and perhaps most significantly, neither Kuhn, Popper nor Lakatos' theories account for an agnostic or data-led approach to scientific methodology, bringing into question their relevance for scientific frameworks today.

[3] *"History of science without philosophy of science is blind. Philosophy of science without history of science is empty" (*Lakatos, 1971).
[4] This was heavily criticised by others in the field.
[5] As a scientist may be reluctant to accept that the programme is failing or pursue further experiments indefinitely.

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