



Critical Rationalism: A Copernican Revolution in Contemporary Philosophy

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Abstract:

The twentieth century witnessed significant scientific development and gave rise to a number of epistemological problems that became the subject matter of contemporary philosophy of science. The project of the contemporary philosopher of science “Karl Popper” was to uncover the logic governing the development of scientific research. The aim of this article is to identify the criterion that distinguishes science from non-science according to Popper, the logic governing its progression, and his position toward traditional philosophies and logical positivism.

The study concludes that the criterion of “falsifiability”, according to Popper, is what distinguishes science from non-science. Science does not develop through “verification”, as claimed by the positivists, but rather through “refutation and falsification”.

Keywords: Science; Philosophy of Science; Criterion; Verification; Falsifiability.

1. Introduction

The twentieth century witnessed major scientific revolutions. Scientific knowledge developed considerably and gave rise to various epistemological problems at the levels of both subject matter and methodology. These problems became the concern of the philosophy of science, one of the most important branches of contemporary philosophy. It has two principal axes: the first concerns the subject matter of this branch of philosophy, namely the experimental sciences; the second concerns the methods of reasoning and the critical tools specific to the experimental sciences. The problem of induction constituted one of the most significant issues to which modern and contemporary philosophers of science devoted considerable attention.

If science is the highest form of human intellectual activity, then its experimental-inductive method is the greatest tool for understanding the universe. It constitutes the foundation of the experimental sciences and the guiding principle of the modern age. The principal factor behind the advancement of modern Western civilization was its discovery and adoption of the experimental scientific method in addressing practical problems. Consequently, empirical verification came to be regarded as the criterion of scientific knowledge. However, this view has not been unanimously accepted by modern and contemporary philosophers of science.



What, then, is the criterion that distinguishes scientific discourse from other forms of knowledge according to the contemporary philosopher of science Karl Popper? How can science be distinguished from non-science (metaphysics and pseudoscience)? Under what conditions is a theory classified as scientific according to Popperian philosophy? What is the criterion of its validity? And what is the logic governing the process of scientific development? The main hypotheses addressed in this article are as follows:

- Critical rationalism constitutes a correction and transcendence of traditional philosophies and their approaches to science and knowledge.
- Critical rationalism represents a revolution against logical positivism and its criterion of “empirical verification,” uprooting it from its very foundations.
- The Logic of Scientific Discovery represents a Copernican methodological revolution whose criterion is “falsifiability.”

The objective of this approach is to uncover the nature of the critical revolution introduced by Karl Popper’s philosophy into contemporary thought. This revolution was directed against everything that could constitute an authority over reason and produced a contemporary “organon” capable of accompanying the major scientific revolutions that shook the twentieth century, after the modern “organon” had become too outdated and inadequate to explain them. To examine these hypotheses, we adopted the critical-analytical method, as it is most appropriate to the nature of our study. We concluded that this philosophy represents a Copernican revolution in philosophy in general and in contemporary philosophy in particular. It called for liberation from closed systems and advocated critical openness. It also marked an important epistemological turning point by addressing the problem of induction and its limitations. Furthermore, it affirmed that the criterion distinguishing science from non-science is falsifiability (refutation or disproof), rather than verifiability.

2. From Dogmatic Philosophies to Infinite Critical Rationalism

The primary characteristic of Western reason is criticism and the criticism of criticism. This began with Kant and his critical philosophy and continues to the present day. “Perhaps the criticism of criticism constitutes the most distinctive feature of Western reason, for it never rests satisfied with any product or result. It constantly moves from the product to the instrument, medium, and apparatus that conceived, produced, and invented forms of thought and creation. Western reason has never been content with itself nor with any cultural, social, or technological system. Rather, the criticism of criticism has continually motivated it to free itself from every framework that confines it... Western reason, or this reason, truly thought. Thought was more important than ideas, and the urge to journey and wander was stronger than the tendency to settle and remain fixed” (Safadi, M., 1990, p. 05). This is what made it a living and creative reason that continually transcends itself.

A prominent example of this is Karl Popper, the founder of critical rationalism, who fought against all forms of closed frameworks that restrict thought and hinder its freedom. He advocated an open society and an open mode of thinking through fruitful discussion and rational debate among diverse minds rather than like-minded individuals. The aim is not to justify our



theories but to criticize them in order to arrive at better ones. This, according to Popper, is the basis of human progress. Greek philosophy represented the revolution of “logos” against “mythos”, while modern philosophy represented a revolution against scholastic thought. Within modern and contemporary thought, revolutions and counter-revolutions continue to emerge.

Karl Raimund Popper was born in Austria in 1902. He became renowned for his criticism of scientific tendencies and ideological currents that cast doubt on the values of science and rationality. A specialist in the philosophy of science, he is best known for the criterion of falsifiability, which he regarded as the epistemological criterion for distinguishing scientific theories. Among his most important works are “The Logic of Scientific Discovery”, “The Poverty of Historicism”, “The Open Society and Its Enemies”, “Conjectures and Refutations”, “Objective Knowledge”, and “The Myth of the Framework”. He died in 1994.

Popper emerged during the first third of the twentieth century after publishing “The Logic of Scientific Discovery” in 1934. He was one of the major philosophers of the twentieth century whose influence extended into the philosophy of the twenty-first century, and his philosophy constituted a major epistemological turning point.

He witnessed the collapse of the Austrian Empire and the emergence of new revolutions and theories that generated widespread debate, such as socialism, Freudianism, Adlerian psychology, and the theory of relativity. His perplexity increased when he compared the first three theories with Einstein’s theory of relativity. The first three achieved remarkable success and possessed numerous “confirming” and “supporting” instances, whereas the theory of relativity was supported by only a single confirming and corroborating observation (Baghoura *et al.*, n.d., p. 130).

Popper became skeptical of these theories and asked: “How can one determine whether a theory is true? How do scientific propositions acquire their validity? And how can we distinguish between scientific and non-scientific statements?” (Popper, K., 1986, p. 20).

From this point, his critical philosophy began to assume its true place in contemporary thought. He discovered that “what the three theories shared was their ability to explain phenomena in a quasi-theological manner and their capacity for projection in interpreting human phenomena through a conceptual arsenal inspired by people’s social, psychological, and even historical experiences, such as ‘class struggle’ in Marxist ideology and ‘repression’ in Freud’s theory. However, the widespread acceptance of these theories does not necessarily confer scientific legitimacy upon them, just as the limited acceptance of relativity does not deprive it of scientific legitimacy” (Al-Muhammadawi *et al.*, 2013, p. 1012).

Popper subjected Marxist theory to severe criticism perhaps the most serious and rigorous criticism ever directed against it. He had once participated in socialist organizations and aspired to a better world characterized by justice and equality, which Marxism claimed to pursue. However, his encounter with its practical applications and its use of violence and authoritarianism to achieve these aims led him to reject and strongly criticize it. The dictatorship of the proletariat, in his view, threatened the most precious value for human beings freedom.



The pursuit of justice and equality, therefore, seemed to require the elimination of one or more social classes through bloodshed and violence (Baghoura *et al.*, n.d., p. 130).

Popper launched his philosophical project with the publication of “The Logic of Scientific Discovery” in 1934. In this work, he criticized logical positivism and all traditional philosophies, as well as their approaches to science and philosophy. He maintained that most philosophical problems, particularly theoretical ones, are fundamentally methodological problems (Popper, K., 1986, pp. 93–94).

According to Popper, science is neither a body of absolute and certain truths nor a gradual activity aimed at constructing final knowledge. It cannot attain complete truth in the Platonic sense of absolute and certain knowledge. He states: “I find conventionalism unacceptable because the conception and purpose of science among conventionalists differ entirely from my own view. While I do not seek any final certainty in science (nor can such certainty be attained), conventionalists regard science as ‘a system of knowledge resting upon ultimate foundations’” (Popper, K., 1986, p. 119).

Critical philosophy thus revolted against every form of thought that claims the possibility of possessing certainty. It opposed both classical and contemporary philosophies, whether rationalist or empiricist, ancient or modern, all of which sought absolute certainty and endeavored to establish foundations, sources, methods, and goals for science and philosophy (Baghoura *et al.*, n.d., p. 124).

It is a revolution against traditional thought and its methods in science and knowledge, and a radical transformation in the course of thought: from closed systems of thinking to critical openness, as is suggested by the very titles of Popper’s works and chapters. Dogmatic philosophies were founded upon erroneous premises and constituted one of the greatest epistemological obstacles to genuine scientific and philosophical development. Critical rationalism therefore emerged to demolish and uproot them, standing against everything that represents an authority over reason. It begins fundamentally with the destruction of what Popper calls the “idol of certainty,” upon which dogmatic theories are founded. These theories fortify themselves behind supposedly secure sources and firmly established foundations, implicitly rejecting criticism. Their danger lies in their claim to possess the precision and explanatory and predictive power that grant them the legitimacy to monopolize “information,” interpretation, and prediction with certainty, sustained by an excessive belief in determinism in their study of the phenomena of the universe and life (Baghoura *et al.*, n.d., p. 124). Such a stance shackles free thought and restricts its development.

The critical rationalism advanced by Popper strongly rejected all the claims of rationalist and empiricist (classical) philosophies, which maintained that human beings are capable of attaining certainty if only they discover the correct sources and methods. Through his new critical-analytical methodology, Popper refuted this view and asserted that neither the method nor the goal of science and philosophy should ever be conceived in such a manner (Baghoura, n.d., p. 124). Instead of focusing on the sources and foundations that preoccupied modern philosophers, he proposed the principle of “critical openness” and categorically affirmed that the claim of



certain knowledge is nothing but an illusion and an idol. Indeed, belief in absolute truth or certainty in science or philosophy, as Descartes claimed, is an illusion and a misconception. Contemporary physics has abundantly demonstrated that there is no absolute truth; all concepts and theories are limited, approximate, and probabilistic (Fayyad, 1995, p. 60).

Reason the greatest of our faculties develops, like science itself, through criticism, refutation, rejection, and falsification. In the absence of these processes, it remains imprisoned within obsolete dogmatic forms of knowledge that hinder its development. Popper states: “The critical method alone explains the extraordinarily rapid development of the scientific image of the world and the remarkable progress of science. All pre-scientific knowledge whether animal or human is dogmatic knowledge, and science begins with the discovery of the non-dogmatic method, that is, the critical method” (Popper, 1994, p. 32).

Popper rejected the very possibility of attaining certainty, whether absolute, relative, or even probabilistic. Any philosophy that claims possession of certainty is, in his view, a subjective, dogmatic philosophy closed in upon itself and incapable of freeing itself from psychological and social tendencies. Such philosophies place absolute trust in the truthfulness of their sources of knowledge whether reason and its self-evident principles, as in Descartes, or sense perception and empirical observation, as in Bacon. This trust becomes a dogma regarding the truth of the sources and foundations, and consequently the truth of the conclusions. Science and knowledge, however, must be objective. For this reason, Popper emphasized the need to liberate scientists and researchers from these subjective psychological and sociological tendencies (Psychologism and Sociologism), which are incompatible with scientific discourse (Baghoura *et al.*, n.d., p. 12).

Popper’s philosophy draws upon all sources while simultaneously subjecting all sources to criticism. It is founded upon an organon of criticism and falsification and calls for the destruction of all intellectual frameworks that constrain the development of thought. It advocates “liberation from intellectual myths that call for specialization and that leave no room for science and rationality. Such myths lead to the inevitable demise of knowledge, especially since, according to Popper, the growth of knowledge is based upon disagreement” (Saleh, 2016, p. 90). Consequently, the “idol of certainty,” upon which classical dogmatic systems are founded, must be shattered, and free, calm, and courageous rational discussion must be encouraged in order to achieve what is better and more desirable for humanity and thereby promote human development.

Traditional philosophies (both rationalist and empiricist) were founded upon the notion of a conspiracy of ignorance and sought ways to eliminate error once and for all. This idea, rooted in the Christian doctrine of original sin, is present in classical philosophies. Error is regarded as an alien vice imposed upon human beings, whether in the form of hasty judgment, as in Descartes, or language, as argued by the empiricists. Popper, however, maintained that error is neither a vice nor a sin; rather, it is a natural aspect of human existence. He thus “establishes a philosophy of error: through error, human beings learn and adapt to nature. Error should not be viewed from a moral perspective but from an epistemological one, whereby it becomes a



necessity for establishing more acceptable knowledge”(Al-Muhammadawi *et al.*, 2013, p. 1014). Human beings are not infallible, and error is not a sin, as portrayed by many religions and philosophies; it is a natural phenomenon that can be identified and overcome through criticism and refutation, enabling us to approach the truth more closely.

Accordingly, traditional philosophies have become incapable of keeping pace with the developments of the twentieth century, and epistemology in its classical form remains distant from “understanding the relationship between humanity and the universe, because it conceives knowledge as a confrontation between subject and object. It relies on the notion of determinism and belief in the rigidity of nature on the one hand, and on the other hand maintains that the subject imposes its conceptions upon the object, thereby rendering knowledge subjective and immune to revision and criticism. It also believes in ‘certainty’” (Al-Muhammadawi *et al.*, 2013, pp. 1013–1014). This is precisely what Popperian epistemology rejects. Instead, it embraces process and continual transformation rather than permanence, indeterminism rather than determinism, and advocates a science and a body of knowledge free from dogmatism a science open to all structures and engaged in an ongoing process that knows no stability, just as reality itself is in constant flux.

However, Popper should not be classified among the skeptics who doubt everything merely for the sake of doubt itself. He rejected skeptical tendencies that questioned the existence of the world and regarded such views as among the “scandals of philosophy.” He also opposed dictatorships and closed philosophical systems that sought to determine the socio-political order through a specific ideology, such as Platonism, Hegelianism, and Marxism, and he challenged them at their roots. All of this “demonstrates the profound coherence of Popper’s philosophy... despite his rare independence and his opposition to illusions that few would dare challenge” (Al-Khouli, 2020, p. 331).

Critical rationalism, therefore, is a positive form of rationality that contributes to the growth of knowledge and the elimination of error as a natural phenomenon. It constitutes a great intellectual project aimed at awakening human thought and reviving the spirit of criticism and scrutiny with respect to ideas and forms of knowledge, so that they do not become authorities over reason. It rejects every mode of thought that abolishes human freedom and deprives individuals of their right to think and criticize freely and independently, thereby undermining their creative capacities. Its objective is to prevent the enslavement of human beings by deceptive illusions or false truths whose proponents believe them to stand above the logic of criticism and which consequently determine human thought and behavior (Al-Muhammadawi *et al.*, 2013, p. 1005).

Critical Rationalism as a Revolution against Logical Positivism and the Criterion of “Empirical Verification”

The philosophy of science underwent significant development with the emergence of the Vienna Circle in the twentieth century, which laid the foundations of logical positivism by taking mathematical logic and relativistic physics as its models. Logical positivism focused on the relationship between philosophy and science and maintained that, despite its richness and



development, scientific knowledge generated problems that it could not resolve on its own, thereby making them the subject matter of the philosophy of science. This doctrine was based on two fundamental principles:

1. The Principle of Logical-Linguistic Analysis:

Logical positivists identified meaning with science. Any proposition that possesses meaning must necessarily be subject to the principle of verification and testing. Accordingly, scientific propositions are limited to analytical (formal) propositions and synthetic (empirical) propositions, both of which are meaningful. Metaphysical statements, by contrast, are devoid of meaning because they cannot be empirically tested.

2. The Principle of Empirical Verification:

A proposition is meaningful insofar as “its truth or falsity can be verified; reality and sensory experience constitute the criterion of the truth of scientific propositions, and the researcher can verify a proposition directly through experimentation” (Ikhtiyar, 2010, p. 23). This principle was categorically rejected by Popper. His philosophy thus emerged as a revolution and a vigorous critique of logical positivism, directing against it some of the most severe criticisms that ultimately contributed to its disintegration.

Critical rationalism represents a significant epistemological turning point in contemporary philosophy and a “Copernican” revolution in the philosophy of science. This philosophy was developed by thinkers who were themselves deeply engaged in scientific practice and familiar with the scientific method, namely the philosophers of the Vienna Circle. In 1934, the year in which he published “The Logic of Scientific Discovery”, Popper adopted a critical method in his examination of scientific knowledge as it had emerged from the Vienna Circle. Although he had belonged to that intellectual movement and contributed to the maturation of its project through his writings, Popper was in fact laying the foundations for a revolution against the doctrine of scientific monism by introducing the concept of “falsifiability” (Al-Muhammadawi *et al.*, 2013, pp. 1005–1006).

Popper refuted the foundations and philosophy of logical positivism, which regarded philosophy merely as the logical analysis of science, limiting its function to explanation and clarification rather than innovation or creativity. Logical positivism also rejected metaphysics on the grounds that no reality exists beyond the empirical world. For its adherents, the criterion of science was verification and testability through experience. Popper considered these attempts unsuccessful because they relied upon the principle of induction, itself based on the principles of uniformity and determinism, both of which are ultimately metaphysical assumptions.

Popper rejected the dogmatic claims of positivism because it treated science with excessive reverence and excluded metaphysics from the domain of scientific knowledge. This exclusion was strongly opposed by Popper, who maintained that metaphysics had played a major role in the development of science. As he states: “Philosophical ideas have been of the utmost importance for cosmology. From Thales to Einstein, from ancient atomism to Descartes’ reflections on matter, and from the reflections of Gilbert, Newton, Leibniz, and Boscovich on forces, metaphysical ideas have illuminated the way” (Popper, 1986, p. 33).



Many metaphysical hypotheses have significantly contributed to scientific progress. Even hypotheses that later proved false or mythical often stimulated scientific discovery. Chemistry, for example, developed partly through attempts to validate erroneous assumptions, such as the possibility of transforming base metals into gold. Although scientists failed to confirm such claims, these assumptions nevertheless opened broad avenues for scientific investigation (Al-Khouli, 2000, p. 146). In this respect, Popper opposed the empiricist and positivist conception of knowledge represented by Bacon, Locke, and logical positivism, which links knowledge to observation and assigns a passive role to the senses while diminishing the importance of reason. For Popper, however, creative reason is both the starting point and the culmination of scientific innovation.

Popper strongly criticized the criterion of “empirical verification”, one of the central principles of logical positivism. A theory that successfully passes numerous tests and experiments does not thereby become scientific knowledge in any final or definitive sense. Rather, it remains a hypothesis provisionally accepted as true. Popper was able to dismantle the claims of logical positivism through his critique of induction itself (Abdelkader, 1998, p. 355). This inductivist tendency, characterized by excessive confidence in science, restricts scientific inquiry and obstructs the growth of scientific knowledge.

The principle of verification, therefore, is not a sufficient criterion for distinguishing science from non-science. Consequently, Popper sought an alternative scientific criterion. He writes:

“The problem of finding a criterion that enables us to distinguish the empirical sciences on the one hand from mathematics and logic, as well as metaphysical systems, on the other this is what I call the problem of demarcation” (Popper, 1986, p. 71).

The logical positivist view that a theory is scientific simply because it has been empirically verified is untenable and without foundation. Scientific knowledge is characterized by continuous growth and development. As Popper states:

“The central problem of epistemology has always been, and still remains, the problem of the growth of knowledge; and the growth of knowledge can best be studied through the study of the growth of scientific knowledge... The method I have in mind is one concerned with formulating problems clearly and critically examining the proposed and competing solutions” (Popper, 1986, p. 52).

The criterion for distinguishing scientific knowledge from non-scientific knowledge, together with the problem of induction, constituted the core of Popper’s epistemological project. This concern appeared as early as 1927 in his work “The Two Fundamental Problems of the Theory of Knowledge”. His rejection of induction was initially met with ridicule and opposition. Yet, according to Popper, this issue was the fundamental problem from which all other problems in the philosophy of science derived.

Popper maintained that induction is not the method of science. His critique of induction and inductivism which regards induction as the foundation of all scientific truth constitutes one of the most distinctive features of his epistemological position. At the beginning of “The Logic of Scientific Discovery”, Popper asks: “Can inductive inferences be justified logically?” (Popper,



1986, p. 64). His answer is an unequivocal negative. Although Hume and Russell had previously raised the problem of induction, generalization, and prediction in science, Popper made the problem of induction the central axis of his philosophy.

The generalization of a particular law to all similar phenomena is scientifically impossible because “the verification of a natural law can only be achieved through the empirical observation of every individual event to which the law applies, and by establishing that each of these events indeed confirms the law. Clearly, such a goal is impossible” (Popper, 1986, p. 101).

Induction based on observation and experiment, whether in its absolute or moderate (probabilistic) form, is therefore nothing more than a myth, in Popper’s view. The truth of universal propositions cannot be established through the confirmation of particular propositions. For example, observing a number of cases of white swans does not logically justify the conclusion that “all swans are white” (Popper, 1986, p. 64). No matter how numerous experiments may be, they can never definitively establish a scientific truth; at most, they can refute and falsify. Furthermore, inductivism diminishes the role of reason in the construction of scientific knowledge. The opposite is true: reason is indispensable to scientific inquiry. Science begins with questions. As Popper maintained, “science begins with problems” (Chalmers, 1991, p. 54), and scientific facts are solutions to those problems. There can be no science without hypotheses, just as generalization, quantification, and scientific prediction are all fundamentally rational operations.

Popper also rejected the position of “Hans Reichenbach”, who maintained that induction provides probabilistic knowledge. Popper regarded this view as merely “an attempt to rescue the principle of induction by introducing probability into it, because if we assign a degree of probability to propositions established through inductive inference, then that degree of probability itself must be justified by means of a new inductive principle... and this new principle would in turn require justification, and so on” (Abdelkader, 1998, p. 350).

Accordingly, induction is not a scientific method in Popper’s view, because scientific laws are universal judgments, and it is impossible to establish their certainty through experience. Experience provides only particular instances; it does not verify, but rather refutes and falsifies.

4. The Logic of Scientific Discovery: A Major Methodological Revolution Based on Falsifiability

If the multiplicity of tests were the criterion of a scientific theory and the sign of its strength, then the synthetic and comprehensive character of theories would make it impossible to verify their truth through repeated experiments. Hence, another criterion is required: “falsifiability”. A theory is scientifically acceptable only under two conditions: first, that it is capable of being refuted, and second, that it has not yet been refuted. Everything else is mere nonsense. Popper states: “I refuse to accept the view that there are propositions in science which we must accept as true because, for logical reasons, they cannot be tested” (Popper, 1986, p. 84).

Contemporary scientific revolutions, particularly the theory of relativity and quantum theory, transformed many established concepts and assumptions. This led Popper to reformulate the



central question of epistemology. He writes: “I do not think that the question epistemology should ask is: ‘Upon what does our knowledge rest?’ ... Rather, epistemology should ask: ‘How do we test scientific statements by means of their deduced consequences?’” (Popper, 1986, p. 141).

What we encounter here is a contemporary “organon” that corresponds to the nature of modern scientific revolutions, after the inductive method had proven incapable of doing so. This new method is the “hypothetico-deductive method”, through which “we can test the consequences necessarily derived from a theory. If the results of the test are incompatible with the consequences deduced from the theory, then the theory is false” (Saleh, 2016, p. 109).

A scientific theory that has not been falsified by any particular fact remains a valid scientific theory and retains its value. However, it is neither the final truth nor an absolute truth; rather, it is simply the best theory currently available. Popper states: “As long as a theory withstands severe and detailed tests, and is not superseded by another theory in the course of scientific progress, we may say that it has proved its worth” (Popper, 1986, p. 70).

The world of ideas, therefore, resembles the world of living organisms in nature: only the fittest survive according to the law of natural selection, as described by Charles Darwin.

At every historical stage, a scientific paradigm emerges and dominates the scientific landscape, providing the framework through which the universe is understood. When that paradigm fails to explain certain phenomena and unresolved problems arise, another paradigm emerges in an attempt to provide solutions. Newton’s theory, for example, enjoyed centuries of success, and repeated attempts to falsify it initially failed. Yet:

“The successes it achieved did not prevent repeated attempts at falsification from eventually attaining their objective. Newton’s theory was falsified in several ways: it could not provide a detailed account of the peculiarities of Mercury’s orbit, nor of the varying mass of rapidly moving electrons in discharge tubes. As the nineteenth century gave way to the twentieth, physicists were confronted with problems that required new speculative hypotheses, representing the conditions necessary for scientific progress” (Chalmers, 1991, p. 57).

Naturally, such problems could not remain unresolved indefinitely. An alternative scientific theory was required to provide solutions, and Einstein undertook this task. His theory introduced remarkable new scientific predictions. It predicted that: “Mass depends upon velocity and that mass and energy can be transformed into one another. General relativity also predicted that light rays would bend under the influence of strong gravitational fields. Attempts to falsify Einstein’s theory with respect to these new phenomena failed, and the falsification of Einstein’s theory continues to be a challenge for contemporary physicists. Should they succeed in falsifying it, a new stage of scientific development will have been reached” (Chalmers, 1991, p. 57).

Thus, scientific progress, according to Popper, does not proceed through the accumulation of verified truths but through the continuous process of proposing bold conjectures and subjecting them to rigorous attempts at falsification. Theories survive only so long as they withstand



criticism and testing, remaining open to replacement whenever a more adequate explanation emerges.

This confirms that Popper had a deeper understanding of the nature of contemporary scientific revolutions, which transformed many concepts and inspired his new conception of both the method and criterion of science. Scientific discoveries begin with problems, followed by conjectures and then refutations, because criticism and falsification eliminate the errors that may prove fatal to thought and science. Popper states: “The important point is that when we propose a solution to a problem, we should try by every means to overthrow our solution rather than defend it. Unfortunately, only a few of us practice this direct insight” (Popper, K., 1986, p. 52).

It is easy to refute a theory and invalidate it from its foundations through a single experiment, but it is impossible to prove it through multiple experiments. Consequently, verifiability is not the criterion of scientific truth; rather, falsifiability is the criterion that distinguishes science from non-science. Popper writes: “I shall not require of a scientific system that it be capable of being singled out, once and for all, in a positive sense; but I shall require that its logical form be such that it can be singled out, by means of empirical tests, in a negative sense: it must be possible for an empirical scientific system to be refuted by experience” (Popper, K., 1986, p. 77).

For example, when we say, “All ravens are black,” this universal proposition can be falsified by a single observation: “A non-black raven has been observed at a particular place and time.”

Premise: A non-black raven has been observed at place X and time Y.

Conclusion: Not all ravens are black (falsification of the universal proposition “All ravens are black”). This is a logically valid deduction.

The epistemological value of the criterion of falsifiability lies in its emphasis on discovery rather than justification and in its continuous challenge to prevailing theories. Science is therefore characterized by its revolutionary nature.

Accordingly, falsifiability is the most appropriate criterion for assessing the validity of scientific theories because “scientific theories are never fully justifiable or verifiable; rather, they are testable” (Popper, K., 1986, p. 81). Through this criterion alone, science can be distinguished from non-science; in its absence, a theory remains outside the domain of empirical science.

Science does not consist of certain and absolute truths, nor does it aim to attain them. According to Popper, the goal of science is to approach truth progressively through the method of critical rationality. This method involves, first, the clear formulation of scientific problems, then the proposal of solutions in the form of conjectures, and finally their testing according to methodological rules. Thus, the growth of scientific knowledge “proceeds through the elimination of error and may be represented by Popper’s formula:

$P1 \rightarrow TT \rightarrow EE \rightarrow P2$

where we begin with a problem, formulate a tentative theory, and then subject it to the most rigorous tests possible within a process of error elimination, which in turn leads to the



formulation of new problems. These problems arise from our own creative activity” (Popper, K., 1986, pp. 42–43).

Scientific research does not begin with sense observations, as empiricists and positivists claimed. Rather, it begins with problems that provoke our curiosity and demand solutions. To address these problems, the natural sciences employ the same method used by sound human reasoning: the method of trial and error. This method proposes various solutions to a problem and then eliminates those that prove to be erroneous. It “presupposes the existence of many solutions, each of which is selected and subsequently rejected if shown to be false” (Popper, 1994, p. 27).

Karl Popper’s philosophy constitutes an original, distinctive, and integrated system that cannot be fragmented. It is a problem-oriented epistemology (problématiste), since science begins with problems and ends with problems; a fallibilist philosophy based on refutation and criticism; and an objective philosophy that distinguishes between subject and object. Through critical rationalism, reason is liberated from the illusion of absolute certainty and from all forms of authority that restrict its freedom.

Before concluding this study, it is important to emphasize that criticism as the spirit of philosophy is an indispensable intellectual and civilizational tool and a sign of genuine awareness. Development, change, and liberation begin with the exercise of criticism, which shapes thought, individuals, and societies, since every human project is marked by imperfection and limitation. Every falsification of a scientific truth represents a scientific achievement. This is what enabled critical rationalism to secure its place in philosophy and leave its mark on science, philosophy, politics, and ethics.

However, doubt and criticism do not imply the denial of all truth and certainty. Rather, they require acknowledgment of the importance of continuous criticism alongside the existence of relative certainty. Scientific truths are neither absolute nor final, and they never will be. Instead, they are relative and evolving truths, developed through criticism, correction, and transcendence imposed by the scientific spirit grounded in a problem-oriented attitude. Scientific knowledge has established itself as the highest form of human knowledge and the foundation of contemporary civilization.

This raises several questions: Is the principle of falsifiability itself open to refutation and falsification according to Popper’s own logic? Is it the sole criterion for distinguishing science from non-science? Are all the scientific theories we possess today free from shortcomings and limitations? Did they all emerge as refutations of preceding theories? Was not at least some of them the result of creative scientific innovation without any prior model, as in the case of the theory of gravitation? Many scientific, artistic, philosophical, and political innovations have arisen through intuition. As Albert Einstein stated: “The truly valuable factor is intuition” (Beveridge, 1983, p. 116).

Results

Before concluding this study, it is necessary to highlight its principal findings:



- Critical rationalism represents a revolution against traditional thought and its methods in science and philosophy, marking a radical transformation in the course of thought: from closed dogmatic thinking to an open and emancipated critical attitude consistent with the spirit of contemporary science and philosophy.
- Critical rationalism constitutes a revolution against logical positivism and its principle of “empirical verification” as the criterion of scientific knowledge.
- Critical rationalism is an original philosophy that reflects the revolutionary character of contemporary thought and represents a major methodological revolution whose criterion is falsifiability.

Conclusion

Popper’s philosophy represents a Copernican revolution in philosophy in general, and in contemporary philosophy in particular. It marks a shift from closed systems of thought to critical openness. It was influenced by major philosophical and scientific currents that emerged during the twentieth century, constituting a significant epistemological turning point and leaving a lasting impact on twenty-first-century thinkers in the fields of science, philosophy, politics, and ethics.

This study has concluded that critical rationalism constitutes a revolution against both classical and modern philosophical trends, which assumed that human beings could attain certainty and sought to identify definitive sources of knowledge upon which they established methods for science and philosophy. In doing so, they restricted the vast and open horizons of both philosophy and science. Popper also criticized Marxism and psychoanalytic theory, highlighting what he considered their weaknesses and lack of scientific validity. Furthermore, he launched a vigorous critique of logical positivism, challenging its principles and criteria and undermining its theoretical foundations. He likewise opposed all closed intellectual and political frameworks.

Karl Popper’s philosophy represents a major epistemological turning point aimed at addressing the problem of induction and its limitations. He argued that the criterion of falsifiability and refutability is the most appropriate means of distinguishing science from non-science, as well as science from metaphysics. In this respect, his philosophy constitutes a profound expression of contemporary thought.

The contemporary Arab world, perhaps more than ever, is in need of this critical mindset to challenge the various manifestations of stagnation and underdevelopment sustained by flawed patterns of thought. It calls for a deep, rational, and courageous dialogue with the self in order to uncover, correct, refute, and transcend its errors. Not every inherited tradition remains suitable for the present age, for each era and social environment possesses its own challenges and problems. Genuine thought is living and continuously renewed thought that responds to the demands of its time and provides solutions to its problems. Likewise, not all truths are absolute or universally applicable across all times and places; what proved suitable for others may not necessarily be suitable for us.



From this perspective, criticism and refutation become indispensable mechanisms for any open and dynamic form of thought. They enable intellectual renewal and ensure harmony with the evolving spirit of the age through the production and reproduction of sciences, knowledge, and philosophies, thereby contributing to the realization of a better world.

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