

Examining the Core Elements of Popper's Falsifiability Perspective and Their Compatibility

Farrouz. Atai¹, Mohammad. Akvan^{2*}, Mehdi. Najafi Afra²

¹ PhD Student, Department of Philosophy and Religions, Central Tehran Branch, Islamic Azad University, Tehran, Iran

² Associate Professor, Department of Philosophy and Religions, Central Tehran Branch, Islamic Azad University, Tehran, Iran

* Corresponding author email address: www.akvan2007@yahoo.com

Received: 2024-09-19

Revised: 2024-11-07

Accepted: 2024-11-17

Published: 2025-01-01

Falsifiability is a perspective introduced by Karl Raymond Popper, influenced by David Hume's critique of the problem of induction and Immanuel Kant's method of criticism in contemporary philosophy of science. It is considered one of the influential viewpoints in this field. Before the introduction of this theory, members of the Vienna Circle sought to establish a foundation for scientific laws independent of Aristotelian essentialism and rationalism. However, Popper highlights the failure of such efforts, arguing that a scientific theory is not the product of cumulative observations that could serve as proof or confirmation for it. Hypothesis, falsification, the primacy of theory over observation, approximation to truth, and realism constitute the core elements of the falsifiability perspective. This research employs a descriptive-analytical method, and its findings indicate that if observation does not play a positive role in the formation of theories, there is no guarantee of approximation to truth. Moreover, certain expressions of the primacy of theory over observation are incompatible with realism. Ultimately, Popper's perspective entails a form of profound skepticism.

Keywords: Falsifiability, Popper, Correspondence Theory, Hypothesis

How to cite this article:

Atai, F., Akvan, M., & Najafi Afra, M. (2025). Examining the Core Elements of Popper's Falsifiability Perspective and Their Compatibility. *Interdisciplinary Studies in Society, Law, and Politics*, 4(1), 88-99. <https://doi.org/10.61838/kman.isslp.4.1.9>

1. Introduction

Falsificationism is a perspective introduced by Karl Raymond Popper, influenced by David Hume's critique of the problem of induction and Immanuel Kant's method of criticism in contemporary philosophy of science. It is regarded as one of the influential viewpoints in this domain. Prior to the introduction of this theory, members of the Vienna Circle sought to establish a foundation for scientific laws independent of Aristotelian essentialism and rationalism. However, Popper, based on critiques that will be elaborated later, demonstrates the failure of such efforts, arguing that a scientific theory is not the result of accumulated

observations that can serve as proof or confirmation for it. From Popper's perspective, any theory is a conjecture that comes to the mind of a scientist as a solution to a problem. However, this conjecture is not devoid of rationality or merely an instrument for problem-solving; it is subject to critique and ultimately falsifiable, and thus it possesses rationality. In other words, although a conjecture is not a means to reach the truth, the critique and falsification of a conjecture provide a rational path toward approximating the truth. Therefore, according to Popper's perspective, scientific theory precedes observation, and the purpose of observation and experimentation is solely to test a theory and find a way to falsify it.



Popper claimed that scientists never resort to induction when evaluating scientific theories, and that inductivism is nothing more than a myth. Popper consistently emphasized three principles: first, he identified himself as a realist; second, he recognized the pursuit of truth as the ultimate goal of scientists; and third, he asserted that truth can be conjectured but not proven. Popper's primary concern was understanding the nature of scientific theories and distinguishing them from pseudoscience, which was widespread during his time. Marxism and the psychoanalytic theories of Freud and Adler, in his view, were examples of theories that wore the guise of science but were not scientific in reality. Unlike positivists, he did not consider metaphysical claims meaningless but merely believed they were not "scientific" (Abtahi, 2010).

Popper, regarding the problem of induction, stated that the problem does not indicate that scientific inquiry is unjustified, as science is fundamentally not reliant on induction. He points out a logical asymmetry between confirming and falsifying a general statement. The problem of induction arises because, no matter how many positive instances are observed for a general statement, the possibility remains that the next instance may falsify it. For example, if we consider the general statement "All swans are white," observing a single non-white swan would suffice to falsify this statement. Popper argues that science is essentially oriented toward falsifying theories rather than confirming them and therefore posits that science can progress without induction, as deducing the falsification of a theory from a falsifying instance is entirely deductive.

In Popper's view, the method of science is the method of conjectures and refutations, not induction and certainties. Falsifiability means that experience only has the power to show the falsity of empirical theories but cannot demonstrate their truth. This stands in contrast to the positivist approach, which seeks to explain what exists in any field without making any value judgments about what should exist. This approach prioritizes observation over theory and asserts that the method of induction must be used when collecting information through observation and judgment (Popper, 1993).

Nevertheless, to evaluate Popper's theory, it is necessary to separately and carefully analyze the concepts and core elements of this perspective and examine their compatibility with one another. In the following sections,

the core elements of this perspective will be elaborated upon, and certain challenges associated with this viewpoint will also be discussed.

2. Examining the Fundamental Role of the Method of Conjectures and Refutations

According to Popper, every theory is a conjecture that comes to a scientist's mind to solve a problem. However, this conjecture is not devoid of rationality nor is it merely a tool for solving a problem; rather, it is a scientific conjecture open to critique and, ultimately, falsifiable, thus possessing rationality. In other words, while conjecture does not provide a direct path to truth, the critique and falsification of a conjecture serve as a rational means of approaching truth. Popper asserts that conjecture plays a fundamental role in the process of discovering and evaluating a theory. To illustrate the role of conjecture in the emergence of theory, he draws on the theory of evolution.

In Popper's view, theorizing begins with the presence of a problem, and the problem of survival is the origin of all problems. Every organism, including humans, has innate expectations. When these expectations are unmet in the environment, a problem arises. In other words, as long as the expectations of the organism encounter no obstacles, there is no need for conjecture. However, when something contrary to previous expectations is observed, a problem arises, leading to the formulation of a conjecture to address it. In such a situation, the individual's previous expectation, invalidated through observation, gives rise to a new expectation based on the conjecture, which itself is not guaranteed to survive and remains open to further critique and challenge.

Moreover, conjectures play a role in observing events, as individuals do not pay attention to events that align with their conjecture and expectations but focus only on those that contradict their previous conjecture. Numerous conjectural theories can be proposed to solve a single problem, all of which have the potential to be true. Therefore, Popper considers the preference for one theory over others a decision based on conjecture. The only distinction between scientific conjectures and other products of imagination is that scientific conjectures are subject to critique and falsification (Popper, 2007, p. 164).

Popper occasionally describes the process of knowledge acquisition as "critical imagination" and scientific

theories as "imaginative conjectures." In his view, the method of science involves "bold and intelligent conjectures and rigorous attempts to refute them." By "bold," he refers to the content-rich nature of a conjecture; the more a conjecture excludes events, the more falsifiable and scientific it becomes. Thus, Popper emphasizes that as the content of a theory increases, its degree of falsifiability also increases. For instance, the theory that "metals expand when heated" has more content and a higher degree of falsifiability than the theory that "iron expands when heated" and is, therefore, more scientific.

Popper has been criticized for this criterion, as it implies that a preferable theory is one that is less probable. Although Popper presents the method of conjectures and refutations as the criterion of scientificity, he sometimes applies it to non-scientific fields. For instance, he compares the method to that of an artist, such as a painter who first sketches an image experimentally (as a conjecture), then observes it from a distance to identify and correct errors. He even refers to his concept of falsifiability as a conjecture itself. Clearly, extending the method of falsifiability to philosophy and art is inconsistent with Popper's primary aim of distinguishing science from non-science. This issue becomes more problematic when Popper applies this method to animals and even plants. He considers scientific problems to stem from innate expectations and thus regards Pavlov's dog as a theorist who, based on its conjectural theory, associates the sound of a bell with feeding.

However, many expectations and the problems they generate arise from observation rather than being innate. For example, we expect animals to have a visual system based on observation, but when we observe bats, we encounter a problem that is unrelated to our innate expectations. Moreover, many problems arise not from survival concerns but from an innate desire to know (Popper, 2000).

Before Popper, the central problem of the philosophy of science was how universal statements could be proven from particular observations. Popper's response was that universal statements cannot be proven from particular observations, but they can be falsified. In other words, the only role observation plays in science is to discover errors. If it is impossible to identify which event would falsify a theory, it implies that no observation can

confirm it either. Because of his opposition to positivism, Popper avoids using the concepts of "proof" or "confirmation" and instead introduces the concept of "corroboration."

The survival of a theory depends on the diversity, number, and difficulty of the tests conducted to falsify it. These tests do not confirm a theory but strengthen it. The strengthening of a theory demonstrates its approximation to truth. The idea of approximation to truth differs from the concept of probability. The probability of a theory approaches logical certainty only when its content is reduced. However, in the approximation to truth, comprehensive and inclusive truth is approached while maintaining content (Chalmers, 2000).

Falsifiability belongs to the domain of the logic of science; it is merely a logical perspective that establishes the criterion of scientificity. According to this view, a falsifiable theory is scientific. Therefore, to achieve and recognize falsifiability, it is unnecessary for falsification to occur, nor must what is considered falsification be incontrovertible. Logically and a priori, falsifiable theories can be identified. However, determining which event falsifies a specific theory is a scientific question and not related to the logic of science. Every theory is a conjecture awaiting falsification. Hence, science is an ongoing battle that constantly leads to failure and never to victory. Nevertheless, in science, relative success exists; a theory that is more falsifiable is closer to truth. Every scientific theory is a prohibition, declaring certain events impossible, and the more events it prohibits, the more falsifiable it is. In Popper's view, falsification is not merely negative but contributes to the growth and progress of science, as falsifying dominant theories paves the way for scientific advancement. Therefore, falsifiability encourages the proliferation of theories, their clarity, and creativity, along with boldness in proposing innovative and new theories.

To falsify a theory, all methods of critique can be employed. Critique of a theory involves demonstrating that the theory has incorrect results, fails to solve a problem, generates new problems, or is more complex than competing theories. However, according to Popper, the most significant critique of a theory is proving its inconsistency with experimental results. He categorizes critique as internal or external. Internal critique relies solely on the assumptions of the theory itself, while

external critique uses assumptions outside the theory. Still, Popper believes that most falsifications result from discovering internal inconsistencies and rarely from discovering inconsistencies between theory and observation (Gillis, 2002).

Popper denies pure observation and direct data. Therefore, inconsistency between theory and observation does not conclusively falsify the theory, as every critique relies on assumptions. Consequently, the outcome of critique also lacks certainty, and falsifications are not definitive. This suggests that Popper's view may contain internal inconsistency, as he simultaneously claims that falsification brings us closer to truth and that falsifications are not definitive, implying that a falsified theory could be reinstated.

The possibility of reinstating a theory implies that falsification might distance us from truth. Another issue is that the logical falsification of a theory implies the affirmation of its negation, meaning that falsifiability entails provability. Popper attempts to address this by asserting that the negation of a theory lacks explanatory nature and cannot be considered a scientific perspective. However, this response is not convincing because what is falsified may have a negative aspect, and falsification would then entail positive knowledge. For example, falsifying the geocentric theory affirms Earth's motion, which has an explanatory nature for many phenomena (Popper, 1991).

Another issue is that many scientific propositions are not falsifiable. For instance, probabilistic propositions are scientific but cannot be falsified through observation. For example, the statement "There is a 20% probability that this substance will ignite at a specific temperature" cannot be falsified through observation, regardless of the number of contrary observations. This only denies the universality of the judgment, not its probabilistic nature. In other words, only universal and absolute propositions are falsifiable through observation. Existential propositions, such as those stating the existence of a gene, virus, or gravity, cannot be falsified through observation but can be proven.

Popper addresses this issue by explicitly claiming that existential propositions are not empirical. However, the problem is that if existential propositions are not considered empirical, their role in falsifying universal propositions becomes questionable. To falsify universal propositions, particular propositions must be

empirically proven, and unproven particulars cannot falsify universals.

In any case, it appears that by introducing conjecture as the source of theory discovery and replacing the concept of falsification with those of proof and confirmation, Popper arrives at absolute skepticism.

3. Examining the Primacy of Theory Over Observation in Falsifiability

As noted, Popper defends the primacy of theory over observation. However, various statements on this matter appear in his works. Upon examining these statements, we will see that none of them, individually, are sufficient to establish the primacy of theory, and collectively, they are inconsistent.

The first and simplest statement Popper can make is that, according to the falsifiability perspective, a theory results from conjecture, and since observation is conducted to falsify the theory, it comes into play after the theory is formulated. However, this statement is unconvincing because a theory is proposed when a problem exists, and a problem arises when environmental events do not align with individual expectations. Thus, the emergence of a problem, which precedes theory, requires the observation of events contrary to expectations. In other words, if nature is not observed, no question about it will arise. Here, Popper might attempt to resolve this issue by expanding the meaning of theory to include innate expectations as theories preceding observation (Popper, 1995).

However, critics may counter by applying a broader definition of observation, claiming that individuals need some form of internal observation to comprehend their innate expectations. Nonetheless, this approach would become purely rhetorical and semantic, as innate expectations are neither scientific theories nor is their comprehension a form of scientific observation.

Despite this, Popper employs more complex arguments to explain the primacy of theory over observation, the most important of which we will now examine. According to the empiricist view, a theory results from repeated observations. However, Popper argues, based on falsifiability, that considering an event as a repetition of a prior event requires an assumption of similarity, and similarities are determined by theories.

Here, too, Popper's reasoning is unconvincing. His argument holds only if similarities are not observable

and have no objective source. However, the assumption of similarity between things is not arbitrary; it arises from the similarity of perceptions, which, in turn, is caused by the similarity of their sources. Admittedly, things can be categorized differently based on different similarities. Nevertheless, this does not mean that similarities are determined by theory.

Another statement by Popper is that the mind is selective and, based on its innate structure, attends to certain sensory data while neglecting others. However, this argument does not necessarily establish the primacy of observation. While the mind cannot fully attend to all data, the portion it selects is still the result of observation, and the theory arising from this selection is influenced by the observation, which precedes the theory (Popper, 2000).

Another statement by Popper, perhaps the most common justification for the primacy of theory, is that observation is always interpreted in the light of theories. Popper explicitly states, "There is no such thing as uninterpreted observation or observation free from the influence of theory." In his view, even private experiences, once expressed through concepts and linguistic propositions, are historical and cultural.

The premise of this argument is that concepts and linguistic propositions precede observation. However, logically, observation must exist first for a concept or proposition to be created and used to refer to its content. Therefore, Popper's conclusion is incorrect. If observation is theory-laden, as its confirmatory role diminishes, so does its critical function. Critiquing a theory with observation would then mean critiquing theory with theory.

Popper denies the existence of direct data and considers data as interpretations shaped by individual expectations, referring to them as hypothetical. This suggests that he regards observation entirely as a product of theory. Earlier, we discussed this view of Popper. What is crucial here is that interpretation still requires a subject. Thus, even if data are considered interpretative, a kind of non-interpretative understanding is still needed to provide the subject of interpretation. Moreover, if direct data are considered hypothetical, scientific knowledge becomes a network of assumptions and conjectures, leaving no room for critique (Popper, 1993).

Perhaps due to the aforementioned issues, Popper occasionally adopts a more cautious approach regarding the primacy of theory over observation, acknowledging that observation sometimes precedes theory. Elsewhere, he contrasts the empirical content of a theory with the theory itself, clarifying that a theory is merely a collection of definitions and conventions, while the empirical content of a theory remains valid even after the theory is falsified.

While this position partially addresses the above objections, it necessitates a revision of the principle of falsifiability. Accepting the validity of a theory's empirical content implies its proof or at least its empirical confirmation, which is incompatible with the theory of falsifiability.

4. Examining the Correspondence Theory in Falsifiability

Coherence theory and pragmatism are the two main alternatives to the correspondence theory, which Popper critiques to defend the correspondence theory. Coherence theorists define truth as the consistency of beliefs with one another. However, the issue lies in the difficulty of determining such consistency, as individuals are often unaware of the implications of their beliefs. Moreover, if the truth of each new belief depends on its consistency with prior beliefs, it implies the immutability of previous beliefs. Pragmatism, on the other hand, equates truth with utility, which limits the meaning of truth, as utility is specific to the natural sciences. Furthermore, the utility of natural sciences is relative, always raising the question, "Useful for whom?"—demonstrating the relativism inherent in the pragmatic criterion.

Proponents of the correspondence theory do not deny the importance of practical utility or coherence. However, they argue that coherence is merely one of the criteria of truth, which alone is insufficient; correspondence with reality is also necessary for truth. It is evident that such correspondence can result in utility, making the correspondence theory an appropriate explanation for the utility of scientific theories (Lacey, 1983).

In his early works, such as *The Logic of Scientific Discovery*, Popper identified the main aim of science as the pursuit of truth. However, he noted two challenges regarding the concept of truth: first, how propositions

could correspond to facts; and second, how to establish a criterion for correspondence. His familiarity with Tarski's theory resolved these two issues. According to Popper, Tarski's framework, which operates at the meta-language level, allows references to both language and facts, thus enabling the correspondence between the two to be expressed. After encountering Tarski's theory, Popper realized that the correspondence theory derived from Tarski's approach was not incompatible with the theory of falsifiability.

Falsifiability involves accepting the possibility of error, and this acceptance is compatible with the correspondence theory. In other words, accepting absolute truth does not imply accepting an absolute criterion for truth. Accordingly, Popper writes, "We have no criterion of truth, nor do we possess any entirely reliable means of discovering whether a theory is false" (Popper, 1989). However, the lack of a definitive criterion does not invalidate the concept of truth, as many fundamental logical concepts also lack definitive criteria.

Concepts such as validity, inference, and proposition also lack definitive criteria, yet this does not justify abandoning them. In discussing truth, Popper distinguishes between its definition and its criteria. He defends the correspondence theory in defining truth, noting that he initially believed the correspondence theory required a definitive criterion for truth. Consequently, in his early works, he avoided using the concept of truth in formulating falsifiability. However, after encountering Tarski's framework, he concluded that Tarski successfully revived the correspondence theory without succumbing to the problems of traditional realist theories. Thus, Popper offered a realist interpretation of Tarski's theory, defining the truth of a proposition as the realization of its content.

Popper's acceptance of the correspondence theory does not imply the existence of a definitive criterion for truth. That is, the existence of absolute truth does not imply absolute proof. The distinction between theories lies in their relative proximity to truth, with absolute truth as an ideal, regulative principle that remains a guiding aspiration for theorists.

One critique of this perspective is that without knowing the truth, it is impossible to claim proximity to it. Popper acknowledges that the degree of proximity to truth cannot be determined directly through truth itself but

argues that action is necessary, and a theory's resistance to critique indicates its proximity to truth. However, this perspective seems to align Popper with pragmatism, especially since unfalsifiable theories exhibit the greatest resistance to critique. Therefore, if resistance to critique is considered a criterion for proximity to truth, unfalsifiability could also be deemed a criterion for truth (Alvand, 2009).

Nevertheless, Popper identifies additional criteria for preferring one theory over another, which, in practice, indicate proximity to truth. For instance, the precision of a theory's reports, the number of facts it explains, and the level of detail in its explanations all serve as criteria for proximity to truth in Popper's view. Additionally, a theory always has implications, and a theory with more true implications and fewer false ones possesses greater verisimilitude. However, the issue with this last criterion is that the implications of a proposition are neither finite nor well-defined, making it difficult to evaluate their truth.

Moreover, it seems that alongside the criterion of proximity to truth, Popper still requires a criterion for truth itself to determine the truth of a theory's implications. Similarly, determining the number of facts a theory explains necessitates a criterion to verify the reality of the phenomena it explains. Without such criteria, Popper cannot adequately defend the criteria for proximity to truth (Popper, 1995).

Another issue is whether determining the degree of verisimilitude of a theory is itself a conjecture or verifiable. Here, Popper faces a serious impasse: if proximity to truth is merely a conjecture, then optimism about scientific progress is unfounded, and claims of proximity to truth become baseless. Conversely, if proximity to truth is verifiable, then this would imply provability.

Popper chooses the first option, explicitly stating, "Not only are all our theories conjectural, but all our evaluations of theories, including their comparison in terms of their degree of verisimilitude, are conjectural as well." Clearly, in this case, falsifications will not be definitive, and falsified theories may be reinstated—an outcome inconsistent with the idea of proximity to truth and the belief in scientific progress that Popper takes for granted.

In *Conjectures and Refutations*, Popper suggests that falsifiability might also involve the possibility of proof,

describing this approach as moving toward testability to distance science from instrumentalism. He clarifies that a theory is empirical if it is both falsifiable and capable of confirming novel predictions, writing, "Science will stagnate and lose its empirical nature if we cannot find reasons to confirm new predictions." Ultimately, he concludes that increasing the verisimilitude of a theory requires not only reducing its false content through falsification but also increasing its true content (Popper, 1989). Clearly, increasing the true content of a theory and confirming scientific predictions is inconsistent with the principle of falsifiability.

Another point is that Popper occasionally describes truth itself as having degrees. However, this position faces two significant challenges. First, it is inconsistent with the correspondence theory, which Popper supports. If truth is defined as the realization of a proposition's content, it makes no sense to ascribe degrees to the realization of that content.

Second, Popper emphasizes that the idea of proximity to truth operates within a bivalent logic. However, if truth has degrees, the logic would necessarily become multivalent.

5. Examining the Dimensions of Popper's Realism

Popper aligns with realism in various ways. On the one hand, he accepts the existence of a world independent of the mind and critiques idealism. On the other hand, he defines truth as correspondence with reality and critiques competing views such as coherence theory, instrumentalism, and the incommensurability of frameworks. Despite his critique of Aristotelian essentialism, Popper also rejects nominalism, presenting himself as a proponent of a revised essentialism. Finally, he considers knowledge to be intersubjective and objective. Thus, Popper's realism encompasses various dimensions, each of which requires separate examination.

5.1. Critique of Idealism

Popper argues that without realism, the role of science cannot be explained, as the aim of science is to describe and explain the truth of reality. Thus, the validity of scientific theories necessitates the validity of realism. Even the descriptive function of language presupposes the existence of a subject to describe and an audience to

hear the description. Therefore, idealists inherently contradict themselves as long as they use language.

Popper considers phenomenalism, phenomenology, and positivism to entail idealism, accusing idealists of viewing the external world as a product of their imagination. He counters this perspective by pointing to the grandeur and beauty of observable natural scenes, arguing that these cannot be mere constructs of individual imagination. Thus, he concludes that the origin of such scenes lies in a reality independent of the mind.

To further refute idealism, Popper refers to great works of art and literature, asserting that his imagination is incapable of producing such creations, which leads him to deduce the existence of other minds. However, he does not expect idealists to be convinced by this reasoning, writing that an idealist can always retort that one has underestimated one's imagination. Consequently, Popper views the denial of realism as a form of self-aggrandizement, calling it "the most common occupational disease of professional philosophers" (Hempel, 1990).

5.2. Critique of Incommensurability

Kuhn's view represents another alternative to realism, which Popper critiques extensively. Before Popper, observation was considered a means of confirming theories. However, Popper rejected this role, presenting observation as a means of falsification. In Kuhn's theory, however, observation does not even serve as a means of falsification. Kuhn argues that the dominance of a paradigm prevents scientists from addressing anomalies. According to Kuhn, anomalies only gain attention when a paradigm faces a legitimacy crisis, at which point a new paradigm, with its unique logic, methodology, tools, and concepts, emerges.

For Kuhn, incommensurability is a key characteristic of paradigms, as each paradigm's logic and methodology are internally determined, with no shared logic outside these paradigms to enable their comparison. Even the concepts of each paradigm have unique definitions, meaning there is no common language for comparing paradigms.

Incommensurability implies the impossibility of critique and stands in opposition to falsifiability and the pursuit of truth. Thus, in *The Myth of the Framework*, Popper critiques Kuhn's perspective, labeling it relativistic and

arguing that relativism poses a significant obstacle to learning from others. Additionally, Popper contends that Kuhn's view, like all relativistic perspectives, contains dogmas that lead to self-destruction. For instance, while Kuhn relativizes truth within each framework, he implicitly assumes the existence of absolute truth, which distances him from relativism. Consequently, falsifiability is not equivalent to relativism, and the two are fundamentally different (Popper, 2000).

Popper also critiques Kuhn's perspective through the lens of the history of science. He points to different frameworks that have coexisted throughout history and engaged in dialogue, facilitating the growth of science. For example, the historical dialogue between atomism and the theory of continuity demonstrates the simultaneous presence and interaction of two distinct frameworks. Hence, the history of science empirically refutes the idea of incommensurability.

Although incommensurability has often been perceived as a path to human autonomy, Popper argues that it implies the arbitrary acceptance of each framework's principles without recourse to a shared logic. This not only contradicts rationality but also renders humans prisoners of their mental frameworks. Popper identifies similar constraints in the philosophies of Hume and Kant, where humans are bound by habits (Hume) or predetermined mental structures (Kant). Although Kant's Copernican revolution is often cited as the foundation of human autonomy, Popper argues that Kant's thought makes transcending predetermined frameworks impossible. Therefore, contrary to Copernicus, Kant's revolution reinforced anthropocentrism rather than challenging it (Hosseini, 2002).

5.3. Dialogue and Learning

For Popper, incommensurability also denies the possibility of learning through dialogue. Dialogue clarifies the positions of both parties and enables progress toward truth. However, dialogue becomes futile when one culture considers itself inherently superior to another, as it fails to achieve its goal of learning from others. Conversely, a culture that perceives itself as inferior cannot engage in meaningful dialogue with a dominant culture and merely imitates it. Kuhn seems to have assumed that every dialogue would lead to the decisive dominance of one theory. When this expectation

was not met, he rejected the possibility of dialogue. Ultimately, Kuhn's relativism, while ostensibly accepting the plurality and legitimacy of frameworks, sacrifices critique, dialogue, and progress in the process.

Popper identifies the core issue with Kuhn's theory as its disregard for the external world, as Kuhn does not accept external events and realities as criteria for evaluating theories. In contrast, Popper assigns at least a falsifying role to reality. While Popper views theories as hypothetical, he emphasizes that their falsification results from their encounter with reality, a point he sees as supporting realism (Popper, 1989).

5.4. Realism in Logic

In *Conjectures and Refutations*, Popper appears inclined to treat the rules of logic as rules of action. He critiques the term "Copernican revolution" applied to Kant's mind-centered theory for two reasons. First, as Popper notes, Kant's mind remains trapped in a predetermined structure of which it is unaware and from which it cannot escape. Second, whereas Kant's revolution sought to revive anthropocentrism, Copernicus's revolution challenged it by removing Earth—and humanity—from the center of the cosmos.

Popper argues that many logical conditionals have no correspondence with reality and that the rules of logic fundamentally differ from those of physics. For example, the statement "A stone is heavy" is a physical claim about the world, whereas the statement "A stone is a stone" is a logical proposition that makes no claims about reality (Russell, 1988). However, Popper's reasoning here appears flawed, as the proposition "A stone is a stone" implies that a stone is not a person or another entity, thus referencing external reality.

Similarly, Popper's claim that $2 + 2 = 4$ says nothing about the world unless understood in a physical sense is incorrect. He argues that combining two drops of water with two more results in a single new drop, not four. However, by using precise metrics such as grams of water instead of ambiguous terms like "drops," it becomes clear that adding two grams of water to another two grams results in a total of four grams.

In his later works, Popper adopts a realist perspective on logic, viewing it as part of the scientific method and arguing that the function of logic is to transfer truth or falsity. Therefore, logic is inherently linked to the concept of truth (Popper, 1995). When combined with

his correspondence theory, this position underscores Popper's realism in logic.

Popper rejects the idea that the plurality of logics makes logic arbitrary. Citing his involvement in developing a new logical system, he stresses that the choice of logic is not arbitrary, as rationality and critical reasoning require logic. Claiming "my logic is different" in response to critique undermines the method of criticism. Popper aligns two-valued logic with the scientific method, arguing that robust logic is necessary for effective critique and that treating logic as arbitrary is incompatible with rationality.

Logic and mathematics remain problematic areas for empiricism, which must either disregard them or treat them as empirical. Pragmatists often replace truth with utility in the context of logical laws, equating them with rules of conduct, such as traffic laws. However, Popper rejects this approach, as it fails to address the main issue—why the rules of logic are useful.

Similarly, Popper critiques the view that logic merely describes the rules of thought, arguing that it faces a dilemma: if this view is descriptive, it is false, as humans do not always think logically or avoid contradictions. If prescriptive, it requires an objective basis. This basis implies that logic is connected to reality, as it prescribes rules for achieving true beliefs.

5.5. *Revised Essentialism*

Realism in discussing universals refers to the belief in the existence of essences and inherent attributes, standing in contrast to nominalism. In the traditional debate between essentialists and nominalists, Popper distances himself from both views and seeks to defend an intermediate position he calls *revised essentialism*. Popper agrees with essentialists that the goal of science is to provide accurate descriptions of the laws of things but denies the possibility of definitive knowledge. He rejects the idea of final descriptions and, without affirming or denying the existence of essences, argues that such doctrines do not contribute to the progress of science. In his view, they may even hinder it. For example, if gravity is considered an inherent property of matter, questioning the cause of gravity becomes meaningless.

In Aristotelian essentialism, defining things is emphasized, with the assumption that knowing a definition reveals the truth about an object. This effort to

define things precisely, as a path to knowledge, persists from Plato to Husserl and even in analytic philosophy. However, Popper considers attempts to define things futile and problematic, rejecting this aspect of Western philosophy as a form of essentialism (Hempel, 1990).

Popper observes that, in the modern era, Galileo was an essentialist, while the Church, opposing Galileo, portrayed scientific theories as mere computational tools. Instrumentalism, championed by philosophers like Berkeley and Mach, gained dominance over essentialism in the modern era. Yet, Popper also rejects instrumentalism, arguing that testability and falsifiability are the main features of theories, which are lost if they are treated merely as tools. Tools cannot be falsified. Furthermore, if theories are only tools for computation, there is no reason for scientific progress, as many computations can be made using falsified theories. This shows that a theory's preference in science is not merely due to its utility but also its proximity to truth.

Nominalists believe that every word is the name of an object and that universals are merely names for collections of things. Popper counters this view, arguing that, under such an understanding, all statements become analytical (Hempel, 1990). For instance, if "human" refers to Socrates, Plato, and others, then the statement "Socrates is human" simply means "Socrates is Socrates."

If universals are merely names, then the language of science would consist solely of names, lacking the creativity of the mind and leaving no room for hypothesis formation. Thus, Popper emphasizes that the language of science requires "genuine universals," which are universals with indeterminate referents. He calls this view *revised essentialism*. According to this perspective, we should always strive to uncover deeper properties, and every explanation is subject to further refinement.

Popper sometimes refers to the belief in the objectivity of knowledge as a form of revised essentialism, distinguishing it from both Aristotelian essentialism and modern instrumentalism. He argues that the objective laws of science can explain the similarities between things. However, he maintains that he does not believe in final explanations and holds that the laws themselves require further explanation.

Popper identifies two elements in revised essentialism: first, that the laws of nature express the structural properties of the world, and second, that a new theory,

which explains facts with a higher degree of universality, possesses greater depth. Thus, in the scientific process, there is no final explanation, but there is a constant movement toward greater depth (Popper, 1962).

For Popper, knowledge is objective and independent of the mind. This independence contrasts with Descartes' definition of knowledge as justified true belief. Popper rejects this definition, paradoxically stating, "I do not believe in belief." As previously mentioned, Popper considers mental events immaterial, making him a dualist. However, he sees the world of science as independent of the worlds of matter and mind, advocating for the existence of three distinct worlds: the world of matter, the world of the mind, and the world of science.

Popper argues that epistemology has gone astray by focusing solely on the mental world. Objective knowledge, for Popper, is "knowledge without a knowing subject." The inhabitants of the objective world of science include the contents of books, journals, universities, and all collective aspects of science, such as critical arguments, problems, problematic situations, and theoretical systems. Popper considers autonomy the primary characteristic of the world of science.

He cites examples like computer-generated tables or unread books, which he regards as part of science, existing independently of any mind. For objective knowledge, only the potential for understanding is required, with no further prerequisites. Popper's argument for the autonomy of the world of science is that sometimes issues or discoveries arise within it that have not been considered in the mental world.

In explaining this autonomy, Popper even asserts that, for him, the mental world (World 2) depends on the world of science (World 3), not vice versa. He argues that individual self-awareness relies on theories and requires an objective language, while problems in the third world give rise to new theories. Thus, self-awareness is influenced by the objective dimensions of knowledge.

Popper also contends that scientific theories surpass the comprehension of any single individual or even all humanity combined. He refers to infinite problems in mathematics as evidence of the independence of the world of science. Furthermore, the world of science can influence the world of nature (World 1) through its impact on the mental world. For instance, technological effects on nature, such as the application of electrical

transmission theories, exemplify the influence of the third world on the first (Shojai Shakouri, 2011).

5.6. Critique of the Autonomy of the World of Science

Popper's belief in the existence of the world of science and its independence does not equate to Platonism. The main distinction between Popper's third world and Plato's world of ideas is that Popper views the third world as human-made and subject to change. Although Hegel also considered the world of ideas mutable, Popper criticizes Hegel for treating contradictions as essential and necessary. According to Popper's theory of falsifiability, criticism is a means to discover and eliminate contradictions.

A critique of the autonomy of the world of science raises the question of whether the objectivity of knowledge and its independence from the mind align with Popper's criterion of scientificity—falsifiability. Falsifiability requires understanding and critique; a book cannot be subjected to critique or falsification until it is read. Popper's arguments for the independence of the world of science from the worlds of matter and mind are unconvincing. A table created by a computer remains part of the physical world until it is observed and used by a consciousness, at which point it becomes part of the mental world.

Popper argues that if all subjective knowledge were lost but libraries remained, science could be revived, demonstrating the independence of the third world. However, this argument is flawed. A physics book to an unaware mind is merely fuel for a fire, and libraries cannot persist without readers. Moreover, any problem must first belong to the world of awareness to qualify as a problem. While theories may contain implicit problems and implications that elude their creators but are later discovered, these still rely on mental engagement.

Finally, Popper stretches the definition of "problem" and "solution" to prove the autonomy of the world of science. For example, he claims that a plant deprived of sufficient light faces a problem, which it solves by adjusting its growth. Popper writes, "Animals and even plants are problem-solvers, resolving their issues through trial and error and the elimination of mistakes" (Popper, 1996). However, this use of "problem" and "solution" makes the discussion purely semantic. Plants and animals indeed face challenges and solutions specific to their contexts, but these differ fundamentally from scientific questions

and solutions, which are intersubjective and expressed through propositions and theories. Thus, some problems, driven by human curiosity and the desire for knowledge, are unique to humans and are resolved within the frameworks of language and logic.

6. Conclusion

Popper made fundamental criticisms of the principle of empirical verification and its inductivist foundation. His critiques of logical positivism, on the one hand, created a new paradigm known as empirical falsificationism within the realm of scientific knowledge, and on the other hand, provided a new criterion to distinguish empirical science from other branches of human knowledge. Popper defined objective knowledge as "knowledge without a knowing subject" and removed belief from the definition of knowledge, labeling mental data as myth. Therefore, Popper's explanation of the objectivity of knowledge is a materialistic explanation. Although it might seem that Popper extends knowledge to all of existence, in reality, he reduces human knowledge to something material and independent of the mind.

What is significant in Popper's view is the contradictory combination of materialism and idealism. When Popper considers observation to be the result of a theory, he reaches a kind of Kantian idealism, according to which the mind imposes laws on the world. On the other hand, he resorts to a Darwinian interpretation of the process of knowledge, which, by reducing epistemology to biology, leads to materialism. This contradiction reflects a deeper paradox in modern anthropology, where a human, as the measure of all things, has no essential distinction from other bodies and animals. In Popper's works, the concept of revised essentialism remains largely ambiguous and even lacks coherence. Although Popper critiques nominalism and considers science to require genuine universals, he simultaneously calls all universals conventional, which results in problems associated with nominalism. Moreover, the critique of Hume's establishment of knowledge based on nominalism has been proposed, and by treating Hume's critique as definitive, Popper encounters the same issues of nominalism.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were observed.

References

- Abtahi, S. A. (2010). *Rationality of Knowledge from the Epistemological Perspective of Popper*. Young Thinkers Association.
- Alvand, M. (2009). An Alternative Reading of Falsificationism (Responding to Some Criticisms of Popper's Methodology with an Epistemic Approach to Knowledge). *Hawzah va Daneshgah Journal*, 34, 80-95.
- Chalmers, A. F. (2000). *What is Science? An Introduction to Philosophical Epistemology* TRAN - Saeed Zibakalam. Samt Publishing.
- Gillis, D. (2002). *Philosophy of Science in the Twentieth Century* TRAN - Hassan Miandari. Taha Publishing and Samt Publishing.
- Hempel, C. (1990). *Philosophy of Natural Science* TRAN - Hossein Masoumi. University Press.
- Hosseini, S. H. (2002). The Meaning and Verifiability of Religious Propositions. *Qabsat Journal*, 25, 16-25.
- Lacey, J. (1983). *A Historical Introduction to the Philosophy of Science* TRAN - Ali Paya. University Press.
- Popper, K. (1962). *Conjectures and Refutations*. Routledge.
- Popper, K. (1989). *Conjectures and Refutations: The Growth of Scientific Knowledge* TRAN - Ahmad Aram. Shareket Sahami Entes̄ar.

- Popper, K. (1991). *The Logic of Scientific Discoveries* TRAN - Ahmad Aram. Soroush Publishing.
- Popper, K. (1993). *Realism and the Aim of Science* TRAN - Ahmad Aram. Soroush Publishing.
- Popper, K. (1995). *Objective Knowledge: An Evolutionary Approach* TRAN - Ahmad Aram. New Era Thoughts.
- Popper, K. (1996). *Conjectures and Refutations* TRAN - Ahmad Aram. Shareket Sahami Enteshar.
- Popper, K. (2000). *The Myth of the Framework in Defense of Science and Rationality* TRAN - Ali Paya. Tarh-e-No Publishing.
- Russell, B. (1988). *The Problems of Philosophy* TRAN - Manouchehr Bozorgmehr. Khwarizmi Publishing.
- Shojai Shakouri, M. (2011). Falsificationism Under Criticism. *Philosophical Knowledge Journal*, 14, 128-147.