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Karl Popper and His Struggle Against Logical Positivist in the Context of Falsifiability Theory

Yanlışlanabilirlik Teorisi Bağlamunda Karl Popper ve Mantıksal Pozitivistler ile Mücadelesi.

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Abstract
The purpose of this study is to better understand Popper's method of falsifiability, based upon Logical Positivists and their methods- Popper was one of them for a period. It aims to examine the inductive method, which is one of the main reasons for Popper's criticism of positivists and the deductive method brought by Popper. Karl Popper (1902-1994) was considered one of the most important science philosophers of the 20th century, made significant contributions to the philosophy of science and society. Some of science philosophers supported Popper's theories, at the same time some of them criticized them fiercely. Despite all, it has attracted the attention of many people in the world of science and philosophy. In our study, we will examine the development process of logical positivism, which is one of the important movement of thought in that era, and reveal efforts to separate science from metaphysics. We will also examine the logical evidence that Popper brought to the verificationism and try to contribute to the falsification principle that he put forward.

Keywords: Karl R. Popper, Inductive, Falsification, Deductive, Verification, Logical Positivism.

1. His Life And Intellectual Personality

1.1. Karl Popper's Life

Karl Raimund Popper was born in Vienna on July 28, 1902.[1] Describing his childhood as a bit puritanical, Popper greatly admired his cousin, Eric Schiff, for his being one year older than him, for his tidiness and especially for his good looks. Popper had a good library because his father Dr. Simon Siegmund Carl Popper was a law professor at the University of Vienna. Another important figure in Popper's life was his friend Arthur Arndt. As native German, Arndt was born in Moscow and spent his youth in Moscow. Arndt, who was about twenty years older than him, was a socialist. Although Arndt was not a big fan of Marxism, he also thought Marx was the most important socialist theorist. As a result of this friendship, Popper read a book about socialism for the first time (Edward Bellamy's Looking Backward).[2] Karl Popper's mother Jenny Popper (her maiden name was Schiff) (1864–1938) came from a musician family and was a talented pianist. Both Simon and Jenny Popper were Jews by origin, but later converted to Protestantism. Apart from Karl, they had two daughters, Dora (1893–1932) and Anna Lydia (1898–1975) who were older than him.[3] Popper was only 12 years old when the First World War began. And during this war, some changes emerged on Popper's ideas, and it also influenced his approach to political thought with more criticism. Under the influence of socialist propaganda, Popper firstly recognized Austria's attack on Serbia and Germany's attack on Belgium but he veerd away his idea in a short time and said, 'We must lose this war'. Popper was deeply

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1 Ekin Erdem, "Karl Popper'in Platon Eleştirisinin Epistomolojik ve Politik Kökenleri", *Anadolu Üniversitesi Sosyal Bilimler Dergisi* 3 (2019), 424.

2 Karl Popper, *Bitmeyen Arayış*, Translation: Mustafa Acar, (İstanbul: Serbest Yayınları, 2019), 18-21.

3 P. Schroeder- Heister, "Popper, Karl Raimund (1902-1994)", *International Encyclopedia of the Social and Behavioral Sciences,* ed. NJ Smeser, PB Baltes, (Bergama: Elsevier, 2001), 11727.

affected by the fact that many of his friends and cousins fought in the Austrian army and did not return.[4] While Popper had no concern with contemporary music, he learned church music at the Viena Conservatory and developed himself in that area.

Karl Popper decided to drop out of school in late 1918. He continued to study at the University of Vienna until 1922 without being enrolled. Popper, who describes the time spent at school as a waste, supports this idea as follow. At school, the student had to listen to the teacher no matter how boring the lesson was. It was also mandatory to attend school. Popper, who found maths teacher Philip Freud interesting and different, was away from school for about two months due to an illness. When he returned, he saw that his friends, in cluding math class, had not made any progress and this affected his decision to drop out of school.[5]

During the Treaty of Brest-Litovsk between Russia and the Central Powers in 1918, the speeches made by the Russians, especially Trotsky's speech, really influenced Popper.[6] In 1919, Popper had become a communist together with several friends with of the influence of communist propaganda. This situation continued for only a few months. The event that caused Popper to leave Marxism was the death of many young people in the conflict that broke out with the provocation of the communists while some young and unarmed socialists were trying to help the imprisoned communists.

Although this violence was caused by the police, Popper blamed himself. Popper asked himself these questions: I'd read Marx and Engels, but did I really understand them? Did I ever think about Marx with critical thinking? Realizing the dogmatic ideas and intellectual arrogance of this ideology, Popper became an anti-Marxist.[7]

In 1922, while he was still a student, he worked as a furniture master apprentice and received a certificate. In 1924, he completed his initial teacher training and started to work as a teacher.[8]

Popper's interest in philosophy was triggered by the family environment in which he grew up. Another reason for his interest in philosophy is his conversations with his master A.Pösch while he was a carpenter.[9] Popper describes his master as a tender-minded person.

4 Popper, *Bitmeyen Arayış*, 22-24.
5 Popper, *Bitmeyen Arayış*, 47-48.
6 Giancarlo Bosetti, "Karl Popper ile Marksizm, özgürlük ve tarihsicilik üzerine…", Translation: Sinan Gürtunca, *Liberal Düşünce Dergisi* 33, (2006), 56.
7 Popper, *Bitmeyen Arayış*, 49-51.
8 Rahmi Şeyhoğlu, "Açık Toplum ve Karl Raimund Popper", *Türk Akademisi Siyasi Sosyal Stratejik Araştırmalar Vakfı* 8 (2014), 1
9 Karl R. Popper, *Tarihselciliğin Sefaleti*, Translation: Sabri Orman, (Istanbul, Deli Publications, June 1998), 7.

When they were alone with he master, he used to ask Popper some questions about history and when Popper couldn't find the answer, his master used to answer the question. Then when he asked a few more questions and gave the answers, he used to praise himself and say he knew everything. Speaking of this situation, Popper says that the biggest reason he was Socrates' student and learned about information theory was his master. Because, according to Popper, his master not only taught him how little he knew, but also allowed him to see the infinity of his ignorance.[10] In 1928, received doctoral degree in psychology on thesis entitled "On Questions of Method in the Psychology of Thinking" under the supervision of Karl Bühler.

Popper was a lecturer in Philosophy at Cantenbury College in Christchurch, New Zelenda, for a short time from 1937 until the end of the Second World War and became a lecturer at the London School of Economics and Political Sciences in 1946 with the support of his friend Hayek in England. Between 1949 and 1969, he was a professor of logic and science at this school and retired in 1969. He won a lot of honors. He was knighted by the Queen in 1965. In 1993, he was awarded the Otto Hahn Peace Medal by the United Nations. Popper died in Croydon, London on 17 September 1994.[11]

1.2. Scientific Method of Karl Popper

Popper is one of the philosophers whose thoughts are understood in different ways. Lakatos praised Popper, describing him as one of the very intelligent people of our time and also saying that Popper's ideas provided the most important development in 20th century philosophy. Scientists such as Jacques Monod, John Eccles and Sir Ernst Gombrich have expressed that they influenced by Popper. Bryan Magee stated that The Logic of Scientific Discovery was translated into English too late and that the philosophy generation in England could have been much different if it had been published earlier. Feyerabend, on the other hand, mocks Popper's thoughts and calls Popper “our own mini - Kant." and he criticizes him saying that he is not a philosopher, he is a smart-ass.[12]

Popper is one of the philosophers who has unique studies on philosophy of science, methodology, information theory and political philosophy. Popper used sciences such as quan-

[10] Popper, *Bitmeyen Arayış*, 13-14.
[11] Şeyhoğlu, “Açık Toplum ve Karl Raimund Popper”, 1.
[12] Cemal Güzel, *Sağduyu Filozofu Popper*, (Ankara, Science and Art Publishing, 1998), 7-8.

tum physics, relativist physics and biology in his works and also presented philosophical interpretations of these studies. On the other hand, as someone who experienced the first and Second World Wars, he addressed the problems caused by these wars in political philosophy.[13]

According to Karl R. Popper, being a philosopher is a situation that requires an apology. Because when we look at the history of philosophy, the fact that there are more embarrassing debates than arguments to brag about made Popper say these things about being a philosopher.[14] Popper has two aspects. As the political philosopher (expressed with "The Open Society and Its Enemies") and the scientific philosopher aspect (expressed with "The Logic of Scientific Discovery"). One of the basic principles of Popper's philosophy is "rational attitude". According to Popper, it's important to be critical. People can be wrong but what matter is the lessons people learn from their wrong behavior. We call people's tendency to learn lessons and the search for wrong things "rational attitude."[15]

2. Logical Positivists (Vienna Circle School/ Verificationists)

In order to better understand Popper's ideas, the Vienna Circle school of that period also needs to be carefully examined. Popper's criticism of the views of the Vienna Circle can be regarded as the beginning of the interaction.[16] This group was founded in 1910s, when a group of young people gathered in a coffee shop every Thursday evening and talked about the philosophy of science until the morning.[17] And with M. Schlick's seminar in Vienna in 1923, attended by a group of scientists, reached a further point. H.Hahn, O.Neurath, K.Reidenmeister, P.Frank, K.Goedel and other thinkers interested in philosophy attended in this meeting.[18] In Vienna Circle most of attendees were mathematicians and physicists. One of the objectives of them is to separate metaphysics from science and philosophy, which have stood as a set in front of people's minds for years by bringing a criterion to meaning and science. The Circle became a complete school in 1929 with various conferences, open discussions and articles and they called this school as "The Scientific Worldview".[19]

13 Popper, *Tarihselciliğin Sefaleti,* 7.
14 Özün Çetinkaya, "Karl Popper'ın Yönetiminde Hipotetik-Dedüktif Formun Bilimsel İnşası", *Pamukkale Üniversitesi Sosyal Bilimler Dergisi* 19 (2014), 104.
15 Güzel, Sağduyu Filozofu Popper, 7.
16 Popper, Tarihselciliğin Sefaleti, 8.
17 Ömer Demir, Bilim Felsefesi, (İstanbul, Ağaç Publishing House, 1992), 15.
18 Sibel Akgün, "Karl Popper'ın Tarih, Toplum ve Siyaset Felsefesi Üzerine Görüşleri", FLSF Felsefe ve Sosyal Bilimler Dergisi 7 (2009), 60.
19 Demir, Bilim Felsefesi, 15-16.

The scientific understanding that Popper criticizes predicted the generalization of information obtained from the factual world by the induction method, the transfer of information to our minds by the verification method in these generalized hypotheses. Besides, it based on the following assumptions:

1. They claim that the mind was empty before its relationship with the object.
2. The human mind perceives objects objectively.
3. Under favour of the qualification of phenomenons and the relationship between phenomenons, we can reach the induction from partial thesicle.
4. Hypotheses, which is confirmed as a result of empirical comparisons, pass through an cumulative process and form the basic structure of science.

These inductionist conceptions of positivists are criticized by Popper.

1. Observation doesn't have an earthly chance without theory, it comes into existance under favour of theorical structure which makes it meaningful.
2. Based on partial information, reaching universal information doesn't mean logical absoluteness.
3. The criterion of scientificness is falsifiability.
4. Scientific knowledge doesn't advance by the multiplication of the truths but by the elimination of the fallacies.[20]

We can discuss the basic thesis of Logical Positivists in four groups: Cognitive significance, verifiability principle, induction, encounter (Correspondence/Equivalence) rule.

Cognitive Significance

According to logical positivists, if a sentence is not tautologic and cannot be factually verified, it should be considered meaningless. Tautology is an expression with the same content of information, both verb and subject. For example, in the sentence "Ali is human", "Ali" is the subject and " human" is the predicate. The word "Ali" covers being human, and in this case, it does not give us any different information about the subject. Again, "people are male or female" expression is tautologic.

Verifiability Principle

20 Demir, *Bilim Felsefesi*, 29-30.

The accuracy of a proposition depends on how much the content of that proposition is supported by facts. If a person knows by which observations he/she can verify or reject a proposition as false, we say that this proposition has a factual meaning. It should also be noted that although we know that many propositions are verifiable, in practical terms we may not have the chance to verify it. The proposition of "the world's highest point is Mount Everest" is verifiable in practical terms, but does not seem possible to verify. However, the proposition that "the matter that forms the essence of the universe is in evolution" is a meaningless proposition, since it is not possible to confirm it with our sensory observations. All the propositions that we cannot confirm with our sensations are metaphysical. Logical Positivists, who consider metaphysics meaninglessness equal, stated that there is no claim beyond saying 'you stole this gold' in the example of 'you were wrong to steal this gold'. To say that the behavior was wrong is not a new claim, but simply that it is not considered ethical. As the example shows that, whether a term makes sense depends on its verification.

Induction

Before explaining induction, it is better to mention the importance that logical positivists gave to this concept. Moritz Schlick (1882-1936), who was an important philosopher in Vienna Circle, took over the chair called Philosophy of Inductive Sciences from Ernest Mach (1838-1916) in 1922. It is not coincidental that the name of an important philosopher's chair is "induction". This is a result of the importance that positivists give to induction. Induction, which played an important role in the emergence of scientific thought, has been reexamined by logical positivists together with the principle of verifiability. The attempt of Circle to draw boundaries through what makes sense and what is not has only changed the existing problem. Logical positivists who needed another criterion that separated the lack of meaning and meaning accepted the verifiability criterion, which is on the same plane as the verifiability by observational propositions. For Popper, it was a minor change of form, so there was no real difference.[21]

We can briefly define induction as follows: The method of achieving complex results based on partial observations is called induction. In order to verify the proposition of "Mehmet's rabbit is white", we can find Mehmet's rabbit and then check its color to verify or falsify this proposition. However, if we say that "all rabbits have four leg", it is necessary to check one by one all the rabbits that exist on Earth in order to verify this proposition. Here, the induction method helps us to free from this burden. We cannot use experimentation to verify some

[21] Kemal Batak, "Bilim Tümevarım Kaynaklı mıdır ya da Tümevarım Diye Bir Şey Var mıdır? -Karl Popper'ın Tümevarım Eleştirisi", *Marmara Üniversitesi İlahiyat Fakültesi Dergisi* 34 (2008), 238.

propositions. Mathematical propositions is one fo these. We cannot compare the accuracy of the 2+2=4 equality with the facts. If we try to test this equality experimentally, when we put two more next to 2 oranges, it is an expression of mathematical equality in our minds. Kant called such propositions as synthetic a priori propositions. In this way, Logical Positivists took the shortcut of accepting mathematical laws logically correctly.[22] A lot of observation is needed to verify an induction. However, can we definitively verify a proposition through experimentation and observation methods? It is one of the most crucial questions against logical positivists. Because they accepted any information that was not empirically verified as metaphysical information, they chose to reject them. Here, logical positivists are in a contradiction. The verification method requires always accepting it as correct by abstracting information that is currently correct. At this point, they get very close to the metaphysics they want to get away from. Realizing this deficiency, Popper tried to find an alternative way. [23]

Encounter (Correspondence/Equivalence) Rule

Logical positivists have argued that the scientificness of a theory should be expressed by a mathematical formula of the relationship that this theory predicts. They have predicted an isomorphic relationship that is exactly the same reality between the cognitive system of symbols and factual reality. Since not every word except the depiction of facts has an isomorphic equivalent, it is considered meaningless because it does not have exactly the same (isomorphic) equivalent.[24]

With the influence of E.Mach, the philosophers of the Vienna Circlet placed philosophy against metaphysics. In addition according to these thinkers philosophy should be verifiable. Therefore the unverified judgment is metaphysical and does not make any sense. As a result of this opinion: Some questions such as "What's meaning?" and "What is verification?" came forward, and Vienna Circle philosophers concentrate on these problems. For Einstein's Theory of Relativity, "in what circumstances I cannot defend my theory or what causes my theory to be falsified?". Based on this example, Popper argued that the characteristics of science are not verifiable, but falsifiable.[25] With this method which he followed, he left the Vienna Circle. Popper attended a lesson given by Einstein in his youth and later mentioned that this lesson influ-

22 Demir, *Bilim Felsefesi*, 22-24.
23 Deniz Kurtyılmaz, "Pozitivizmin Doğrulama ve Yanlışlama İlkeleri Ekseninde Modern Bilimin Bilgiyi Metafizikten Arındırma İdeali", *Bülent Ecevit Üniversitesi İlahiyat Fakültesi Dergisi* 1 (2018), 26.
24 Demir, *Bilim Felsefesi*, 26-27.
25 Popper, *Tarihselciliğin Sefaleti*, 9.

enced him very much. He says that at that time Newton mechanics and Maxwell's electrodynamics were both accepted as unquestionable truths. Ernst Mach criticized Newton's theory of absolute time and absolute space based on Newton's laws. Marx, Freud and Adler were also in a different situation than the dogmatic state of that time. Einstein, on the other hand was trying to find a different way to make the theory of his inferences untenable. Popper was influenced from this situation and decided that it was exactly what he was looking for. Because dogmatic thinking, which was constantly seeking verification, was far from a scientific attitude for Popper.[26] Of the four theories Popper was interested in, he saw only one that was not inductive by its nature, Einstein's theory of relativity. What distinguished Einstein's theory from Marx's, Freud's and Adler's theories was that it could be tested in a way that could be shown to be wrong in principle. In this way, Popper claimed that falsifiability is the boundary point between science and pseudoscience and that all theories that are allegedly scientific should be falsifiable.[27] Popper justifies Kant's statement, "Our mind does not take its laws from nature, it makes nature accept its own laws." Kant however was wrong about that our search for information would be compulsively accurate, that these laws were strictly true, or that their practice of nature was definitely successful. Because of these thoughts, Kant believed that Newton's dynamic was a priori valid. Because of these thoughts, Newton's theory was taught as strict and immutable facts in the West. In addition, Popper's other criticism of Kant is why a priori valid information, such as Newton's is difficult to obtain.[28]

A.J. Ayer, one of the logical positivists, stated that; "A proposition is said to be verifiable if and only if its accuracy can be definitively determined by experiment." If a hypothesis has no connection with the experiment, it also has no factual content. Logical positivists agree that theological language is not successful in meeting the empirical verifiability criteria and has no cognitive equivalent. They claimed that religion and metaphysics were meaningless because they could not verify their claims in experimental ways. For example, a person who claims that litmus paper changes color in acid can prove this claim by performing various tests. However, such a method is not possible in religious proposition. For example, it is impossible to test a religion proposition such as "God is mighty" by an empirical test method. Therefore, logical positivists

[26] Popper, *Bitmeyen Arayış*, 55-57.
[27] Kevin G. Helfenbein - Rob DeSalle, "Falsifications and corroborations: Karl Popper's influence on systematics", *Moleculer Phylogenetics and Evolution* 35 (2005), 272.
[28] Kemal Batak, "Bilim Tümevarım Kaynaklı mıdır ya da Tümevarım Diye Bir Şey Var mıdır? -Karl Popper'ın Tümevarım Eleştirisi", 242.

see such statements as meaningless statements without characterizing them as true or false.[29] Logical positivists are also called verificationists. Because, according to them, if the hypothesis or theory could not be verified by experiment and observation, they would be considered metaphysical thoughts (even if this was God or morality). The aim here is to save philosophy from metaphysics and to reduce philosophy to logic.[30] According to the verificationist understanding, scientific knowledge means solid and absolute knowledge. Again according to the philosophers of this understanding, in order for a hypothesis to be accepted as correct that hypothesis must be verified with some facts, experiments and observations.[31] According to logical positivists, the verifiability of the proposition reveals its scientificness. The verificationism has three basic principles:

1. The proposition should not be against logical rules.
2. If the solution consists of propositions, directly it should be about the observed facts.
3. Although the propositions that meet the two specified conditions may not be logically problematic but because of the possibility of being incorrect, the hypothesis or experiment should be verified by empirical methods.[32]

3. Popper and Falsifiability (Critical Rationalism)

Popper, on the other hand, argued the distinction between scientific and unscientific rather than meaningful and meaningless with the measure of falsifiability. According to Popper, it would be wrong to reduce meaningfulness to science. Therefore, being metaphysical does not mean being meaningless.[33] Hume was against this understanding of the verificationists with some of questions. When we observe that event A and event B take place together, we cannot say that every time event A occurs, event B will happen. It is not a logical but a psychological inference. No matter how many times we observe these two events happening at the same time, we cannot conclude that this is going to happen every time. Again, just because the sun rises every day does not mean that it will definitely rise tomorrow. However, if someone says that we know what time the sun will rise in the next day just at the right time, we can respond to him/her

[29] Tuncay İmamoğlu, "Mantıkçı Pozitivizm, Wittgenstein ve Din", *Atatürk Üniversitesi İlahiyat Fakültesi Dergisi* 35 (2011), 42-43.
[30] Enis Sınıksaran - Aylin Aktükün, "Karl Popper'ın Yanlışlama Kuralı, Hipotez Testleri ve İktisat", *İstanbul Üniversitesi İktisat Fakültesi Mecmuası* 2 (2004), 48.
[31] Nuriye Merkit, "Karl Popper ve Yanlışlanabilirlik İlkesi", *Birey ve Toplum Sosyal Bilimler Dergisi* 1 (2021), 131.
[32] Deniz Kurtyılmaz, "Pozitivizmin Doğrulama ve Yanlışlama İlkeleri Ekseninde Modern Bilimin Bilgiyi Metafizikten Arındırma İdeali", 24.
[33] Demir, *Bilim Felsefesi*, 30.

in two ways. The first is as follows: Just because the laws of physics were correct in the past does not mean that they will always be correct in the future. Secondly, the laws of physics are general propositions, no matter how many observations are made. Therefore, the effort to prove this induction requires acceptance of the accuracy of induction initially. Science cannot conclude that nature events in the past will be the same in the future. Because the future cannot be proved experimentally. It is also impossible to prove it by logic or by some assumptions. Because it is impossible to conclude that, all future events will be the same as the past or the past will be the same as the future. Hume says that induction is not possible for these reasons, yet we tend to be psychologically inclined to them.[34] Can the claim that a universal theory is true be justified on experimental grounds? Popper says that his answer to this question is the same as Hume's, which means no. No matter how many times it is done, the correct test proposition cannot prove the claim that the explanatory universal theory is correct. In reality, Popper has caused Hume's gap to grow even further for the logician positivists. Because Hume stated that the causality between phenomena cannot be clearly obtained by empirical methods of natural sciences, and therefore it is based on probability rather than certainty. However, Popper went further than Hume here and criticized him for his thoughts. Popper allows us to justify the claim that probability will benefit science, that the statement that is true or false, rather than just the statement that is true, counts the truth of the proposition and sometimes the claim that universal theory is incorrect.[35] Popper was described as an official opponent by Otto Neurath for his criticism of the Vienna Circle, especially regarding the induction.[36]

Induction is generally defined as logic or thought that progresses from private to general that is, after making a series of observations, it creates a generalized expression (hypothesis, theory, conclusion, etc.). Alternatively, induction can be considered as confirmation or verification of a general expression through observational repetitions.[37] In another example, although all the swans we have seen to date are white, we cannot say that "all swans are white". Even if we make observations and see that 100,000 swans are white, we cannot come to that conclusion. Because there may be a swan of another color elsewhere, or there is no guarantee that we will not encounter such a situation in the future. Therefore, since scientific laws are considered as

[34] Bryan Magee, *Karl Popper'in Bilim Felsefesi ve Siyaset Kuramı*, translation: Mete Tunçay, Şahin Alpay, (Istanbul, Remzi Bookstore, 1990), 18-19.

[35] Deniz Kurtyılmaz, "Pozitivizmin Doğrulama ve Yanlışlama İlkeleri Ekseninde Modern Bilimin Bilgiyi Metafizikten Arındırma İdeali", 27-28.

[36] Kemal Batak, "Bilim Tümevarım Kaynaklı mıdır ya da Tümevarım Diye Bir Şey Var mıdır? -Karl Popper'ın Tümevarım Eleştirisi", 238.

[37] Helfenbein - De Salle,"Falsifications and Corroborations: Karl Popper's Influence on Systematics", 271.

in this proposition in hypotheses, the fact that those laws and hypotheses have been verified by various methods to date does not lead us to conclude that they are definitively verified and they are scientific information.[38] If a proposition like "all swans are white" contains a basic proposition, then that proposition is also falsifiable. Popper gave the name of basic proposition to the propositions, which are about an object that is in a certain place and time. If the hypothesis also has one or more observation proposition in opposition to itself, that hypothesis can be logically falsifiable. When we say, "There is a black swan here", this observation cannot be accepted immediately and unconditionally. It is possible that someone claims that the actual color of that swan is white, but that they may have painted the swan black. They may even claim that this creature is not a swan, but another species.[39] While it is possible to find an example that contradicts the law with a single observation that we will make in this way, for the proposition that we are trying to verify, an infinite number of observations must give the same result. Therefore, the principle of falsification has more certainty in a theoretical sense than validation.[40] It should also be noted that Popper has paid attention to the difference between logic and methodology in his falsification concept. The more Popper logically defends falsificationism, the more methodologically he is cautious about falsificationism. Although it is not possible to fully verify a scientific law, it can be falsified. However, when examined methodologically, it is necessary not to be impatient about the falsifiability of the proposition. We may have made a mistake in the observations. The bird we saw may not be the bird we're looking for. Therefore, a definitive falsification cannot be reached methodologically.[41]

Popper thinks that it is not known whether science will provide information about nature. It cannot be argued that with science's progress in time, we will get close to the real knowledge of nature. It is not known whether we will find causality laws in the future, as we do not know for certain about causality. We cannot say that, with these thoughts Popper has the same ideas as absolute skeptics. He does not want to be completely dominated by skepticism. In such a situation, it is inevitable that science will become impossible. Although we know nothing, he has sought a way to do science without certain facts that we will create theories. At this point, Popper, as a solution, came up with the idea of creating a factualism without facts. Since there are no facts, it is not possible to test theories with facts. The testing of theories will again take place with theories. He has sought a method to fulfill the task that facts have done in the

38 Sınıksaran- Aktükün, "Karl Popper'ın Yanlışlama Kuralı, Hipotez Testleri ve İktisat", 48-49.
39 Demir, *Bilim Felsefesi*, 35-36.
40 Deniz Kurtyılmaz, "Pozitivizmin Doğrulama ve Yanlışlama İlkeleri Ekseninde Modern Bilimin Bilgiyi Metafizikten Arındırma İdeali", 28.
41 Magee, *Karl Popper'in Bilim Felsefesi ve Siyaset Kuramı*, 21.

past. Some propositions are needed to replace the facts. However, these propositions are temporary facts, the validity of which has been decided by scientists.[42]

Let's give another example of Popper's falsifiability. We start with the assumption that it is a scientific law that water boils at 100 degrees Celsius. We can find corroborative samples but no matter how many corroboratives there are, it's not enough to prove it. We can test it in situations where it does not apply. With this method, we can find things that no one has ever thought of before. With the help of imagination and tests, we realize that water does not boil at 100 degrees Celsius in closed containers. And so our assumption that it's a scientific law fails. In this case, we can follow the wrong path and try to save our proposition with the following statement: "Water boils at 100 degrees Celsius in open containers." Then we start looking for ways for falsification of this premise systematically. By using our imagination even more, we can find this falsification more above sea level. We need to further reduce the experimental content of this proposition we have put forward: "Water boils in open containers at 100 degrees Celsius at sea level atmospheric pressure." After that, our third proposition and its testing continue systematically. In the beginning, we were close to the discovery of a new problem when we discovered that water does not boil at 100 degrees Celsius in closed containers. Why so? With this question, we were forced to come up with a richer hypothesis than our original simple premise. And now, we have a formulation which has more experimental content than our first hypothesis. When we move forward in this way, whether our theory is wrong or right, our gain here will be that we know more about the world than we knew until then. It allows us to make comparisons between the judgments that arise as a result of the tests and the new observable experiments. If some parts of our theory are not correct, then a new discovery comes. And that gives us more knowledge and a better way of theory searching. If we tried to verify our proportion that water boils at 100 degrees Celsius, we would not have trouble finding billions of samples. But that wasn't enough to prove that our proposition was correct. Finding examples that supported our first proposition would not have made us think of changing it and at the same time would not have made us doubt it. Apart from a random example, we would not go any further. Such a coincidence would be the best thing that could have happened to our proposition. Therefore, the braver our theory, the more it will tell us and keep our imaginations energetic.[43] As our example shows, there are tight links between the objectivity of science and its progress. Any proposition that can be falsified puts itself a little further apart from metaphysics

42 Sercan Kabakçı, "Karl Popper ve Yanlışlamacılığı", *Madde, Diyalektik ve Toplum Dergisi* 3 (2019), 188.
43 Magee, Karl Popper'in Bilim Felsefesi ve Siyaset Kuramı, 22-23.

and ad hoc (temporary) improvements. It saves science from evolving into a dogmatic inference and becoming static.[44]

Popper's description of knowledge for this period is as follows: A structure built on poles in a swampy area. The understanding of knowledge at that time, just like the structure in this example, has the illusion that it is based on solid foundations. After a certain time, the foundations of this structure may rot, just like in this example, the knowledge that is considered to be true can be falsified over time. Just like the poles in the swamp need to be controlled at certain intervals and the foundation reinforced, the scientists should accept the information they have reached for a short time as reliable information and always seek new information based on this information. A scientist should be able to dive into the depths of science insistently.[45]

Popper's aim is never to determine whether the theories are true or not. The important thing is whether they are scientific or not. Theories are not tested by nature, but we can test them with logic. Subjective effects are speculative. Popper emphasizes the need to be objectively tested while leaving the subject alone in the process of creating assumptions. He moves objectivity from the phase of creating assumptions to the phase of testing. It does not matter what intentions and purposes a theory is created with. As long as it is formulated in a falsifiable way. Although the most absurd theories are created in this way, they will be eliminated in the first tests.[46]

Popper's principle of falsifiability has been subjected to criticisms such as "how can a falsifiable proposition be scientific?" However, what Popper means by falsifiability is not the fact that falsified propositions are scientific, but the determination of which proposition will be considered false as a result of tests or under what conditions. The central concept of Popper's falsificationism is testability. We cannot talk about being scientific for an untestable proposition, nor can we know when it may be falsified. Of course, some propositions can be tested when we examine their contents, but they may not be logically falsifiable. A statement that "it will or will not rain today" will be verified in both possibilities, because it has two possibility; it will rain or it will not rain. Therefore, it is not possible to say that this proposition has information content.[47] According to Popper, hypotheses must withstand the toughest tests. In cases where

44 Deniz Kurtyılmaz, "Pozitivizmin Doğrulama ve Yanlışlama İlkeleri Ekseninde Modern Bilimin Bilgiyi Metafizikten Arındırma İdeali", 29.
45 Karl R. Popper, *Bilimsel Araştırmanın Mantığı*, Translation: İlknur Aka and İbrahim Turan, (İstanbul, YKY, 2020), 18.
46 Kabakçı, "Karl Popper ve Yanlışlamacılığı", 189.
47 Merkit, "Karl Popper ve Yanlışlanabilirlik İlkesi", 137.

hypotheses are not falsified under these conditions, Popper raised the term Grad der Bewahrung (Degree of Verification). So, understanding what it means by "verification" is very important to understand the full scope of Popper's philosophy of science. The degree to which a hypothesis withstands tough tests, the evaluation of the value of the hypothesis, is the degree of its verification. Hypotheses other than tautologies that have been tested and have not been falsified have been verified. However, the validity of such a hypothesis is not one of a verified hypothesis. Specifically, it should not be considered an "accurate" statement after critical testing. Verification is temporary: One test may have confirmed a hypothesis yesterday, a more serious test may have confirmed it today and the most severe test could confirm the hypothesis tomorrow. Therefore, the rejection of the word "approval" is in full harmony with Popper's attitude towards the hypothesis test and his skeptical attitude towards our ability to claim to have discovered the "truth".[48] Popper also advised us to abandon our theories easily if necessary. Accepting our theories as unfalsifiable truths means that our theories cannot be tested enough. Therefore, although Popper may seem naive at the logic level, he is also a highly critical falsificationist at the methodological level. Many of the mistakes about his work arise from not being able to see this difference.[49] For Popper, being falsifiable or not, are different things. Theory may have falsifiable feature. However, it has not been falsified for now, as it has not yet encountered a better or more qualified theory than itself. It is possible to falsify the theory by encountering a better theory and accepting that this theory is closer to the truth, leaving its place in a theory with better qualities than it does. For example, Einstein's theory of relativity is still a theory that has not been falsified, although it is falsifiable.[50] Science does not move from facts to theories. Rather, it begins with the expression of theories that are invited to falsification by others. Therefore, scientists should not aim to prove the accuracy of new or existing theories. On the contrary, they should aim to reveal their inaccuracy: They should use all the tools to eliminate errors in existing theories. Popper's conversion of scientific method from inductive to deductive process has several important philosophical and epistemological meanings. First, since scientific theories cannot be proven to be true, they must remain hypothetical forever (at least, until they are falsified). Therefore, in order to contribute to knowledge, scientific theories should be framed in a way to invite falsification. Popper argued that theories that do not accept the possibility of falsification, such as Marxism and Freudian psychoanalysis and the mysterious theories put

48 Helfenbein - DeSalle, "Falsifications and corroborations: Karl Popper's influence on systematics", 272.
49 Magee, Karl *Popper'in Bilim Felsefesi ve Siyaset Kuramı*, 21-22.
50 Mercan Maden, "Karl Popper'ın Felsefesinde Bilimsel Doğrular ve Yanlışlanabilirlik İlkesi", *Akademi Sosyal Bilimler Dergisi* 17 (2019), 292.

forward by critical theorists of the Frankfurt School, cannot contribute to knowledge. Secondly, according to Popper, science is primarily interested in identifying and solving problems in the world. Scientists identify problems and then suggest theoretical solutions, which they invite others to falsify, for these problems. If they cannot be falsified, then they remain as prospects for truth. If they can be falsified, they will be abandoned. However, unlike defenders of traditional opinion, Popper suggested that disproving a theory makes a positive and real contribution to knowledge. It is important to know what is not right only to keep theories that may be true alive. Thirdly, in parallel with this, science is against essentialism. The purpose of science is not to define the basic nature of things, but to identify and solve problems. The 'true' or precise nature of things in the world cannot be clearly known, because mind cannot provide this information. The reason may be wrong. Therefore, the search for final or basic essences or certain facts is useless. Fourth, science should not try to filter out these expectations, predictions and elements of the experience that shape our understanding of the world. Instead, these theories and experiences should be viewed with a critical view. "Science begins neither with the collection of observations nor with the invention of experiments but with a critical discussion of myths," Popper said. Therefore, science begins in theories and accordingly represents the search for truth. And it represents the search for meaning of individuals who try to bring order to the world by using all the tools they have to distinguish mistake from truth or potential truth. Therefore, the growth of scientific knowledge is not a clean or linear process. This is a dispersed and complex process. It is a trial-and-error process in which ideas and theories are discussed to decide which one is the truth and which is not.[51]

Popper says that although positivists show how certain concrete situations or facts overlap with their theories, they do not specify under what conditions their theory will not be able to be defended. For example, in Adler psychology, the feeling of inferiority forms the basis of human behavior. Let's interpret the behavior that a person will show when he sees a child struggling not to drown in the sea while walking on the beach, according to Adler psychology. He has two options. The first is that he jumps into the water to save the child or continues walking on the beach. According to the Adler's psychoanalyst, the man's attempt to save the child is intended to overcome the feeling of inferiority by taking the risk and trying to prove his courage. On the other hand, if the man does not save the child, this time he compensates for his feeling of inferiority by showing that he has the calmness to stay on the shore.[52] Popper says

[51] Phil Parvin, "The Rationalist Tradition and The Problem of Induction: Karl Popper's Rejection of Epistemological Optimism", *History of European Ideas* 37/3 (2012), 263.
[52] Demir, *Bilim Felsefesi*, 32.

that "Once, in 1919, I reported to him a case which to me did not seem particularly Adlerian, but which he found no difficulty in analyzing in terms of his theory of inferiority feelings, although he had not even seen the child" and continues: "Slightly shocked, I asked him how he could be so sure. 'Because of my thousandfold experience,' he replied" Whereupon I could not help saying: "And with this new case, I suppose, your experience has become thousand-and-one-fold." [53]Popper also criticized Marxism. According to Marxist theory, the society in which the first socialist revolution will take place is the claim that it will take place both in countries where class conflict is intense and in technologically advanced countries. According to Popper, when such a claim turns out to be false over time, followers of Marxist theory will naturally renounce it. However, the situation did not continue as Popper expected, and instead of giving up their theories, Marxists again attempted to match it into the existing information with various interpretations. And so, they argued that Marxism was in harmony with all facts. Thus, Marxists emptied their empirical content while trying to preserve their theory.[54] Marxism always makes predictions that cannot be tested. It produces various fictions about social classes, economics and society. And Marxists do not express which prophecy they will abandon when it does not come true. When the prophecies did not come true, they tried to put them in different forms. That's why Marxism has become patchy.[55] Popper understands this better in these cases: It is very easy to find data to support a theory. The opinion that the feature which will make the theory scientific is not verificationism has increased.[56]

Based upon Popper's views, it would be wrong to make a hypothesis as follows: "A solar eclipse will occur". Since this event will happen sooner or later, the information content is low and there is no possibility of falsification. We need to make some changes for this proposition:

A lunar eclipse will be observed in Ankara.

In 20 years, a lunar eclipse will occur in Ankara.

In 2022, a lunar eclipse will occur in Ankara.

On June 07, 2022 a lunar eclipse will occur in Ankara.

When looking at these new propositions (top-down), the probability of hypotheses decreases and the contents of information increase. Hypotheses with low probability can be falsified in a simpler way. If they are not falsified, they contribute to scientific development due to their

53 Magee, Karl *Popper'in Bilim Felsefesi ve Siyaset Kuramı*, 42.
54 Merkit, "Karl Popper ve Yanlışlanabilirlik İlkesi", 136.
55 Kabakçı, "Karl Popper ve Yanlışlamacılığı", 189.
56 Demir, *Bilim Felsefesi*, 32.

information content. Hypotheses that has lower probability are not easy to be falsified. However, since their information content is lower, they do not contribute to scientific progress. After scientists have created hypotheses that are high in information content but easily falsifiable, and have subjected these hypotheses to many tests, they get results that are close to reality if they cannot falsify these hypotheses. These hypotheses are called "corroborated hypotheses". According to Popper, the more tests a hypothesis has passed, the higher corroboration level it has. Trial and error is also a critical method. It contributes to scientific progress.[57] Here, we should also note that Popper's method does not guarantee access to reliable and accurate information. It only allows our hypothesis to decrease its distance from reality, and to increase the similarity of our explanations with the truth. Popper accepts advancement of science, but does not argue that information is progressed by the accumulation of truths like logical positivists. He argues that science emerges by eliminating its mistakes.[58] According to Popper: The beginning of scientific progress is the existence of the problem (P_1). We present some temporary theories to the current problem (GK). We bring various criticisms to the temporary theory and remove the errors we find (HA), and from a critical point of view we create a new problem as a result of various regulations (P_2).

$$P_1 \longrightarrow GK \longrightarrow HA \longrightarrow P_2$$

When we examine this diagram that Popper has put forward, we find that the starting point is not an observation, it is a problem. This is because logical positivists consider the method of deductive against the method of induction more consistent.[59]

4. Criticism Of Popper's Method

Although there were many scholars who stated that Popper's theory of falsification was a scientifically important step, it was also criticized by many, including his student Lakatos. Redman explains asfollowy Popper's theory of falsification cannot be used in positive sciences:

1. Theories are not as simple as Popper's proposition that "all swans are white", but are like a complex network created by assumptions, laws and many factors. Within this network, it is also very difficult to find out where the problem originated. Therefore, there is no possibility of falsification of a theory as a whole.

[57] Sınıksaran- Aktükün, "Karl Popper'ın Yanlışlama Kuralı, Hipotez Testleri ve İktisat", 49-50.
[58] Demir, *Bilim Felsefesi*, 37.
[59] Sınıksaran- Aktükün, "Karl Popper'ın Yanlışlama Kuralı, Hipotez Testleri ve İktisat" 50.

2. In his thoughts that he put forward, Popper said that he defended the deduction method, not the inductive method. It is very difficult in the deductive method to decide which theories are better, which have passed difficult tests and are not falsified for now, and therefore have a high corroboration level.
3. If the rule of falsification had been applied in the past for many theories (that exist today), many of them would it wouldn't be in our lives today.
4. Popper's statement that scientists should subject their theories to the heavy criticism look exaggerated. As his student Lakatos pointed out, it is hard to find a scientist in these ideas and thoughts.
5. Popper attached importance to the findings obtained from observations and experiments in the method of falsification. However, it should be noted that observations can also be fallacious.[60]

Conclusion

Efforts to separate knowledge from metaphysics began to be clearly seen in the empiricist tradition as of 17th century. Especially after Kant, the boundaries of knowledge were narrowed and it was argued that knowledge was limited to knowable things. Logical positivists, known as the Vienna Circle, also imposed a limitation and saw every knowledge that could not be expressed with factual hypotheses as metaphysical. Therefore they considered it as meaningless. In addition, this circle has adopted the induction method by trying to confirm hypotheses that are also logically consistent as a criterion of scientific knowledge through observation. However, since the induction method cannot ensure absolute verification of knowledge, it has become difficult to distinguish scientific knowledge and metaphysics. Metaphysics and religion were in the same pot of meaninglessness. After Popper, the important thing is not whether the proposition is meaningful or meaningless, but whether it is scientific or not. What matters to Popper, who brings a new method, is not a lot of corroborative observations, but falsifiability that allows us to look critically.

60 Sınıksaran- Aktükün, "Karl Popper'ın Yanlışlama Kuralı, Hipotez Testleri ve İktisat", 52.

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