

The Popperian Functionality of Metaphysics with Regards to Scientific Methodology: The Journey Towards Creativity, Discovery and Invention

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This article is an exposition on how Karl Popper views scientific activity in the light of metaphysical research programs. It is a philosophical undertaking meant to clearly define the function of metaphysics with regards to scientific advancement. As will be seen in the exposition that follows, Metaphysics does not simply provide frameworks or previous foundations. It has a more important function especially with reference to the evaluation of scientific progress. Likewise, in the light of the discussion below, Metaphysics adds an “artistic” dimension, reflective of human nature, to the critical atmosphere wherein scientific activity takes place.

Introduction: Science, Correct Methods and the Methodology of Science.

Sir Karl Raimund Popper is one of those philosophers of sciences who believe that science consists not so much in correct conclusions, but in correct methods.¹ He espouses the hypothetico-deductive model. His solution to the problem of demarcation between Metaphysics and science is called “critical rationalism”. But

¹ T.L. Short, “The Discovery of Scientific Aims and Methods” *American Catholic Philosophical Quarterly*. Vol. LXXII, Spring 1998, No. 2, 293-312.

this solution or criterion in itself is not falsifiable. It is a metaphysical program.²

The problem, however, is that Popper's "method" is a "no method". He entitled the "Preface 1956" of the Postscript 1 "On the Non-Existence of Scientific Method". Popper writes: "As a rule, I begin my lectures on Scientific Method by telling my students that scientific method does not exist."³ There is no scientific method in the general sense "because subject matters in general do not exist. There are no subject matters; no branches of learning-or, rather, of inquiry: there are only problems, and the urge to solve them."⁴ Popper labels this as the "myth of the subject" and its myth of giving convenience to students. To be more specific about it, Popper's assertion on the non-existence of scientific method has three modes of application:

1. "There is no method of discovering a scientific theory.
2. There is no method of ascertaining the truth of a scientific hypothesis, i.e., no method of verification.
3. There is no method of ascertaining whether a hypothesis is 'probable', or probably true."⁵

Popper's methodology is a metaphysical program, i.e., a normative proposal: "...I do not regard methodology as an empirical discipline, to be tested, perhaps, by the facts of the history of science. It is, rather, a philosophical-a metaphysical-discipline, perhaps partly even a normative proposal. It is largely based on metaphysical realism, and on the logic of the situation: the situation of a scientist probing into the unknown reality behind the appear-

² For an introductory discussion on the notion of metaphysical program in Karl Popper, see my article: "Karl Popper and the Metaphysical Debate: Historical Context and Critical Innovations" *Philippiniana Sacra* Vol. XXXIV, No.102 (Sept.-Dec. 1999), 423-455.

³ *Realism and the Aim of Science. From the Postscript to the Logic of Scientific Discovery.* (P1) W.W. Bartley ed. (London-New York: Routledge, 1983), 5.

⁴ *Ibid.*

⁵ *Ibid.*, 6. Also found in A. Bagood, *The Role of Belief in Scientific Discovery: Michael Polanyi and Karl Popper.* (Rome: Millenium Romae, 1998), 217. Bagood does not take this from a primary source. [Henceforth Bagood].

ances, and anxious to learn from mistakes.”⁶ In propounding this methodology, Popper also proposed a new definition of science. Science is “the result of human endeavor, of human dreams, hopes, passions, and most of all, as the result of the most admirable union of creative imagination and rational critical thought.”⁷

The exposition that follows in this article will tread upon the paths traced by the texts just cited.

The Metaphysical Framework of Problem-Finding and Problem-Solving:

In Popper’s philosophy, the problem or the question is more important than the answer. In other words, the answer depends on the question. Metaphysics provides science with the problem-situation which is the outcome of three factors: “1) discovery of an inconsistency within the ruling theory, 2) discovery of an inconsistency between theory and experience, 3) relation between the theory and the metaphysical research program.”⁸ These three provide the avenue that leads towards the following interrogations: 1) What are the questions to be asked? 2) What are the most important questions? 3) How should these questions be approached?

Popper proposes his Metaphysics as a framework, a worldview or a perspective through which we look at things. In his own words: “a picture, a dream, rather than a testable theory.”⁹ Nobody is capable of knowing without a picture-framework. Even science stands in need of a picture-framework due to its function of determining the

⁶ *Ibid.*, XXV.

⁷ *Ibid.*, 259.

⁸ *Quantum Theory and the Schism in Physics. From the Postscript to the Logic of Scientific Discovery* (P3), W. W. Bartley III, ed. (London–New York: Routledge, 1982), 161.

⁹ P3, 210. Cf. P3, 160-161. “...metaphysical ideas contribute to the creation of problems and which largely determine the direction in which we seek for a solution.” See also: *Conjectures and Refutations*. (CR) 2nd ed. (New York: Basic Books, 1965), 66-96; (together with J. Eccles), *The Self and its Brain*. (SB) (London: Routledge and Kegan Paul, 1983), 151ff; *Objective Knowledge. An Evolutionary Approach*. (OK) (Oxford: Clarendon Press, 1989), 166-190.

"problem situation".¹⁰ "They largely determine its problem situations. A new picture, a new way of looking at things, a new interpretation may change the situation in science completely (as did Einstein's way of looking at the Lorentz transformations)."¹¹ This also explains why there is no such thing as an accidental discovery in science. Fleming's discovery of penicillin is not an accident because it was already within the horizon of his framework of expectation.¹²

These problem situations have been described by Popper in the following terms:

1. They are "much needed tools of scientific discovery".
2. They are "guides" towards scientific discovery.
3. "They also help us to decide whether a scientific hypothesis is to be taken seriously."
4. They also help us to decide "whether it is a potential discovery, and how its acceptance would affect the problem situation in science, and perhaps even the picture itself."¹³

Popper also enumerates ten metaphysical programs and qualifies them as

1. "Indispensable for science..."
2. Unifying pictures of the world-the real world...
3. Highly speculative; and they were, originally, non-testable..."
4. These programs possess qualities "more of the nature of myths, or of dreams, than science..."
5. But they helped to give science its **problems**, its **purposes**, and its **inspiration**."¹⁴

¹⁰ P3, 160-161. Cf. *Unended Quest. An Intellectual Autobiography*. (UQ) (London: Routledge, 1992), sec. 33.

¹¹ P3, 210-211.

¹² P1, 41. See also Bagood, 20. "He had a direction; he was intellectually absorbed by his search; he and his companions hoped to find this substance one day."

¹³ P3, 210-211.

¹⁴ *Ibid.*, 165. Emphasis mine. Popper furthermore describes these metaphysical ideas as "ideas which not only determine what problems of explanation we shall choose to attack, but also what kinds of answers we shall consider as

But what really matters is the rationality of any given theory. Any theory, whether scientific or metaphysical, is considered rational because of its problems:

In other words, any rational theory, no matter whether scientific or metaphysical, is rational only because it ties up with something else—because it is an attempt to solve certain problems; and it can be rationally discussed only in *relation to the problem situation* with which it is tied up. Any critical discussion of it will consist, in the main, in considering how well it solves its problems; how much better it does so than various competing theories; whether it does not create greater difficulties than those which it set out to dispel; whether the solution is whether we cannot, perhaps, refute it by empirical tests.

This last method of discussing a theory is not, of course, applicable if the theory is metaphysical. But the other methods may well be applicable. This is why rational or critical discussion of some metaphysical theories is possible. (There may, of course, be other metaphysical theories which cannot be rationally discussed).¹⁵

All scientific advancement, in its initial stages, were mixed with inborn anticipations and expectations. These are metaphysical in nature and give direction to our scientific guesses: “*We do not know: we can only guess*. And our guesses are guided by the unscientific, the metaphysical (though biologically explicable) faith in laws, in regularities which we can uncover-discover.”¹⁶ Said anticipations and expectations, because of their metaphysical character, serve as worldviews through which the knower can criticize scientific knowledge. Indeed, metaphysics provides the framework. In this sense, it can be deemed as the “searchlight for science”.

fitting or satisfactory or acceptable, and as improvements of, or advances on, earlier answers.” *Ibid.*, 161. After listing twenty metaphysical programs in the first volume of said work, Popper qualifies them in the following terms: “It indicated the difference of our search, and the kind of explanation that might satisfy us; and it made possible something like an appraisal of the depth of a theory.” P1, 192-193.

¹⁵ P3, 200.

¹⁶ *The Logic of Scientific Discovery* (LScD). (New York: Harper & Row, 1968), 278.

The Functions of Metaphysics as the "Searchlight for Science":

Scientific activity is not all logic and rigid rules. It is first and foremost a human endeavor, subject to human conditions, frailties and hopes. Its critical character also involves an interplay of imagination and intuition. Metaphysics enhances said interplay as it performs the following functions:

A. *The Heuristic Function:*

The term "heuristic" is understood here in terms of being a "help" or "guide". Popper affirms that metaphysical research programs also serve as heuristics to scientific knowledge.¹⁷ "Metaphysics have shown the way."¹⁸ "Metaphysical ideas (are) guiding lights for the physicist."¹⁹ "Metaphysical research programme (serve) as the heuristics."²⁰ Popper points out atomism as an example of this: "An old example of what I called the heuristic use of imaginary experiments is one that forms the heuristic basis of atomism."²¹ In relation to this Alfred Ayer comments on Popper's stand: "He was willing to say of statements which failed to pass his test for being scientific that they were metaphysical, but did not take this to imply that they were meaningless. On the contrary, he held that in certain cases *metaphysical statements might fulfill a valuable heuristic function.*"²²

B. *The Criteriological Function: The Measure of Success.*

Although success is not the prime consideration of scientific activity, but truth, Popper's methodology appears to be a criteriological consideration in determining the success of theories. He

¹⁷ P3, 201-211.

¹⁸ LScD, 19.

¹⁹ UQ, 152.

²⁰ P3, 33.

²¹ LScD, IX, 444.

²² A. Ayer, *Philosophy in the Twentieth Century*. (New York: Random House, 1982), 131. Emphasis mine.

writes: "...the metaphysical research programme makes it possible to judge the success of the theory as an explanation."²³ Thus, its function is explanatory not justificatory with regards to science. However, it is no guarantee of success. "There is no royal road to science; there is no method which guarantees success; and any theory of knowledge which, in explaining why we are successful, allows us to predict that we should continue to be so, explains and predicts too much."²⁴

C. The Distinctive Razor Function:

Popper is not fond of definitions, but this does not mean that he dislikes distinctions and clarifications. In fact, he tries to be as faithful as possible to the principles of Ockham's razor. He affirms that it is the task of the "logic of knowledge" to make linguistic usage in empirical science as definite and clear cut as possible with the aim of establishing a clear demarcation line between science and Metaphysics.²⁵ This "logic of knowledge" makes us capable of distinguishing between "false theory and one which may be true" and "justification and criticism".²⁶

Likewise, Popper proposes a criterion of distinction between subjective experiences or feelings of convictions and that of objective logical relations. The former cannot justify any statement while the latter can corroborate, because it is a scientific statement.²⁷

D. The Regulative Function:

As indicated earlier, metaphysical research programs also serve as regulative functions with regards to scientific knowledge. "Science has at all times been profoundly influenced by metaphysical ideas; certain metaphysical ideas and problems (such as the problem

²³ P3, 161.

²⁴ P1, 60.

²⁵ LScD, 38-39.

²⁶ P1, 27, 29.

²⁷ LScD, 44.

of change, or the Cartesian programme of explaining all change by action at vanishing distances) have dominated the development of science for centuries as **regulative ideas**; while others (such as atomism, another attempt to solve the problem of change) have by degrees turned into scientific theories.”²⁸ This regulative function is functional to the aim of science.

The Epistemic Aims of Science in the Light of Metaphysical Research Programs:

The idea of teleology (telos, end) has traditionally been an ethical notion. It has always been considered “foreign” to modern science, in the wake of the attitude of scientism, i.e., science is the end in itself. Scientists, nowadays, have come to realize that there is also teleology in science and have effectively debunked the then prevailing view of scientism. Popper says: “I shall now argue that modern science has reintroduced teleology.”²⁹ This is a revival of the Aristotelian axiom that “every person acts for an end”. And Karl Popper is instrumental in this revival. “Thus, our thesis, in pursuing their vaguely defined aim, scientists are fated, if they inquire long enough and strenuously enough, to come, by degrees, to an ever more exact conception of that aim and, correspondingly, to a better idea of what their methods should be.”³⁰

The metaphysical research program determines the aim of science³¹ which is **truth**: “...what we are seeking in science is not so much usefulness as *truth: approximation to truth; explanatory power, and the power of solving problems; and thus, understand-*

²⁸ P1, 159-160. Emphasis mine.

²⁹ Short, 307. Popper says that teleology is also Darwin’s great achievement. See P2, 150.

³⁰ *Ibid.*, 296.

³¹ See P3, 160, 195. “The aim is a picture of the world in which there is room for biological phenomena, for human freedom, and for human reason.” Cf. P1, 131; *The Open Universe. An Argument for Indeterminism. From the Postscript to the Logic of Scientific Discovery.* (P2) W.W. Bartley III ed. (London-New York: Routledge, 1982), 149 (teleology is similar to problem solving); P3, 106, 208, 210.

ing.”³² Truth is the most fundamental value.³³ Truth is the most satisfactory explanation.³⁴

The Two-Prong Aim of Science in Relation to Truth:

The aim of science given by a metaphysical research program is a two-prong way: 1) to have better explanations in order to understand; 2) to know the truth or the approximation of truth.

A. To understand as to approximate the truth.

Popper believes that most scientists and historians share his “realist view of the world” and aim to understand the objectives of science in the way he does so “to achieve better and better explanations.”³⁵ This is also what Popper means by “critical pluralism” – “the more, the better, but only the fittest survives.”³⁶ Reality is so vast and no man can fully exhaust its meaning by studies or explanations. There are things which cannot be totally explained. Thus, the search for understanding is a never ending process. A metaphysical research program is in itself a framework through which we can explain things better. For Popper, it makes up the best theory of explanation.

B. To approximate the truth as to understand.

The aim of science is truth, although man can only approximate the truth. Truth is a regulative idea.³⁷ Absolute truth is the

³² P3, 42. See also CR, chap. 10; OK, New Appendix II

³³ P1, 260.

³⁴ *Ibid.*, 132, 193. “From these programmes he derives his aim – what he would consider a satisfactory explanation, a real discovery of what is ‘hidden in the deep’. Although empirically irrefutable, these metaphysical research programmes are open to discussion, they may be changed in the light of hopes they inspire or of the disappointments for which they may be held responsible.”

³⁵ P1, XXV.

³⁶ *In Search of a Better World. Lectures and Essays from Thrity Years* (ISBW). L.J. Bennet trans. with additional material by M. Mew. K. Popper & M. Mew rev. (trans.) (London: Routledge, 1992), 191.

³⁷ OK, 318.

"implicit standard".³⁸ Popper follows the "ancient theory of truth (almost explicit in Xenophanes and Democritus and Plato, and quite explicit in Aristotle) according to which *truth is the agreement with the facts of what is being asserted*."³⁹ Popper likewise affirms: "I therefore think that Tarski's theory of truth is applicable to explanatory theories, and that the success of science is best accounted for by the metaphysical belief that the growth of knowledge consists in progress towards truth."⁴⁰

Popper despises any kind of definition except when "it strengthens a theory"⁴¹ and places in its stead the theory of truth as an aim of science. "I thought that I could do this with my theory of the aims of science: the theory that science aims at truth and the solving of problems of explanation, that is, at theories of greater explanatory power, greater content, and greater testability."⁴² The acquisition of truth tends to clarify the questions at hand.

Is there a method for discovering the truth? None, according to Popper.⁴³ This is so because there is no such thing as an absolute scientific method. Can precision be also an aim of science in view of truth? Popper denies this. "The doctrine that there is as much science in a subject as there is mathematics in it, or as much as there is measurement or 'precision' in it, rests upon a complete misunderstanding. On the contrary, the following maxim holds for all sciences: *Never aim at more precision than is required by the problem in hand*."⁴⁴ Popper continues: "Thus I have no faith in precision: I believe that simplicity and clarity are values in themselves, but not that precision or exactness is a value in itself... I do not believe in what is often called an 'exact terminology': I do not believe in definitions... and I do not believe that definitions add

³⁸ P1, 25.

³⁹ *Ibid.*, XXI. Emphasis mine.

⁴⁰ "Replies to my Critics" (RC) in *The Philosophy of Karl Popper. The Library of Living Philosophers*. Vol. II. P. Schilpp ed. (Illinois: Open Court, 1974), 1095.

⁴¹ P1, XXXVI.

⁴² *Ibid.*

⁴³ See Bagood, 217.

⁴⁴ P1, 7. Emphasis mine.

to exactness."⁴⁵ He then concludes that "[w]hat can be said can and should always be said more and more simply and clearly."⁴⁶

Dream and Reality: Metaphysics and Science.

Popper conceded to the fact that his theory may also be a dream. Reality starts with a dream. Before, man only dreamt of soaring the skies. The Wright brothers made it a reality. In times past, it was only a dream to go to the moon. Neil Armstrong and company turned that dream into reality. Absolute truth may also only be a dream. But the direction it gives to mankind may one day make it a reality. Popper writes: "And I have no objection whatever to [the] description of metaphysical research programmes as 'dreams', in the sense of wish-dreams; for they are *attempts to formulate our hopes, our anticipations, and our ambitions*, concerning the growth of our knowledge."⁴⁷

Kate Noble, in her article in the 1998 issue of *Time Magazine*, has the same observation: "Historically, the great discoverers and inventors were often regarded by their contemporaries as quacks or even heretics."⁴⁸ Noble, in the same work, emphasizes the importance of asking questions. "But true pioneers-people like Socrates, Voltaire, Newton and Einstein-have consistently had the courage of their convictions: the vision to ask the right questions and the determination to keep on asking until they got satisfactory answers."⁴⁹ Popper himself asks whether his dream has any use: "But if my dream is metaphysical, what is the use of it? Is there anything in it beyond, perhaps, an emotional satisfaction? Is it not utterly different from a scientific hypothesis-one in which we are mainly interested because of its implicit claim to be considered, tentatively, as true?"⁵⁰

⁴⁵ *Ibid.*

⁴⁶ *Ibid.*

⁴⁷ P3, 176. Emphasis mine.

⁴⁸ K. Noble, "Shape of Things to Come" *Time*. Special Issue, January 1998, 18.

⁴⁹ *Ibid.*

⁵⁰ P3, 199-200.

Popper answers positively pointing out that there is no more difference between Metaphysics and science regarding this point:

I no longer think, as I once did, that there is a difference between science and metaphysics regarding this most important point. I look upon a metaphysical theory as similar to a scientific one. It is vaguer, no doubt, and inferior in many other respects; and its irrefutability, or lack of testability, is its greatest vice. But, as long as a metaphysical theory can be rationally criticized, I should be inclined to take seriously its implicit claim to be considered, tentatively, as true. And I should be inclined to evaluate it, in the main, by an appraisal of this claim—considering its theoretical interest first, and taking only a secondary interest in its practical usefulness (as distinct from its fruitfulness as a research programme). Practical usefulness or uselessness may be considered as important mainly because it is something like a test of truth—as it may often be in connection with a scientific theory.⁵¹

Dreams and reality, Metaphysics and science may be strange bedfellows. But that is just it, they are bedfellows.

Creativity, Discovery and Invention:

These three terms should be understood as interrelated within the context of science. Without these three, no scientific activity is possible. Popper talks of scientific knowledge in view of discovery⁵² and implicitly refers to these three.

A. Creativity.

By creativity, Popper does not mean *creatio ex nihilo* but as *creatio post nihilo*. It is rather a production, “from something to

⁵¹ *Ibid.*

⁵² UQ, 90. “If we are to look upon the theory of knowledge as a theory of discovery, then it will be best to look at *scientific* discovery. A theory of knowledge should have something to say especially about the growth of physics, and about the clash of opinions in physics.”

something".⁵³ Creativity is metaphysical because it belongs to the psychological realm. "I-Popper affirms-"do not hold, and sometimes say, that there are two different components in the psychological processes which lead to new theories or guesses. One of them is creative imagination or, if you like, 'intuition'; the other is rational criticism."⁵⁴ At first, Popper considers this "irrelevant",⁵⁵ but later on he vouches for its importance. "There cannot be a satisfactory explanation of creativity."⁵⁶ Life is creativity.⁵⁷

What characterizes creativity? Popper writes: "What characterizes *creative thinking* apart from the intensity of the interest in the problem, seems to me often the ability to break through the limits of the range-or to vary the range-from which a less creative thinker selects his trials. This ability, which clearly is a critical ability, may be described as *creative imagination*. It is often the result of culture clash, that is, a clash between idea, or frameworks of ideas."⁵⁸ And what leads to discovery? Nothing more but the repeated and varied attempts to solve a problem.⁵⁹

Popper seems to have localized creativity in imagination and criticism in the intellect. But this distinction is not called for, because of the interplay of criticism and dreams, between science and Metaphysics. Indeed there is a coordinated action of all brain processes with scientific knowledge as its outcome.

So intense is the interplay that Popper sometimes interchanges creativity with invention:

But it seems to me that what is essential to "creative" or "inventive" thinking is a combination of intense interest in

⁵³ W. Carroll, "Thomas Aquinas and Big Bang Cosmology", Jacques Maritain Center. Thomistic Institute. <http://www.nd.edu/Departments/Maritain/ti/carroll.htm> Net-surfing Date: 1/26/98. Cf. P3, XIII. "Something can come from nothing."

⁵⁴ RC, 1086.

⁵⁵ LScD, 31.

⁵⁶ *The World of Parmenides. Essays on the Presocratic Enlightenment* (TWOP). A. Petersen ed. (New York: Routledge, 1998), 126.

⁵⁷ P2, 174.

⁵⁸ UQ, 47. Emphasis mine.

⁵⁹ P1, 40.

some problem (and thus a readiness to try again and again) with highly critical thinking; with a readiness to attack even those presuppositions which for less critical thought determine the limits of the range from which trials (conjectures) are selected; with an imaginative freedom that allows us to see so far unsuspected sources of error: possible prejudices in need of critical examination.⁶⁰

Creativity works all throughout the process of discovery and invention.

B. Discovery and Invention.

In his book *The Role of Belief in Scientific Discovery: Michael Polanyi and Karl Popper*, Dominican Albert Bagood posits the question as to what role belief has in scientific discovery according to Popper. Bagood first noted the meagerness of Popperian literature in coming up with a clear definition of discovery.⁶¹ Bagood then adds that Popper tends to interchange discovery and invention⁶² citing passages from *Unended Quest* (120, 185). This same author then concludes that, generally, Popper maintains "the difference between discovery and invention."⁶³

Popper understands discovery in terms of bringing to fore something that is hidden. But this presupposes a change in the framework, a change in the viewer. Most scientists seem to share this view. "The word 'discovery' literally means: uncovering something that's hidden from view. But what really happens is a change in the viewer. The familiar offers a comfort few can resist, and fewer still want to disturb. But as relatively recent inventions such as the telescope and microscope have taught us, the unknown has many layers. Every truth has geological strata, and you can't have an orthodoxy without a heresy."⁶⁴

⁶⁰ *Ibid.*, 48.

⁶¹ Bagood, 195.

⁶² *Ibid.*

⁶³ *Ibid.*, 198.

⁶⁴ D. Ackerman, "Discoveries on your Doorstep" *Time*, 7.

Invention and discovery are actually closely related. "A thin line separates discovery from an invention. The principles of electricity, for example, were discovered by William Gilbert in the 16th century. The electric light bulb, however, was an invention. Gilbert has been all but forgotten, despite his momentous discoveries; but Thomas Edison, inventor of the light bulb, won both fame and fortune for his electrical inventions."⁶⁵ Invention is related to the technical, technological and practical applications of discovery. Bagood makes this acute observation: "Knowledge is to discovery what skill is to invention... It can be added that scientific knowledge is to discovery while operational principle of technology is to invention."⁶⁶

The process of discovery and invention is continuous. "New discoveries fuel new inventions, which in turn fuel new discoveries."⁶⁷ And all throughout, creativity is in operation.

C. *Discovery and Belief*

Popper considers belief as pertinent to his Metaphysics. Bagood's already cited work concludes that for Popper⁶⁸ belief makes only a minimal contribution to science.⁶⁹ Bagood concludes: "Regardless of how many times Popper mentions intuition and imagination, for him, they remain with no more than irrational character which can have significance only within the scientist's private life but otherwise valued as uninteresting by science. (Cf. PH, 138)."⁷⁰

⁶⁵ "Changing the world through discovery", *Ibid.*, 61.

⁶⁶ Bagood, 196.

⁶⁷ "Changing the world through discovery" *Time*, 61.

⁶⁸ P1, 157. See also p. 62, 79 fn1.

⁶⁹ Bagood, 200, 203, 211-217. "Popper's giving up of the 'psychology of discovery' leaves him almost without any explanation concerning the preparatory disposition of a scientist who embarks on a scientific discovery. His obsession, his mental apprehension, his hunches and his imagination are beyond logical analysis and hence outside the interest of rational justification or validation.", 200.

⁷⁰ *Ibid.*, 211-212.

Bagood's conclusion is limited by his theoretical framework which is primarily sympathetic to Polanyi, the author of *Personal Knowledge*.⁷¹ This article of ours seeks to refute such a view. Popper considers belief as important and interesting to science and not merely to the private lives of the scientists.

Science and Metaphysics are different but complementary. The Popperian demarcation between the two is determined by critical rationalism. Metaphysics, though falsifiable, is criticizable. Bagood's study has failed to take into consideration Popper's maturity. The Popper of the *Logik* seems to have disliked Metaphysics. But a study of his later works (the *Postscript*), would reveal how Popper came to realize the value of Metaphysics to scientific knowledge. This has been the center of interest of this article.

Moreover, Popper does not equate science with its methods or methodical rules, as Bagood claims.⁷² This has been demonstrated in this article. Popper never intends science to be his norm. It is more of an advice or suggestion, however, it is to be the best suggestion among the possible ones. There is nothing dogmatic or authoritative in this. What Popper affirms is that even this prescription or suggestion is metaphysical. It may be a wish-dream, but criticizable and for the present it is the best criticizable theory.

There is rational belief involved in science. Belief, however, is not the subject matter of epistemology.⁷³ Belief, within the context of the rationality of science, is bound up by the "*progressive overthrow* of theories, rather than their alleged *progressive consolidation* (or increasing probability) resulting from the accumulation of supporting observations, as inductivists believe."⁷⁴ The problem of belief is solved by means of corroboration which is the subject matter of another separate study.

⁷¹ Cf. M. Polanyi, *Personal Knowledge. Towards a Post-Critical Philosophy*. (Chicago: The University of Chicago Press, 1962).

⁷² Bagood, 213-215.

⁷³ P1, 22.

⁷⁴ *Ibid.*, 58.

Metaphysics includes belief in Karl Popper. It is important and interesting with regards to the formulation of scientific knowledge and thus has a function with regards to science.

* * * * *

With regards to creativity, discovery and invention – three interrelated concepts – we have started to see the convergence point of Metaphysics and science in the thought of Karl Popper. What matters is that there is a regulative idea, which is truth. Scientific growth is characterized by the acquisition of truth. Popper concedes that this may only be a dream. But dreams, together with the “artistic” dimensions of creativity, discovery and invention, motivate the fulfillment or realization of reality. These three interrelated concepts or better said, the mere fact that they are interrelated would lead us to conclude that in Karl Popper there might be more than just mere converging points for Metaphysics and science. □