THESIS, Vol. 3, no. 1, 2014. (87-100).

Has science got a basic principle?

(Epistemological approach to science: Novelties and problems brought by evolution of epistemological thought to the manner the science is developed)[1]

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Abstract

The subject of this paper will be the attempts to find a basic principle of science from different philosophers of science. These resulted into novelties as well as new problems of perception, interpretation and approach to science, and its development.
Although the science which constitutes the most obvious evidence of increased human knowledge, turned out to be a very complex phenomenon with many different challenges to be understood and explained, which is expressed through different theories of philosophy of science, which also express different approaches, but at the same time reflect its evolution.
The novelties as well as epistemological problems, roughly speaking, can be summarized as follows:
(i) the formulation of the basic principle of science – the principle of verifiability,
(ii) the falsification as a guiding principle of science,
(iii) the paradigms and their shift as main principle of development of science; and
(iv) the controversial developments after Kuhn
Yet, despite the success, there is still no epistemological theory, which would give answers to questions: whether there is any rational explanation of how the community of scientists sets, culminating in moments of scientific development, to change the paradigms.

Keywords: verification, falsification, paradigm, rationalism, science community.

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[1]This paper was presented at the Conference "Euroscience 2013", held on May 30, 2013 at AAB University.

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Introduction

The question above (Has science got a basic principle?) is not selected to provoke a debate, but to express a challenge that is yet very sharp, and which has provoked many prominent epistemologists. Such a question would not even be raised in the past: it represented a well-known problem. It was clear and self-explanatory. One would just need to find and formulate such a principle.

The search of the basic principle of science was driven by the need to understand the fascinating success of natural sciences, as well as to make viable rational explanation of knowledge production, its growth and advancement, including the development of science in the past, at present and in the future. A rational explanation, to be valid, was believed had to be supported by a basic principle. In this sense, the question of whether a basic principle of science is there; was equivalent to question whether science is rational, or if scientific activity can be explained rationally.

This paper will pose the main efforts in providing responses to the above question, also whether science has a basic principle. The pivot of this treatise will be the most known theories which, explicitly or implicitly, resulted with the construction of such a principle. Those theories featured different approaches and mutual criticism, through which the evolution of epistemological thought flowed: bringing the conceptual innovation, which expressed deepening of understanding and explaining the science.

The contributions of epistemologists looking for a basic principle of science can be summarized in four different efforts: (i) the formulation of the basic principle of science –the principle of verifiability, (ii) the falsification as the guiding principle of science, (iii) the paradigms and their shift as main principle of the development of the science; and (iv) the controversial developments after Kuhn.

Elaboration will be done through adduction of theoretical formulations of basic principle, the belief of how it operated and how it could explain the success of scientific development historically and currently, as well as mutual criticism in hot topics, to sensitize

significance, value, necessity and possibility of the existence or not of governing and regulating such a principle of science[2].

Formulation of the basic principle of science – verifiabilityand new problems

The verification principle expresses the (neo) positivists[3] theoretical view points of science, the core of which presents the conviction that the intent of science is verification of assertion. This meant that all the success of science depended on and is fraught with achieving the target – stating the truth of the assertion.

In the spirit of philosophical thought for centuries associated with explanations of science and synthesizing them, the (neo) positivists aimed at finding the basic principle of science whereby it functioned as a whole, as well as to explain how the growth of scientific knowledge took place historically and currently, showing clearly the guiding principle and procedural aspect of scientific research.

Such basic principle is known as principle of verifiability, as Alfred Ayer concludes:

"We say that a sentence is factually significant to any given person, if, and only if, e knows how to verify the proposition which it purports to express - that is, if he knows what observations would lead him, under certain conditions, to accept the proposition as being true, or reject it as being "[4].

The outcome of the confrontation with experience ascertains the verity of the sentence.

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[2] It sounds like the Kantian formulation of the problem (Imanuel Kant, *"Regulative Principle of Pure Reason in relation to the Cosmological Ideas", in The Critique of Pure Reason*. Section, translated into English by F. Max Müller, Second edition, revised, London,The MacMillan Company, 1922, *p. 413*), and so it is, because nearly so believed in the role of such a principle epistemologists who tried to formulate it.

[3]Also known as the logical positivists, or Wiennerkretz (County of Vienna).

[4]Alfred J. **Ayer**, *Language, Truth and Logic*, Victor Gollancz LTD, London, 1936, p. 19-20.

This principle worked through the method by which scientists led research, as it, for example, was formulated by the founder of positivism: from observing to predict, on purpose of studying that is stable and relate into the future[5]. This is known as inductive method. In other words, scientific theories should stem from observations, should express that was stable in those observations, and from these to glean valuable predictions for the future.

The principle of verifiability and method of scientific research consisted in that the fate of theory depended on the outcome by facing with experience, which means that the assertion could be falsified by experience and, in such case, it should be cast as false, or rather verified, meaning that it was confirmed by experience and then joins the corpus of scientifically proven sentences. Every such success increased scientific knowledge, an increase which was linearly and cumulatively, in a continuous process. So it seemed that the entire scientific activity was a known procedure but completely rational, in as much as it was known how everything had to be done and what based on outcomes had to be the evaluation of a scientific theory. The principle of verifiability and the implemented method were universal norms according to which developed the science, as well as explained the success of the growth of scientific knowledge.

The principle of verifiability seemed really to work, according to its conceptual premise. The (neo) positivists concerned the fact or the experience or the reality as something given and pure, independent of theory and unaffected by it, and served as a test stone to all scientific theories. This view on science, when just it emerged from Wiennerkretz, was then found wide support in philosophical and scientific circles. The reason seems to be that (neo)positivists through the principle of verifiability, in a way, could explain the success and growth of scientific knowledge as it appeared, and such a view

[5]Auguste **Comte**, *Om positivismen,* translated into Swedish by Otto Manheimer, Surtre, Sweden: Bokförlaget Korpen, printed at MINAB, 1979, p. 19-20

seemed to be supported by almost any everyday achievements of empirical science.

That's why Karl Popper's criticism addressed to (neo) positivists fell on deaf ears at that time and have no effect. Popper enunciates the argument that (i) scientific theories cannot be verified as claimed by (neo)positivists. He stressed that (ii) the experience (also the given, the fact) was affected by the theory and it could be understood in the light of theory[6], also it was not so pure as believed by (neo) positivists. Another criticism was that (iii) the elimination of metaphysics from scientific theories leads to the elimination of natural sciences itself[7], as each theory contained generalizations, which could not be tested empirically, hence did not meet the (neo)positivists' empirical criteria. He criticized (iv) the inductive method too, as a procedure that if followed rigorously will lead to an infinite regress, therefore it was not a scientific method.

Popper in (iii) in principle has right; in (i) seem that he has not, since Imre Lakatos notes that most of the tests de facto end with confirmation. The (ii) argument had support but was ignored by (neo)positivists. In (iv) had somewhat right Popper, but he wasn't correct when he tried to eliminate it from science or considered it as unscientific one, and so to give connotation to the (neo) positivists explanation of science as non-rational.

While the (neo)positivists could explain the increase of knowledge and scientific progress in stable periods, they met a crucial problem: could not explain periods of thorough transformations, namely the change of existing macro-theory (corpus scientific assertions) with a new one. Despite efforts, the (neo)positivists explanation could not yield sustainable without falling into contradiction with its principle of verification: how could a corpus of verified statements be disproved?

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[6]Karl **Popper**, *The Logic of Scientific Discovery*, London and New York, Routledge classics, 2003, p. 90, f. *3. Referred as *LSD*.

[7] ibid., p. 13.

Falsification as guiding principle of science and its insufficiency

Popper seems to have understood how to solve the main problem that could not (neo) positivist solve, also to explain scientific thorough transformations that had occurred and occur occasionally according to the story of science. In this aspect focused his view of philosophy of science: in key moments of thorough transformations in science, with the conviction that they were the only ones that mattered for science, its development and growth of scientific knowledge.

But to do this, he had to deal and priory to solve issues with (neo) positivists. In this battle he harshly criticized and argued against the principle of verifiability claiming openly to completely defeat it as an inadequate point of view for the mission set to itself, failing precisely in what it aimed: to explain the progress of science[8].

Contrary to (neo) positivists, Popper attempted to rehabilitate the metaphysics. There are barren metaphysics that is to say cannot be transformed into scientific theory, but there are also fruitful metaphysics which can be transformed into a scientific research program[9]. At this point Popper was right, even though his view could not be understood by (neo) positivists.

Popper approach is exactly the other side of verification: he constructed a basic principle and implemented a method too, with the same claims as the only scientific one. In other words, it can be said Popper believed that scientific research failed not if it resulted in the falsification of a scientific theory. Instead it was a success, such one of magnitude larger than the one claimed by (neo)positivist.

The principle of falsification highlights that a theory to be accepted as a scientific hypothesis has to be testable and to contain potential falsifiers. Such can be "singular statements" or "basic statements" that

[8] ibid., p. 3 – 34.

[9] ibid., p. xxiii, p. 16. Also in Imre **Lakatos** & Alan **Musgrave**, *Criticism and the Growth of Knowledge*, Cambridge, Cambridge University Press, 1970, p. 183, f. 3.

describe the event[10]. Every theory, according to Popper, excludes some events[11],which are potentially its falsifiers. On this ground he writes that it is quite possible to argue from verity of singular to falsify a universal statement[12]. Also, when an assertion is a basic statement which contradicts the theory, or when the event which prohibits theory occurred, then this statement or this event falsifies the whole hypothesis[13].

To work, the principle needs a scientific method. Popper believed it was the deductive-nomological method[14], which instructs a critical review, negative one[15], with the open goal of finding possibility to refutation: to investigate the counter-facts to achieve falsification of hypothesis[16]. Obviously, the macro-theories showed often to be stubborn that experiments and tests usually lead to their provisional confirmation[17], expressing that the theory resisted attempts of falsifying, rather than theory was verified. Thus, the fundamental difference with (neo) positivists, was that Popper believed and recommended that scientists should focus their efforts to falsify scientific theories, while the experimental confirmation considered by him as temporal. The principle of falsification and above method was believed as universal norms according to which the science developed, as well as explained the success of the growth of scientific knowledge.

Through view of falsification Popper was able to explain what (neo)positivists could not: how macro-theories replaced. It happened when an existing theory was disproven, whereas new, competing theories strongly resisted to same attempts. Then, the decision about throwing the old theory in favour of the new one is taken by

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[10] Popper, *op.cit.*, p. 66-67.
[11] ibid., p. 67.
[12] ibid., p. 19.
[13] ibid., p. 85.
[14] ibid., p. 6-7.
[15] ibid., p. 9.
[16]Karl **Popper**, *Conjectures and Refutation*, Routledge classics, London and New York, 2002, p. xv.
[17]Popper, *LSD*, op.cit., p. 10, p. 264.

community of scientists: it was a methodological decision[18], also according to the results of the methodological research.

It is a methodological agreement of scientist what would be regarded as empirical statement: simply it is a convention[19]. Also, the fact is such one thanks to the agreement, and it is perceived so in accordance with the convention, meaning that it is not out there, as something pure given. Neither this empirical conception could save the Popper's view of falsification. Ayer answered back: if experience can not verify a theory, it also can neither falsify it; simply, it either works equally in both cases, or does not work in either case[20].

Thus, it can be seen that in its own way Popper explained the (neo)positivists' trouble, but focusing attention only on the momentum of scientific revolutions, he arrived at a position that is characterized as a permanent revolution, in the sense that the revolution happened or could happen at any time, permanently, buton the other side he left aside and paid not the attention to the intermediate aspect between two revolutions.

This view of Popper as well as that of (neo)positivists explained, from the procedural perspective, the totality of the scientific process as a rational activity of scientists, in the sense that it was known the guidance and the research goals, what should be looked for and how to findit, to ascertain it and to replace the old theories with new ones.

But if it been followed the falsificationism, Kuhn argues, then neither the scientific revolutions would happen as Popper claimed, since the new theory always is easier to be falsified than the old one which is already established and resisted tests, whilst the new one in its infancy has deficiency and needs complements. Therefore, even abstracting the above counter-effects, it manifests insufficiency to explain exactly what Popper had claimed to - the real causes that lead to the scientific revolution, and so even the whole development of science.

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[18] ibid., p. 32-34, p. 92.
[19] ibid., p. 88.
[20] Ayer, *op.cit.*, p. 24-25.

Paradigms and their change as main principle ofscientific development and the mystery of scientific revolutions

Thomas Kuhn is the one who unveiled an explanation of the process of scientific development as a whole, describing almost all possible stages through which science goes in its evolutionary development. Kuhn argues that not only taken separately but even if verification and falsification were taken as a combination as verification-falsification are insufficient, because the main aim of scientific research is not simply achieving the verification or falsification[21], though in appearance they give such impression.

Kuhn went further: he shook the grounds of any principle with universal validity, indicating that there is neither any such criterion or principle[22], nor any methodological rule[23] that could have such status, because there was no such one to support the science and could guide it or explain its successful development. This view generates from the thesis that the two competing paradigms are incommensurable[24].

Kuhn expresses a different point of view, the main principle being the paradigm[25], to it and to scientific community the whole scientific development is related According to him the mature science began with the acceptance of a paradigm by the community of scientists. After the event, it is the paradigm which rules the science, namely the community; it determines the direction of the development as well as the scientific research. Paradigm promises success and achievements.

Through the paradigm, as framework for macro-theory or system of theories, Kuhn explained many aspects of science: the role of the scientific community, the birth, development and extinction of scientific tradition, the role of scientist as researcher guiding by paradigm and related to it the scientific activity. The paradigm

[21]Thomas **Kuhn**, *The Structure of Scientific Revolutions*, translation into Albanian by Aleko Minga and Petrit Skende: Struktura e revolucioneve shkencore, Tirana- Peja, Dukagjini & CEU Press, 1977, p. 25, 205.
[22] ibid., p. 134, 233.
[23] ibid., p. 20.
[24] ibid., p. 21.
[25] ibid., p. 44, 77.

determined the reality, the experience and the fact, not the opposite, and then they can be calibrated, of course in support of paradigm[26]. As long as the paradigm shown effective, it directed the research in achieving success towards expected and sometimes unexpected knowledge usually in spirit of paradigm, that's why it was common metaphysical, empirical and research ground of scientists, and almost no one contested it . The undertaken tests reflected effectiveness and skills of scientists[27], as they dealt with concrete theory the success of which provide paradigms.

The Science governed by a paradigm calls normal science[28], which after a period of development seems inevitable to get absorbed, or increase anomalies which, if not resolved, cause crisis[29]. If it continues, loses the trust to existing paradigm, the community get split and encourage the creation of rival paradigms. All these could reach a point that culminates by replacing the paradigm: the new one take place of the old – the scientific community for this change decided.[30]

This paradigm shift expresses the triumph of the scientific revolution[31], extinguishing crisis, re-uniting the community, returning the stability and normal circumstances in scientific activity. At the same time, it changed radically the perceptions so that scientist seemed to work in a different world from earlier[32].

So, without doubt, Kuhn raised to a higher degree the understanding and explanation concerning the nature, operation and development of science, linking the process of cumulatively growth of knowledge with occasional revolutionary transformations as evolutionary nature of scientific development. Also he showed that during crises and revolutions there are different paradigms and

[26] ibid., 46, 48-57.
[27] ibid., p. 61-62.
[28] ibid., p. 22, 29, 36, 39, 45-71.
[29] ibid., p. 117-128.
[30] ibid., p. 138.
[31] ibid., p.. 23.
[32] ibid., p. 189

competition between them (plurality)[33], but after the revolution the science governs by a single paradigm (monism)[34].

At the same time, he pointed out other problems, deeper than previously known. For instance, the key moment of fundamental science turning, the scientific revolution – proved well that it happens, but failed to argue on what grounds it happens, that the only explanation was - scientists convert to the new paradigm. But the conversion is not sudden as claimed Kuhn, contrary it is a kind process with many different influences.

Although Kuhn gave a great contribution to epistemology, he failed to solve Gordian knot. The decision making to change the paradigms, as the culminate moment in the scientific revolution, remained a mystery for which Kuhn gives no clear explanation.

Controversial developments after Kuhn

Up to date developments, currently available in most cases are called as postkuhnian, because they are direct reflection on Kuhn's philosophy of science innovation. Most important are two of them with controversial direction, which contributions will be outlined here.

On the one hand there was an attempt to solve the problems brought by Kuhn's theory. Imre Lakatos formulates a basic principle in his concept of "The Methodology of Scientific Research Programmes"[35], which intended to be valid inter-theoretically, also provide a criteria to evaluate every research programmes. As the title shows the methodology was incorporated into the scientific research programme[36], and the principle was very liberal and flexible: the criterion of progress-degenerating[37], which should show progressive

[33] ibid., p. 120, 128.
[34] ibid., p. 29, 39.
[35] Imre **Lakatos**& Alan **Musgrave**, *Criticism and the Growth of Knowledge,* Cambridge, Cambridge University Press, 1970, *p. 101 – 197.*
[36] ibid., p. 132-133.
[37] ibid., p. 134.

or degrading state of a program and so helping the decision to abandon, respectively accept a research program. Unlike Kuhn and similar to (neo)positivists and Popper, Lakatos rejected the monistic character of science by claiming that its characteristic is plurality and competition between scientific programmes. In addition to internal development as well the external competition determinates the scientific development[38]. The progressive–degenerate criteria and methodological regulation intended to test the rational functionality of science, but as criticized by Kuhn[39] and Feyerabend[40], Lakatos fails to give a time limit when a theory should be considered as degenerated so that should be abandoned and accepted the new research programmes.

On the other hand, there was an attempt to deepen the problems brought by Kuhn's theory, presenting them as natural science and as typical to it. Paul Feyerabend[41] rejected Lakatos and agreed with Kuhn, demystified and denied as counterproductive a basic principle like universal criteria and methodological rules. Instead he affirmed the plurality like Lakatos as characteristic in every stage of the development of science, and not like Kuhn who claimed plurality as characteristic only in times of crises and revolutions. He showed too that so well could function counter-rules, counter-induction, and anarchism versus rationality[42]. Instead of petrifying positions, he stated that the development was made through contacts and opens and free exchanges. However, Kuhn has opposed by reaffirming that such a development is characteristic only for periods of crisis and scientific revolutions, but not for post-revolution's period or normal science when it is guided by a paradigm.

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[38] ibid., p. 155.
[39] ibid., p. 239.
[40] ibid., p. 215.
[41] Paul **Feyerabend**, "*Condolaton for the Specialist*", in Lakatos& Musgrave, *op.cit*, pp. 197-230.
[42] Paul **Feyerabend**, Against Method, translated into Swedish by Thomas Brante and Cecilia Hansson: *Ned med metodologin,*, Lund: Arkiv, 2000, f.. 34-37, 50-60, 219-227.

Postkuhniane efforts to date have shown some attempt of deepening in any given direction, making any modified version, without being able to provide solutions to the problems that caused Kuhn's theory.

Conclusion

As stated roughly in this essay, it is clear that in an attempt to discover a basic principle through which in a rational way could be explained how science works, that so successfully produces ever increasing and progress knowledge, the thought of epistemology, through various theories, has evolved. It revealed various problems, treated them and tried to give solutions, but other increasingly problems arose all the time, thus pushing as an impetus for further visionary changes. Currently the epistemology thoughts are in a limbo, when attempts on different aspects, ways and approaches without any significant achievement. So there is still no theory of philosophy of science which has given answers to questions: is there is any rational explanation about how the scientific community, in culminate moments of scientific development, decides to change the paradigms? Or scientific revolution really is a conversion?

This lack of response, indicates that despite all allegations, science does not and cannot have any basic principle of universal validity to guide it, or in which science works and could be rationally explained, the development, success in producing and advancement of scientific knowledge[43], although we see almost every day how new knowledge is achieved as well as advance increasingly the technique and technology.

[43]Hajdin **Abazi**. *Investigations of rationalism in Philosophy of science*. http://www.yumpu.com/sq/document/view/20450290/doctor-hajdin-abazi-universiteti-i-tiranes-doktoratura (seen for the last time on 20/ 05/ 2013, 20:05)

Or perhaps epistemology has not yet managed to understand the underlying manner of science, namely principles, norms, rules and proceeding, respectively how really science works and evolves?

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