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Lakatos's Revision of Popper's Criteria of the Demarcation of Science

The twentieth century witnessed the emergence of influential philosophers like the "Vienna Circle" and the Positivists who paved the way for discussions involving the Principle of Verification, the Problem of Induction, and the demarcation between science and pseudoscience. Verificationism claimed that a statement of reality is meaningful if it is, in theory, verifiable. Induction predicted a generalization "if it passe[d] from singular statements to universal statements" (Popper 27). Utilizing these two concepts, philosophers tried to establish an objective system that would precisely differentiate between science and pseudoscience. This conflict developed due to the rise of fields like astrology and alchemy compared to astronomy and chemistry. Karl Popper, Imre Lakatos, and Thomas Kuhn emerged as monumental figures of this debate. Altogether, although Popper effectively argues against verificationism and induction and characterizes the demarcation between science and pseudoscience through the principles of falsifiability and testability, Lakatos differs with him on the demarcation of science by dismissing immediate refutations, proposing a three-part research programme, and arguing for a more sophisticated version of falsification.

The problems associated with the Principle of Verification were the basis of Popper's proposal for a new criterion of demarcation. Positivists believed that scientific theories should be verifiable or derivable from experience. Schlick, a renowned Positivist, concluded that "a genuine statement must be capable of *conclusive verification*" (Popper 40). Waismann

supported this statement by asserting that "if there is no possible way to *determine whether a statement is true* then that statement has no meaning whatsoever" because "the meaning of a statement is the method of its verification" (40). Verificationism accounted reality through experience. Empirical verification satisfied this criterion of verification, which characterizes the empiricist epistemological theory of knowledge. They claimed that what cannot be known scientifically cannot be known at all. Statements were further classified as analytical or synthetic. Analytical statements, like mathematical truths or logical statements, are *a priori*, or truths which occur prior to experience. These statements do not say anything about the world and therefore, fall out of scope of verification. On the other hand, synthetic statements make claims about the nature of reality and are based on experience. Therefore, the foundation of knowledge is synthetic. Although Verificationism was a widely held view of the time, Popper emerged as one of its notable critic.

Popper disagreed with the criterion of verification and professed that generalizing "inference to theories, from singular statements which are 'verified by experience' (whatever that may mean), is logically inadmissible" (Popper 40). He argues that in principle, a scientific theory cannot be verified, which implies that science itself is a pseudoscience. For example, laws of nature cannot be verified, but they are, indeed, integral parts of science. In addition, he claimed that no scientific theory is verifiable, but some pseudo-scientific theories are. These independent statements are all contradictions, and therefore, exhibit that the principle of verification cannot be applied to all circumstances relating to the demarcation of science. He claimed that "theories are *never* empirically verifiable" (Popper). Verifying one possible theory does not necessarily refute other competing theories. Popper claims that if an individual wishes to "avoid the positivist's mistake of eliminating," these competing theories accurately, then

falsifiability should be utilized as a tool (Popper). Due to the problems evident in the application of verification, Popper proposed falsifiability as an integral part of his demarcation criterion.

Apart from verification, Popper rejects induction and the manifestation of truth. He claimed that no general conclusion is possible by experience. One cannot generalize experiences of the past, present, and future combined. Popper "contend[s] that a principle of induction is superfluous, and that it must lead to logical inconsistencies" (Popper 29). Lakatos agrees with Popper on induction by stating that "one can today easily demonstrate that there can be no valid derivation of a law of nature from any finite number of facts" (Lakatos 21). There are two components of Inductivism—the Anticipation of Nature and the Context of Discovery. First, the experimenter should purge his or her mind of the preconception of the investigation of nature. The interpretation of nature claims that conjectures are derived from preexisting data, while the anticipation of nature does not and should, hence, be avoided. Francis Bacon held that hypothesis should not precede observation of data collection. Popper disagreed and argued that data is meaningless without a hypothesis. Observation cannot answer questions unless a question has already been posed. Therefore, there is no concept as a theory-neutral observation. Furthermore, Popper, along with the positivists, agrees that the context of discovery does not really matter; rather, it is the context of justification that is more important. Earlier, Bacon and René Descartes were known for their belief in the manifestation of the truth. They believed that if preexisting notions could be cleansed and ignorance could be conquered, then it would illuminate the path of knowledge. Popper, on the other hand, asserted that error in human perception could not be eradicated, and therefore, ignorance was the default state of human knowledge. He declared that striving towards the truth is a regulative ideal but is unreachable. He disagreed with Descartes and Bacon by proclaiming that there was no way to purge false

beliefs. This was known as Fallibilism. All in all, Inductivism and the search for truth were essential considerations in the demarcation of science that Popper refuted.

In order to improvise on erroneous models based on the principles of verification and induction, Popper developed his own criteria of demarcation, which included falsifiability, testability, and the H-D model. Popper stressed that "the fundamental feature of a scientific theory" should be falsifiability i.e. it can generate predictions that can be refuted by experience (Okasha 13). He emphasized that a good theory is a risky one. Two categories of falsifiability are evident—(1) logical falsifiability and (2) community falsifiability. Logical falsifiability emphasizes that the theory has at least one testable experience that can be refuted by experience, while community falsifiability observes that the community of practitioners and adherents to the theory must be willing to relinquish that theory in case disconfirming evidence is provided. A closely related criterion associated with falsifiability is testability. It states that without corroborating empirical data with theory, experimentation and testing should be able to falsify it. Popper exclaims that only luck can verify truths through "'empirical reasons,'" but in order to establish a "true theory, falsity [should] not have been established," and all other "competing theories" need to have been refuted (Popper). Popper emphasizes falsifiability because of the logical defects of verification and the impossibility to derive a universal generalization. This problem occurs because the "number of possible theories is infinite," and Popper further concludes that these conjectured theories "remain[] *applicable*, though inconclusive" (Popper). He provides the Hypothetico-Deductive (H-D) Model to resolve this conflict. This model exhibits that through auxiliary assumptions and an underlying hypothesis, an observation can be predicted. Popper claims that if the observation is inconsistent with the prediction, then the theory itself is false. However, if the observation is correctly predicted, then it does not

necessarily imply that the hypothesis is true. Therefore, according to Popper, it is not possible to prove a hypothesis or theory. In essence, a theory might be deemed "scientific even if there is not a shred of evidence in its favor, and it may be pseudoscientific even if all the available evidence is in its favour" (Lakatos 22). Altogether, Popper emphasizes testable predictions that can be falsified in order for a theory to be considered scientific.

Popper's analyses of counterexamples clearly display the intricacies of his theory. He utilizes "Einstein's theory of relativity," as well as "Marx's theory of history, Freud's psycho-analysis, and Alfred Adler's so-called individual psychology" to illustrate his point (Popper 4). Popper is thoroughly critical about psychoanalysis and Marxism. He asserts that the "two psycho-analytic theories" are "simply non-testable, irrefutable" (8). This is because "no conceivable human behavior [] could contradict them" (8). On the other hand, Marxism is testable but fails the community falsifiability criterion. Although the Marxist theory delivers testable predictions, his "followers re-interpret []" the theory in order to "rescue[] the theory from refutation" (8). Popper describes these ad hoc arguments as a "'conventional twist' or a 'conventionalist stratagem'" by the actions of the followers of the given theory (7). On the other hand, Einstein's theory fits Popper's criterion because of its testable prediction. Einstein's predictions were "confirmed by the findings of Eddington's expedition" who confirmed that light rays bend in a solar eclipse, which is a prediction in Einstein's theory (6). It was a potential theory that was falsified by experience and was testable. Therefore, Einstein's theory of relatively was consistent with Popper's demarcation of science, while Marxism and psychoanalysis were not.

Although Popper revolutionized the philosophy of science through his demarcation criteria, Lakatos is critical of Popper and revises the concept of falsifiability. Popper discredits a

theory completely in light of a miniscule disconfirming evidence, but Kuhn, and later Lakatos, extend their paradigms and programmes respectively, to incorporate anomalies. Although Lakatos argues that "blind commitment to a theory is not an intellectual virtue: it is an intellectual crime," he is not as strict in the refutation of theories as Popper is (Lakatos 20). He proclaims that a theory triumphs if it can answer fundamental questions. The Copernican model is a prime example for the reasoning behind incorporating these anomalies. This model displaced Ptolemaic model but did not explain every related phenomena. Stellar Parallax, which observes the change of the apparent position of stars, contradicts Copernicism. According to Popper, this theory would be born refuted because it contained disconfirming evidence and therefore, would have been immediately dismissed. Lakatos, emphasized that 'budding programs' should be judged leniently" (26). Lakatos's criterion to distinguish between science and pseudoscience if community falsifiability is not taken in account centers on a 'research programme'. He states that a programme is said to be progressive as long as its theoretical growth anticipates its empirical growth. His programme consists of three parts—the protective belt, hardcore of the scientific theory, and heuristic. The protective belts consist of auxiliary hypothesis and are not as fundamental, and the heuristic is "powerful problem-solving machinery," which "digests anomalies and even turns them into positive evidence" (24). Lakatos highlights that if anomalies are present within the protective belt, then the theory should not be disbanded. It is anomalies that are observed in the core of the scientific theory that become problematic. The core of the research programme predicts novel facts in advance of the facts being discovered. Lakatos's criterion of falsification is a more sophisticated version of falsifiability than Popper's criterion. The key to Lakatos's theory is that a theory is adjudged to be falsified if and only if another proposed theory has excess empirical content and the new

theory explains the success of the earlier theory. As a whole, a theory should be given the benefit of the doubt and should be replaced only if there is an alternative theory.

Lakatos utilizes Popper's examples to portray his own version of falsifiability. He incorporates the theory of gravitation, relativity theory, quantum mechanics, Freudianism, and Marxism as research programmes. If Popper's criterion is to be considered, then every theory is "born refuted and die refuted" (Lakatos 24). This is the basis of Lakatos's revision of falsifiability. He focuses on the differences between a "progressive programme from a pseudoscientific or degenerating one" (24). Lakatos concludes that in a progressive research programme, the "theory leads to the discovery of hitherto unknown novel facts," while in degenerating programmes, "theories are fabricated only in order to accommodate known facts" (25). For example, the "Newtonian programme led to novel facts," while Marxism altered "their auxiliary hypothesis" to "protect theory from the facts" (25). Newtonian gravitation would have been falsified by Popper's criteria since it made some incorrect predictions. Lakatos summarizes that Popper's "so-called 'refutations' are not the hallmark of empirical failure; rather, it is the "'dramatic, unexpected, stunning predictions' that really counts" (25). While Popper has a pessimistic view of scientific theories, Lakatos embraces a more lenient position. He emphasizes that "programmes may take decades before they get off the ground and become empirically progressive" (26). Therefore, they should be given the benefit of the doubt. This leads Lakatos to conclude that "Popperian crucial experiments and Kuhnian revolutions are myths" (26). In essence, it is only a gradual replacement of a degenerating research programme by a progressive one.

All in all, Lakatos's lenient criteria for the research program revises Popper's concept of falsifiability in order to accurately demarcate the sciences and pseudo-sciences accurately.

Popper revolutionized the philosophy of science with his harsh criticism of verificationism and Inductivism. His criticism led him to incorporate falsifiability in expense of verifiability, which was later revised by Kuhn and eventually Popper. The mid-1950s witnessed the downfall of the principle of verification as it signaled the descent of the Positivists. As a whole, the contributions made by Popper, Kuhn, and Lakatos effectively characterize the profound questions surrounding twentieth century philosophy of science.

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