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THE UNIVERSITY OF YAOUNDE I
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POST GRADUATE SCHOOL FOR SOCIAL AND EDUCATIONAL SCIENCES
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The Role of Metaphysics in Scientific Rationality: A Study of Karl Popper's Opposition to Logical Positivism

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To

My Parents,

Mr. SHIYNTUM Calestus and Mrs. SUI Henreitha

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RESUME

Il était question, dans cette thèse de comprendre la fonction épistémologique de la Métaphysique en Science. Pour répondre à cette préoccupation, nous sommes partis de l'opposition entre les conceptions Popperienne et positiviste du paradigme de la rationalité scientifique. En nous fondant sur une méthode historique et analytique, nous avons démontré comment le Positivisme logique a procédé à l'élimination de la Métaphysique et à la naturalisation de la Philosophie sur la base du critère du sens. Ainsi, à travers le vérificationnisme, la réconstruction rationnelle et la probabilité le positivisme logique montre comment la Métaphysique est un non-sens. Or chez Karl Popper, la rationalité scientifique ne saurait évacuer de son sein toute la Métaphysique. C'est pourquoi Popper propose le falsificationisme comme paradigme fondateur de la démarche scientifique. Chez Popper, nous constatons qu'il procède à une revalorisation épistémologique de la Métaphysique, à trois niveaux : 1/- Popper tente un dépassement du Positivisme logique pour accéder à un réalisme scientifique qui serait la voie royale à l'élaboration d'une méthode permettant une meilleur approche de toute étude que mène à la science. 2/- A partir d'une illustration fondée sur l'histoire de la science, Popper a réussi à démontrer ce qu'est la valeur heuristique de la métaphysique dans le raisonnement scientifique. 3/- Cette revalorisation de la métaphysique peut se justifier à partir du rôle que Popper accorde à celle-ci (métaphysique) en la considérant comme le fondement de l'objectivité scientifique. Mais il faut dire que cette valeur accordée à la métaphysique repose sur les principes dont la pertinence est discutable. Car il y a une contradiction dans la pensée de Popper pour qu'il faut toujours faire une distinction entre science et non science quand on veut réfléchir rigoureusement et objectivement. Or, en disant que la Métaphysique n'est pas de la science au sens premier du terme et qu'en même temps cette métaphysique est contenue dans le raisonnement scientifique, cela devient contradictoire. Pour résoudre ce problème, nous avons procéder de trois manières. Premièrement en remettant en question cette valorisation de la Métaphysique, deuxièmement en proposant une sorte de falsificationisme progressiste d'une part ainsi qu'un deuxième critère de démarcation entre la « Métaphysique positive » et la « Métaphysique négative ». Ainsi, au lieu du naturalisme scientist qui vise au naturalisation de la métaphysique nous avons fait recours au naturalisme compatibiliste qui réponde à la question de savoir quelle métaphysique est utile en science. Une telle métaphysique scientifiquement utile est ce que nous appelons la « Métaphysique positive ».

Concepts clés : Démarcation, Rationalité scientifique, Métaphysique, Sémantique, Métaphysique Positive, Naturalisme, Vérificationnisme et Falsificationnisme

ABSTRACT

The major concern in this thesis was to understand the epistemological role of Metaphysics in science. To answer this preoccupation, we proceeded from the opposition between the logical positivists and the Popper's conceptions of the paradigm of the rationality of science. Using a historical and analytical method, we have demonstrated how logical positivism proceeded into the elimination of metaphysics and the naturalization of Philosophy using the criterion of meaning. As such, by making recourse to verificationism, rational reconstruction and probability, logical positivism show how metaphysics is nonsense. However, in Popper's rationality of science, it is difficult to eliminate metaphysics completely from science. That is why Popper proposes falsification as the founding paradigm of scientificity. Popper in this approach proceeds to the epistemological valorization of metaphysics at three levels: 1 / Popper attempts to surpass logical positivism by defending realism as the best theoretical framework of the reliable method of studying science. 2/ Through an illustration grounded on the history of science, Popper demonstrates the heuristic value of Metaphysics in scientific reasoning. 3/ Also, Popper revalorizes Metaphysics by considering it as the basis of scientific objectivity. However, it should be noted that this epistemological value accorded to metaphysics by Popper is bases on principles whose pertinence is questionable. This is because there is a contradiction between Popper's early insistence on a sharp demarcation between science and Metaphysics and his later thesis of that Metaphysics is indispensable in the elaboration of scientific knowledge. Thus, to assert that Metaphysics is non-science and to affirm that Metaphysics is contained in science is contradictory. To solve this problem, we proceeded in three ways. Firstly, in questioning this valorization of metaphysics. Secondly, in proposing progressive falsification and thirdly, by proposing a second criterion of demarcation between "positive metaphysics" and "negative metaphysics". As such, instead of scientist naturalism which aims at the naturalization of Metaphysics, we made recourse to compartibilist naturalism which answers the question to know which Metaphysics is useful in science. Such a scientifically useful metaphysics is what we refer to as "positive metaphysics".

Key concepts: Demarcation, Scientific rationality, Metaphysics, Semantics, Positive Metaphysics, Naturalism, Verificationism and falsificationism.

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GENERAL INTRODUCTION

The motivations of Epistemology and Philosophyof Sciencecan be deduced from the Aristotelian assertion that: "all men by nature desire to know."[1] This renders knowledge the nerve-centre of epistemological preoccupation. By epistemology, we do not only refer to the study of the various theories of knowledge[2] but also as the study of science as the operational kind of knowledge. Epistemology then questions knowledge, its formation, its justification and its limits. To James Ladyman, It deals with questions such as "what is knowledge as opposed to belief; what things can we know?"[3] Philosophy of Science overlaps with Epistemology because science in the former is considered as the pragmatic and the most operational form of human knowledge. That is why Steven Cowan equates epistemology to philosophy of science as he asserts that "epistemology is that branch of philosophy concerned with the nature, scope and justification of science. The question, what we know? And how we know it"[4] are core preoccupations in epistemology. Philosophy of Science is then applied epistemology. Jennifer Lackey holds that "applied epistemology brings the tools of our contemporary epistemology to bear on particular social concern."[5] The social concern here is science as a human activity and a form of human culture. In this respect, Joseph E. Brenner reiterates that "philosophy of science is a major field within philosophy concerned with the foundations, methods and results of science and their implication in the society."[6] Thus, our research topic is philosophical and can be situated within epistemology and specifically in the operational context of the philosophy of science.

The central question in the Philosophy of Science that of the definition of science. The question of the definition of science coincides with that of distinguishing between science and non-science on one hand and that of differentiating between science and pseudo-science on the other hand. Even though there are other forms of sciences like the formal sciences, the humanities and the social sciences, our concern in this intellectual itinerary is on empirical or experimental sciences. That is, the sciences that justified their theories using experiments like physics, chemistry, biology, geology and astronomy. The question of the definition and status of empirical sciences is intrinsically related to the question of demarcation. That is, the question of the distinguishing between science on one hand and pseudo-science or non-science on the other hand.

[1]Aristotle, *Metaphysics*, Trans., W. D. Ross, 350 BC, South Dakota, Nuvision Publications, 2005, p. 1.
[2]The study of the theory of Knowledge is understood as gnoseology.
[3]James Ladyman, *Understanding Philosophy of Science*, London and New York, Routledge, 2002, p. 5.
[4] Steven B. Cowan, *Problems In Epistemology and Metaphysics-An Introduction To Contemporary Debates*, London, Bloombury Academic, 2020, p. 17.
[5] Jennefer Lackey, *Applied Epistemology*, Oxford, Oxford university press, 2021, p.3.
[6] Joseph E. Brenner, *Philosophy In Reality*, A new Book of change, Dordreicht, Springer, 2021, p. 3.

This is the question of the criterion of scientificity which Popper raises as "when should a theory be ranked scientific? Or is there a criterion for the scientific character or status of a theory?"[7] This criterion of scientificity to Karl Popper exclusively applies to empirical sciences. He also likens the question of the scientificity of empirical science to that of the demarcation as he qualifies the latter as "the problem of finding a criterion which enables us to distinguish between the empirical sciences on the one hand, and mathematics and logic as well as metaphysical systems on the other hand."[8]

The question of the criterion of scientificity is inseparable from the problem of demarcation. This is because to define science is to distinguish it from what science is not. The urgency of defining and distinguishing science from non-science is due to the growing authority of science over nature. The question is then as old as natural philosophy and science and will remain actual as long as natural science remains the most operational form of knowledge. That is why Michael D. Gordin, states that:

> *We have wrestled with the problem of demarcation for as long as domains of knowledge about the natural world have claimed authoritative status. One of the oldest medical writings in the western tradition, the fifth century BCE Hipporateic text, "one the sacred Diseases", is essentially a demarcation document about how to understand and treat what we now call epilepsy.* [9]

Questioning the criterion of scientificity is to engage at the same time in normative Epistemology on one hand and into the logic of science on the hand. By the logic and rationality of science, we imply not only the procedures, aims, methods that theories should follow to be ranked scientific but also the conditions for the acceptability of scientific theories. By normative epistemology on the other hand, we imply the branch of epistemology that prescribes norms, standards, that theories should respect in other to be given a scientific connotation. It is in this line of reflection that, Mario Bunge situates normative epistemology in history of knowledge as he asserts that:

> *Unlike descriptive epistemology, its normative partner, methodology, has only weak roots in antiquity and the Middle Ages. Leaving logic aside, they amount to a handful of rules, such as Plato's injunction to shun opinion (doxa) and seek only certain knowledge (episteme), Aristotle's practice of defining everything, Hippocrates' recommendation to abstain from super naturalistic explanation, and Ptolemy's advice that astronomy be*

[7]Karl Popper, *Conjectures and Refutations, The Growth of Scientific Knowledge*, London, Routledge, 1963, p. 33.
[8]Karl Popper, *The Logic of Scientific Discovery (1934)*, London, Routledge, 1954, p. 3.
[9] Michael D. Gordin, *On The Fringe, Where Science Meets Pseudo-Science*, New York, Oxford university Press, 2021, p. 1.

> *restricted to describing phenomena (appearances) […] Bacon swore by induction and Descartes by conceptual analysis and deduction from indubitable first principles.*[10]

The question of the criterion of scientificity is normative then because it presupposes prescriptions on what tenable, acceptable and true knowledge or true science consist of. It is also a question of engaging into the logic of science. This is the same point of view held by Popper who asserts that "the task of the logic of scientific discovery, or of the logic of knowledge, to give a logical analysis of this procedure; that is to analyse the method of the empirical sciences."[11] Thus, although our topic of research is epistemological, we can limit it to normative epistemology which is grounded on the logic and rationality of science.

It is then within the context of normative epistemology that we conceive the topic of our research as "The Role of Metaphysics in Scientific Rationality: a Study of Karl Popper's Opposition to Logical Positivism". When we talk of the rationality of Science, we are not referring to theories of knowledge where there is a traditional conflict between empiricism and rationalism, but we are referring to how scientific theories are constructed and tested. Scientific rationality then refers to the criterion, the standard or the conditions for a theory to be ranked scientific. It is in this light that Rudolf Carnap warns against the misuse of the rationality of science as he asserts that:

> *If we take the word (rationality of science) in the scene of the old epistemological and theoretical opposition between rationalism and empiricism, then this expression should obviously not be used to indicate our position. Since, according to the construction theory, each statement of science is at bottom a statement between elementary experiences, it follows that each substantive (i.e., purely formal) goes back to experience. Thus, the designation "empiricism" is preferred.*[12]

However, as a traditional empiricist, Carnap like other logical positivists talk of scientific rationality to refer to what makes a theory to be scientifically acceptable and what guarantees the specificity, uniqueness, and the legitimacy of the scientific methodology. He thus insists that: "the word 'rationalism' is nowadays, for the most part and perhaps also in this case in its modern sense, namely in opposition to irrationalism."[13] The rationality of science then is a concept in normative Epistemology which refers to the standards and measures that science follows. Antony O'Hear, is of this view when he holds that: "I called this the model approach because it was meant to capture the thought that science is the paradigm of institutionalised rationality; that science had some

[10]Mario Bunge, *Treatise on Basic Philosophy, Epistemology and Methodology 1: Exploring The World*, Dordrecht, D. Reidel Publishing Company, 1983, p. 4.
[11]Karl Popper, *The Logic of Scientific Discovery*, p. 3.
[12]Rudolf Carnap, *The Logical Structure of The World and Pseudoproblems In Philosophy (1926)*, Chicago, Open Court, 2003, p. XVII.
[13]*Ibid*., p. 298.

special unique form of rationality embodied in the method of science which scientists heroicly follow."[14]

Scientific rationality then refers to what makes a theory in science to be tested or chosen over others. Popper notes that as "we arrive at the fundamental new possibility, our trials, our tentative hypotheses, may be critically eliminated by rational discussion, without eliminating ourselves. This indeed is the purpose of rational critical discussion."[15] To talk of the role of metaphysics in scientific rationality then is to question if metaphysics is of any importance in the development of science and if metaphysics plays any role in the way scientific theories are constructed, tested and preferred over others. It is then evident that in attempt to define science, to state the scientificity of scientific theory or to differentiate between science and non-science is to determine the paradigm of scientific rationality. The rationality of science thus refers to the standard of scientificity, which distinguishes science on one hand from metaphysics, logic and mathematics on the other hand. In the context of logical positivism and Karl Popper that concerns us, rationality does not refer to any extra-scientific rule nor does it refer to any regional standards to judge the scientificity of a theory. The regionalisation of rationalism defended by Hebga seems more anthropological than philosophical and scientific. Such pseudo-rationalism is evident in Meinrab Hebga who asserts that:

> *« Au total, la croyance au Kon et Famla n'est pas irrationnelle, pourvu qu'on la replace dans son contexte socioculturel. A l'extrapoler indûment, et à la juger en fonction d'une anthropologue dualiste qui est étrangère, on la dénatue et l'on tient sur elle un discours qui ne la concerne pas. »*[16]

Although logic and mathematics are generally recognised as useful, especially in the formalisation of empirical science, this is not the case with metaphysics. This is partly because logic and mathematics are considered as tools and methods and thus do not make discourse about nature and reality while metaphysics makes claims about the real. However, the most important reason why metaphysics is given the pejorative connotation in the criterion of scientificity is apparently because with the obsession to state the criterion of scientificity, most philosophers ignore the study of the role of metaphysics in the constitution of scientific theories and discourses.

[14]Antony O'Hear, *Karl Popper's Philosophy and Problems*, Cambridge, Cambridge University Press, 1995, p. 15.
[15]Karl Popper, *The Myth of Framework: In Defence of Science and Rationality*, London, Routledge, 1994, p. 69.
[16] Meinrab Hebga, *La Rationalité d'un Discours Africain sur les Phénomènes Paranormaux*, Paris, L'Harmattan, 1998, p. 338. "In a whole, the belief in *Kon* and *Famla* is not irrational, provided we replace it in its sociocultural context. To unduly exterapolate and judge it using a foreign dualist anthropology that is foreign, is to denature it and to make a discourse on it but which does not concern it "(my translation).

That is why besides other non-empirical sciences like logic, mathematics and humanities our research topic is limited only to metaphysics.

In the antiquity, metaphysics was considered as the fundamental and natural science. Aristotle describes metaphysics in the following terms:

> *There is a science which investigates being as being and the attributes which belong to this in virtue of its own nature. Now this is not the same as any of the so-called special sciences; for none of these others treats universally of being as being. They cut off a part of being and investigate the attribute of this part.*[17]

Metaphysics was therefore considered as a science that studies the totality of everything that exists. In this same line of reflection, Charles Romain Mbele, a Cameroonian philosopher reiterates in this global view of metaphysics, in one of his congress presentations that metaphysics refers to "a philosophical reflection on being as such on the totality of what is"[18] Secondly, it was considered as a fundamental science. That is, metaphysics was considered as the science that assured the security of other sciences by assuming the position of the foundation. In his famous metaphor of the tree of philosophy, Descartes refers to philosophy as a tree "of which the roots are metaphysics, the trunk is physics."[19] While metaphysics is the root, Descartes identifies empirical sciences with the trunk, implying that metaphysics plays a role in the development of science. However, this is not the same view that was shared by positivism of Auguste Comtes and the Empiricism. While Auguste Comte reduces the scientific object to the concrete and situates metaphysics in the pre-scientific stage of the evolution of the human mind, the British empiricists philosophers like Locke rejects the possibility of innatism asserting that experience is the only sources of knowledge. Whether in Comte's positivism or the British empiricism, empirical knowledge is projected as the most acceptable while experience is the only method to access tenable knowledge. Scientific rationality in this classical empiricism then consisted in acquiring knowledge through experience. That is, tenable knowledge to them is knowledge of facts. That is why Cameroonian philosopher, Ayissi Lucien notes that:

> *« Pour Hume comme pour Comte, il s'agit moins de rectifier l'esprit humain que de le discipliner pour qu'il sorte résolument de son enfance théologique ou de sa jeunesse métaphysique, car ce n'est pas dans les considérable investigations théologique et métaphysique que l'esprit humain peut donner la prévue de sa maturité. C'est plutôt dans*

[17] Aristotle, *op.cit*., pp. 42-43.
[18] Charles Romain Mbele, *The Question of a Philosophy of The Margins, Between Truth, Solidarity and Justice*, Trans. Li Dan, in *Learning To Be Human*, compilation of The XXIV World Congress of Philosophy, From August 13th-20th in Beijing, 2018, p. 231.
[19] Rene Descartes, *Principles of Philosophy (1644)*, Trans., Valentine Rodger and Reese P. Miller, Dordrecht Kluweit Academic Publishes, 1982, p. xxiv.

l'observation et l'analyse des faits que Hume désigne précisément par le terme matters of facts. »[20]

The result of classical epistemological positivism and Empiricism then was the rejection of metaphysics as respectively pre-scientic and pseudo-knowledge. In fact metaphysics did do meet up with the empirical criterion of acceptable knowledge. If empirical knowledge is knowledge of the concrete phenomena as Comte asserts or knowledge of experience as the British empirists hold then there is an attempt to exclude metaphysics from science for it plays a negative epistemological role. Thus, classical empiricism and epistemological asserted that metaphysics plays a negative role in the development of knowledge.

In the 20th century, the attempt to exclude metaphysics from the epistemological landscape witnessed a transition from epistemological positivism to logical positivism. While traditional empiricism and epistemological positivism posited experience as the grounding of knowledge, logical positivism gave a linguistic and an analytical orientation by focussing on language in which scientific knowledge is expressed. Logical positivism is then another approach of analytical philosophy. Even though there are many approaches to logical positivism that developed anti-metaphysical approaches such as the Cambridge school,[21] the Marburg School,[22] the Vienna Circle,[23] among others, our topic is restricted only to logical positivism who defended the semantic paradigm of scientific rationality on one hand and whose ideas were highly opposed by Popper's rationality of science on the other hand.

We talk of the semantic paradigm of scientific rationality of logical positivism because according to the latter, a theory is scientific only if it is meaningful. To Lars-Goran Johansson "a fundamental notion in semantics is therefore reference, the relation between a term and the object it stands for."[24] Semantics thus, deals with how to deduce meaning from propositions by confronting them to the factual world from which they are drown. It is the same point of view held by Robert Disalle who notes that:

[20]Lucien Ayissi, *Le positivism de David Hume*, Paris, L'Harmattan, 2017, p. 14. "For Hume just like to Comte, it is a question of rectifying the human mind than disciplining it so that it can resolutely come out of its theological childhood or from its metaphysical youthfulness, for it is not in the considerable theological and metaphysical investigations that the human mind can show proof of maturity. It is instead in observation and analysis of facts that Hume precisely designates as matters of facts" (my translation).
[21]With pioneer philosophes like George Edward Moore, Betrand Russell, Ludwign Wittgenstein, Lizzie Susan Stebbing and John Wisdom.
[22]With Neo-Kantian analytical philosophers like Hermann Cohen and Paul Narterp.
[23]With leading philosophers such as Otto Neurath, Rudolf Carnap, Moritz Schlick, Philipp Frank among others.
[24] Lars-Goran Johnasson, *Empiricism and Philosophy of Physics,* Dordreicht, Springer, 2021, p. 7.

Logical empiricists account of the theoretical and observable languages, with associated distinction between theoretical and observable concepts and statements, were intended to connect theories as formal axiomatic structures with the experiments and observations that provided empirical meaning and support.[25]

A scientific theory to logical positivism is a system of statements, drawn from the empirical world. Rudolf Carnap in this line of reflection asserts that "science is a system of statements based on direct experience and controlled by experimental verification."[26] Given that a scientific theory is a system of statements, then the semantic paradigm of logical positivists insists that it is a theory with meaningful statements that is scientific. Charles Alan Tyalor in the same way asserts that "the 'truth' of meaningful statements can be demonstrated either by empirical verification or by analysis of the meanings of their components. Therein lies the proposed demarcation criterion: the statements of the empirical sciences are capable of empirical verification."[27]

The logical positivists in this regard propose three techniques to define meaning in scientific rationality. The first technique of evaluating the meaning of a theory to them is the principle of verification. This principle states that "the sense of a proposition is its agreement and disagreement with possibilities of existence and non-existence of states of affairs."[28] In this correspondence theory of meaning, verificationists argue that a theory is scientific if it corresponds to facts and states of affairs. Metaphysics to them is thus meaningless as its statements are not factual and thus its statements obstructs the construction of scientific theories. While the logical positivists' verificationist approach to scientificity is developed by philosophers like A. J. Ayer, early Wittgenstein[29] and Moritz Schlick, the second approach that is developed by Rudolf Carnap and Otto Neurath is based on physicalist meaning that they attempt to develop through rational reconstruction and the project construction of an encyclopaedic science. In the logical analyses and reconstruction of the language of science, Carnap and Neurath projected scientific theories as meaning, thereby proclaiming the elimination of metaphysics. In the third approach, Hans Reichenbach proposes the probability theory of meaning as a solution to the short-comings of the first two approaches. Reichenbach states the principle of the probability theory of meaning in the

[25] Robert Disalle, *Logical Empiricism and Physical Sciences, From Philosophy of Nature to Philosophy of Physics*, London-New York, 2021, p. 181.
[26] Rudolf Carnap, *The Unity of Science*, (1934), Trans. M.Black, Bristol, Thoemmes Press, 1995, p. 42.
[27] Charlse Alan Taylor, *Defining Science*, A rhetoric of demarcation, London, The university of Wisconsin press, 1996, p. 25.
[28]Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, Trans. D. F. Pears and B. F. McGuiness, (1922), London-New York, Routledge, 2001.
[29]Early Wittgenstein reprints the early episode of his philosophy where he insisted on representation as the only role of language. Early Wittgenstein epitomizes his views developed in the Tractatus. However, later Wittgestein refers to his later view that language is a form of life and thus has many functions. This I other words is the Wittgenstein of The Philosophical Investigation, where he develops the notion of language games.

following words: "the first principle of the probability theory of meaning: (holds that) a proposition has meaning if it is possible to determine a weight, that is, a degree of probability, for the proposition."[30]

In the logical positivists approaches to scientific rationality, there is an acute aversion of metaphysics. According to A. J. Ayer, metaphysical statements are products of the erroneous usage of logic and thus cannot be referred to as useful statements. That is, "metaphysical utterances are due to the commission of logical errors, rather than to a conscious desire on the part of their authors to go beyond the limits of experience."[31] To Rudolf Carnap, meta-statements then "have no sense, assert nothing, are merely pseudo-statements."[32] If science is a system of meaningful statements and metaphysical statements cannot be given meaning from experience, then the logical positivist asserts that it is at the same time non-science and pseudo-science. However, the ensuing question is whether we can successfully eliminate metaphysics from science. It is in this respect that role of metaphysics in scientific rationality will help us answer the question, whether empirical science without metaphysics is possible.

Pondering whether science without metaphysics is possible, Karl Popper's answer is negative. In other to examine the role of metaphysics, he attempts a rupture from the logical positivist semantic paradigm scientific rationality to the criterion of demarcation. In his evolutionary epistemology, Karl Popper rejects the inductive approach to science, defending the conjectural knowledge and the deductive method of testing theories. Arguing that there is a difference between the empirical character of a theory and its meaning, Popper criticises the meaning, approach to scientificity, asserting that: "The criterion of the scientific status of a theory is its falsifiability or refutability, or testability."[33] Drawing allusion from the history of science, Popper observes that the Copernican astronomy was influenced by the platonic worship of the sun and asserts that, "this indicates how myths may develop into testable components."[34] This, coupled with a litany of mythical systems and metaphysical theories that later developed into testable theories of science, makes Popper to hold that, "I always dismissed the problem of meaninglessness as a pseudo-problem and I was always opposed to the idea that it may be

[30]Hans Reichenbach, *Experience and Prediction*, An analysis of the foundations and structures of knowledge, Chicago, Chicago University Press, 1938, p. 54.
[31]Alfred Jules Ayer, *Language, Truth and Logic*, 1st ed., New York, Penguim Books, 1936, p. 13.
[32]Rudolf Carnap, "The Elimination of Metaphysics Through The Logical Analyses of Language" in *Erkentsis*, vol. 2, No.24, Netherlands, Springer, 1932, pp. 60-81, p. 71.
[33]Karl Popper, *Conjectures and Refutations*, p. 33.
[34]*Ibid.*, p. 257.

identified with the problem of demarcation."[35] Thus, Popper asserts that there are meaningful metaphysical theories and systems that are neither empirical nor scientific. That is why Karl Popper opposes the meaning or semantic paradigm of logical positivism with the criterion of demarcation. This opposition is crucial in their conceptions of the constitution, the language, the logic and their rationality of science.

Thus, instead of verification which is a form of justificationism and thus an authoritative and dogmatic approach to the logic and rationality of science, Karl Popper proposes falsifiability as the principle of scientificity of a theory. Falsifiability unlike verification is grounded on the epistemic fallibility of man and thus permits the growth of knowledge. Insisting that "science is a biological phenomenon."[36] Popper answers the question of the standard of scientific rationality by affirming that, "The answer to this question is that the distinctive feature of science is conscious of application of the critical method,"[37] which consists in falsification. A theory to him is falsifiable, "If we accept basic statements which contradict it."[38] Thus the scientificity of a theory to Popper is not in its power to make confirmable predictions but in its boldness to make predictions that can be refuted. It in this light that Godfrey B. Tangwa asserts in a Popperian tone that: "A scientist is true to his name, must, according to Popper, show the boldness in the sense by a way of an ever readiness to seek out for tests and refutations of his theory."[39] Thus while scientific rationality in logical positivism consist in the construction of meaningful theories, Popper thinks that such rationality consists in constructing theories that can be refuted by crucial experience.

While metaphysics plays a negative role in the logical positivists' view of scientific rationality, Popper asserts that metaphysics plays an indispensable role in science, for the former is more consistent in the framework of realism than in the logical positivist realm of instrumentalism or anti-realism. Metaphysics to him influences not only the way science studies real but also the status of scientific truth. Scientific rationality to logical positivist is an answer to the question of scientificity but in Karl Popper, scientific rationality consists in the criterion of demarcating between science and non-science. Questioning the role of metaphysics in scientific rationality, in the context of the opposition between the logical positivists' semantic paradigm and

[35]Karl Popper, *Conjectures and Refutations* p. 258.
[36]Karl Popper, *All Life Is Problem-Solving*, trans., Patrick Camiller, London, Routledge, 1994, p. 5.
[37]I*bid*., p. 7.
[38]Karl Popper, *The Logic of Scientific Discovery*, p. 66.
[39]Godffrey B. Tangwa, Karl Popper, *A Thematic Critical Introduction*, Yaounde, Luma Graphics, 1990. (unpublished), p. 12.

Popper's criterion of demarcation, poses the problem of the pertinence of Popper's rejection of the logical positivist paradigm of scientific rationality. The problem of the pertinence of Popper's conception of the rationality of science is justified because chronologically Popper's philosophy is largely influenced by the limits of logical positivism and secondly because logically, Popper's criterion of demarcation is presented in the history of science is presented as the surpassment of the logic of the logical positivists' view of the logic of science.

The problem of the pertinence of Popper's scientific rationality arises because of the apparent contradiction between his insistence on a criterion of demarcation as the best alternative to the logical positivists' criterion of meaning on one hand and his defence of the importance of metaphysics in science. It is the observation of this conflict between Popper's emphasis on the sharp and rigourous criterion of scientificity and his revalorisation of metaphysics that led to the problem of the pertinence of Popper's scientific rationality. Karl Popper identifies the limits of logical positivism, by asserting that "it would be inadequate to draw the line of demarcation between science and metaphysics so as to exclude metaphysics as nonsensical from a meaningful language,"[40] he also insists that falsifiability is the principle of the demarcation of empirical science from metaphysics. However, given the epistemological role of metaphysics, Popper in the second episode of his development of the logic of science cautions that the demarcation between science and metaphysics should not be conclusive, radical and exact.

Thus, questioning the role of metaphysics in science is to pose the problem of the rationality of Popper's scientific rationality. If metaphysics is useful in science, then is it still necessary to reflect on the problem of demarcation? These contradictions evoked in the subjacent questions above, usher the central question of this work which is, can we still talk of the pertinence of Popper's rationality of science viz-a-viz logical positivism, when there is an apparent contradiction between Popper's insistence on the principle of demarcation and his defence of the importance of metaphysics in science?

Posing the problem of the pertinence of Karl Popper's rationality of science as the better alternative to the semantic paradigm of logical positivism is an actual and original problem because it will participate in the current and actual debate on the crisis of problem of demarcation. Infact, With Popper's insistence on the role of metaphysics in science and his advocacy for a less rigorous and weak demarcation criterion, most commentators of Popper like William Warren Bartley IV, instead of prolonging the challenge Popper proposes for future logicians of science, think that the

[40]Karl Popper, *Conjectures and Refutations,* p. 257.

demarcation criterion is useless today in the rationality of science. Others like Larry Laudan capitalises on Popper's revolution from the quest of a rigourous to the quest for a less vigorous criterion of demarcation, to affirm that the problem of distinguishing between science and metaphysics is a pseudoproblem. This is an actual debate in contemporary normative and prescriptive epistemology. Faced with the same problem contemporary logicians of science in the great number propose the naturalisation of metaphysics. However, we will argue that such approach is parochial and biased against metaphysics which in essence is an independent discipline from science. In a metametaphysical approach, we will take an unbiased approach in proposing a second criterion of demarcation between scientifically useful and scientifically useless metaphysics. Thus, instead of asking the Kantian question of how can metaphysics be considered scientific, we will ask the question of which metaphysics is useful in science. With the apparent lack of a sharp and exact principle or criterion of demarcation between science and metaphysics, our thesis seeks to go beyond irrationalism, anti-science and anarchism and excessive naturalism and examine an adequate second criterion between 'negative metaphysics' that is useless in science and 'positive metaphysics' that is useful in science.

To answer the question of the pertinence of Karl Popper's rationality of science as the best alternative to the logical positivists' paradigm, we adopted a historico-analytical and critical method. Historical because we have restituted the conceptual archaeology of anti-metaphysical philosophy of epistemological positivism and empiricism in part one, which is the antecedent of the semantic paradigm of scientificity of logical positivism analysed in the same part. The examination of the meaning theory of scientificity, the logical positivist critique of metaphysics and their naturalisation of philosophy constitutes part one where metaphysics plays a negative role in science. In part two of the work, we examine Popper's critique of logical positivists' semantic paradigm and analyse falsifiability as his criterion of scientificity. This analysis at the same time evokes the positive role of metaphysics in science at the same time evoking the problem of the pertinence of Popper's rationality of science as a better alternative to the logical positivists' paradigm. In part three, the critical method is applied in which we propose a critical evaluation of Popper's examination of the role of metaphysics in his definition of scientific rationality, at the same time attempting to go beyond Popper to develop our thesis of "positive metaphysics".

Questioning the actuality of the criterion of demarcation in our examination of the value of metaphysics in science is of tremendous importance. Infact, doing research on this area will be of great value both to philosophy and the society. In philosophy it will contribute to the development of normative or prescriptive epistemology, the logic of science and analytical philosophy. While

this reflection will help us appreciate the worth of interdisciplinarity as we examine the metaphysical motivations of science, it is also of great practical effects. Firstly, it helps even non-scientist to understand the need to adapt a scientific culture, given that: "Science is having an ever-increasing impact in modern societies. Science commands public attention and prestige: it is funded at very high levels by governments and private sectors."[41]The tanonomy of the world today in terms of developed and underdeveloped countries is based on the criterion of their mastery and utilisation of science and technique. That is why Issoufou Soulé Mouchili Njimom asserts that: *« grâce à son caractère opératoire, la science joue un rôle fondamental dans la société, elle est le moteur des progress sociaux. »*[42]

Thus the economic classification of the development of the world and the representation of the relationship between economic and development zones is determined on science. That is why Charles Romain Mbele states that, *«le développent moderne suppose la science et la technique comme une dimension essentielle pour la maîtrise de la civilisation industrielle. »*[43]

As such, questioning the actuality of the criterion of the demarcation of science from metaphysics of great economic importance. Also, research on the distinction between science and metaphysics is important for it helps to overcome the various conspiracy theories on aspects like the HIV/AIDS pandemic, the pandemic of covid-19 and the fight against climate change. That is why David Ludwig, Inkere Koskinen and others assert that:

> *In addressing social and environmental crisis on local and global scales, modern science and technology are often contested as part of the solution as well as part of the problem. Policy responses to issues such as environmental destruction or the Covid-19 pandemic requires scientific expertise that appears increasingly fragile and threatened by the global rise of anti-science populism.*[44]

These conspiracy theories are on the rise because pseudo-science sometimes make a grasp of the human society. Consequently, "the demarcation problem is not only an exciting intellectual puzzle for philosophers and other scholars, but is one of the things that make philosophy actually

[41]Massimo Pigliucci, Maarten Boudry James Ladyman and others, *Philosophy Of Pseudoscience, Reconsidering The Demarcation Problem*, London-Chicago, Chicago University Press, 2013, p. 3.
[42]Issoufou Soulé Mouchili Njimom, *De la Signification du Monde et du Devenir de L'existence*, Paris, L'Harmattan, 2007, p. 140.
[43] Charles Romain Mbele, *« L'actualité du développement, ou Notre plus Grand Défi »*, in *Syllabus Review*, Human and social Sciences, vol. 2. no. 3, Yaounde, Ecole Normale Supérieure, Université de Yaoundé 1, 2011, pp.420-444, p. 420. "modern development supposes science and technique as essential dimensions for the mastery of industrial civilization"; (my translation).
[44] David Ludwig, Inkere Koskinen and others, *Global Epistemologies and Philosophies of Science*, London-New York, Routledge, 2021, p. 1.

relevant to the society."[45] On the political plan, the most advanced democratic countries are those that make recourse to science for strategic domains such as health and the economy. To answer the question of which diagnosis and therapy is better for a particular pathology, there is need for the distinction between the scientifically viable diagnoses from the non-scientific ones. On the economic plan, the need to assure numeric economy and the question of which techniques are best suited for development, requires the distinction between science and non-science. Thus, we can assert that the result of our research will be of importance not only to philosophy of science but to mankind and the society. Given the above, we can thus concur with with Tim Lewens that:

> *The question about the makers of proper science are important. They affect the power held by people whose advice can determine our financial and social wellbeing; they affect what our children are taught in school; they affect our forms of research, our tax contributions can be used to fund and how our doctors advise what we maintain our health.*[46]

Thus the results our research on the role of metaphysics in scientific rat ionality will be useful to the logic of science for it will contribute to the redefinition of science, to pedagogy for it will permit to understand the stakes of interdisciplinarity between science and metaphysics, to the health domain for the best methods of pathological strategy and the best methods of economic developments necessitates a reflection on the frontiers of science and metaphysics.

[45]David Ludwig, Inkere Koskinen and others, *Global Epistemologies and Philosophies of Science*, p. 4.
[46]Tim Lewens, *The Meaning Of Science-Introduction to The Philosophy of Science*, New York, Penguin Press, 2016, p. 15.

PART ONE:

THE LOGICAL POSITIVISTS' SEMANTIC PARADIGM OF SCIENTIFIC RATIONALITY AND THE REJECTION OF METAPHYSICS

PARTIAL INTRODUCTION

The first theoretical moment of our reflection is teleologically motivated by three subsidiary problems. In the first place, it is a question of examining the conceptual archaeology of the logical positivist semantic paradigm and their antimetaphysical tendencies. It is not a chronological examination but a conceptual analysis of the role that early epistemologists play in influencing the logical positivists antimetaphysical and semantic criterion of scientificity. Thus, given that the history of philosophy is not only that class conflict in theory but also that of continuous conceptual supasment, we will question the conceptual sources of the logical positivist meaning criterion of scientificity which attempts an elimination of metaphysics from the scientific paradigm. The first subsidiary question then is what are the conceptual sources of the major tenets of logical positivism such as empiricism, logical analysis, the meaning criterion and the anti-metaphysical tendencies. We will thus examine the classical philosophers that influence the logical positivist aversion for metaphysics, their insistence on the empirical nature of knowledge and their linguistic and analytical orientation of scientific rationality. This first subsidiary question constitutes the crux of our reflection in chapter one. The second subsidiary question is that of the basic tenets of the logical positivist semantic paradigm. In this second critical moment of part one, we will seek to examine the main ideas that constitute standard of scientific rationality in logical positivism. In this second subsidiary interrogation then is, we will unveil the dialectics of the logical positivist meaning criterion of scientificity. This will be our main concern in chapter two of our reflection. The third subsidiary question of part one, centres on the logical positivists elimination of metaphysics. At this level, we will examine what the logical positivists consider as metaphysics and how they view the origin of the metaphysical impulse in man. In the same articulation, we will examine the different techniques of eliminating metaphysics in the meaning criterion of logical positivism. With the attempt to eliminate metaphysics in this chapter, we will question the implication of such anti-metaphysical attitude on philosophy at the same time examining the status of mathematics and logic in such an anti-metaphysical system. That is, we will examine the scientist naturalism of philosophy and equally question what place ethics occupies in such anti-metaphysical and naturalist definition of scientific rationality. This will constitute the main focus of chapter three of our work.

CHAPTER ONE

THE THEORITICAL ARCHEOLOGY OF THE LOGICAL POSITIVIST HERITAGE

> *When we run over libraries persuaded of these principles, what havoc must make? If we take in our hand any volume; of divinity or metaphysics (…) commit it then to the flames: for it contain nothing but sophistry and illusion.*[47]

1.1. THE CLASSICAL BASES OF THE LOGICAL POSITIVIST ANTI-METAPHYSICAL TENDENCIES

In this sub-chapter, we examine the influence of traditional epistemologists on the logical positivists anti-metaphysical attitude. By anti-metaphysical attitude, we imply their critique and the project to eliminate metaphysics from the domain of knowledge conception. It is not then a linear or historical study but a study of the origin of the major concepts, that constitute the major articulation of logical positivism in their critique of metaphysics. David Hume and Immanueal Kant were the first classical philosophers to make a critique of metaphysics as a discipline. Consequently, Karl Popper states that they are the ancestors of the two major problems of the logic of science; the problems of inductionand the problem of demarcation. Karl Popper asserts that: "if, following Kant we call the problem of induction 'Hume's problem', we might call the problem of demarcation, 'Kant's problem'."[48] That is, while Hume attacks the metaphysical notion of causality and thus questions the logical and rational bases of inductive inferences, Kant attacks metaphysics as a whole, to question if metaphysical claim of scientificity is tenable. The trial of metaphysics by Hume and Kant from their respective angles influences the anti-metaphysical attitude of logical positivism. It is thus our concern in this section to examine the different articulations of Hume and Kant's critique of metaphysics so as to unveil their paternalism of logical positivism.

1.1.1 Hume's Critique of the Metaphysical Principle of Causality.

As a British modern philosopher of the empirical school of thought, David Hume attacked the metaphysical principle of causality. Modern analytical philosophy and logical positivism in particular cannot be adequately situated in the context of the relationship between metaphysics and science without making recourse to David Hume. Besides his status as one of the founding fathers

[47] David Hume, *An Enquiry Concerning Human Understanding*, Edition Tom. L. Beauchamp, New York, Oxford University Press, 1999, p. 211.
[48]Karl Popper, *The Logic of Scientific Discovery*, p. 11.

of traditional empiricism, David Hume is arguably the first modern philosopher to question the epistemological status of metaphysics. That is, he did not only question the rationality of the metaphysical principle of causality but he also asserted that metaphysics is abstruse and useless philosophy because we cannot justify its pretentions from experience Given that knowledge to him originates from experience, he questioned the rational bases of the principle of causality whose justification transcends our experiential world. Thus, it is in this line that David Fate Nortonm a commentator of David Hume affirms that:

> *Among all philosophers who wrote before the twentieth century, none is important for philosophy of science than Hume. This is because Hume is widely recognized to have been a chief philosophical inspiration of most important twentieth century school in philosophy of science. The so called logical positivism.*[49]

It is therefore indispensable, to illustrate the triple functionality of Hume to the three corresponding tenets of logical positivitism, notably, their empiricism, their semantic paradigm and their anti-metaphysical project. In the first moment, Hume's answer to the question of the source of knowledge, influenced the empiricism and physicalism of logical positivism. The content of our mental life to him, is determined by the nature of the reality that the mind is presented with. Distinguishing between relation of ideas that are known through intuition and demonstration and matters of facts that constitute the objective world, Hume insists that knowledge of scientific and factual world is only possible through experience.

Perception to Hume is nothing other than the mental content. This content is dual in constitution for it is made up of impressions and ideas. In the copy principle, ideas of matter of facts to Hume are just copies of impressions. These impressions consist of sensations and also passions, desires and emotions. Hume thus asserts that:

> *By the term impression, then, I mean all our more lively perceptions, when we hear, or see, or feel, or love, or hate, or desire, or will. And impressions are distinguished from ideas, which are the less lively perceptions, of which we are conscious, when we reflect on any of those sensations or movements above-mentioned.*[50]

The original experimental contact between the knowing subject and the object produces impression. That is why when affirms that, "the most lively thought is still inferior to the dullest sensation,"[51] Hume then identified the following kinds of impressions. Firstly, there are impressions of sensations which refer to the feelings that humans derive from the five senses; that

[49]David Fate Norton, *The Companion to Hume*, New York, Cambridge University Press, 2008, p. 64.
[50] David Hume, *op.cit*., p. 97.
[51]*Ibid.*, p. 14.

is tourch, hearing, taste, sight and smell. These impressions of sensations equally include the feelings of pain and pleasure. These to Hume are original impressions because their fundamental source cannot be situated in experience. Secondly, there are also impressions of reflection such as desires, sentiments and passions. While primary or original impressions are products from our contacts with the external experiential world, secondary impressions are simply the human reaction to ideas. For instance, memory of fire burnt last year is simply a copy of the impression that one had when fire burnt him last year. Such recall of past ideas can lead to the impression of fear. While complex impressions are made up of a conjunction of simple impressions, simple impressions to Hume cannot be broken down into the impressions.

He is against the idealist and rationalist grounding of knowledge on abstract idea. Thus impressions assures our experiential contact with the world. Hume by this copy principle influenced the logical atomism of the logical positivists, which holds that the structure of language should reflect the structure of the world. Louise F. Loeb in the same way emphasized that: "Logical claims Hume as one of its own insofar as the stressed on the divide between relation of ideas and matters of facts."[52] Science is only possible in the context of mattes of facts and the knowledge of the latter can only be attained by experience.

On a critical note, the distinction between impression and thought is not apparently convincing in Hume. This criterion to him is vividness. That is, the difference between an idea and impression resides in the efficacity and the vividness of the latter over the former. The impression is the original contact between the knowing subject and the world while an idea is a mental copy of this impression. This distinction that constitutes the empirical grounding of logical positivism is criticized by Anthony Kenny, for,

> *it is never quite clear; in what is meant by vividness: It seems to be a matter sometimes of how much detail a perception contains, sometimes of how much emotional colouring it has, sometimes of how much great an effect it has over action. The notion is too vague to make a sharp distinction and the use of it to differentiate between thought and feeling.*[53]

Hume's empiricist fame still resists the above reproach, if he is well situated in the psychology of his time. Hume was influenced by Newton and his classical physics which was

[52]Louise E. Loeb, "Psychology Epistemology And Skepticism In Hume's Argument on Induction, in *Synthesis*, Dordrecht, Springer, 2006, pp. 321 – 338, p. 324.
[53]Anthony Kenny, *An Illustrated brief History of Western Philosophy*, London, Blackwell Publication Ltd., 2006, p. 274.

based on testing hypothesis using experience. This experimental method and the Lockean denial of innatism fashioned Hume's justification of the pre-eminence of impression over thought.

This empiricist thesis of Hume implies that no idea is possible if it is not attained by impression. Complex ideas are gotten from simple ideas, which are gotten from impression and even some apparently abstract ideas like, the idea of God as a being that is good, intelligent and wise is gotten from reflections on the qualities of "goodness" and "wisdom". A man who is not able to make a particular sensation then cannot produce an idea of it. Hume here gives an example of a blind man that cannot objectively conceive the idea of colour. Hume in this light hold that "we shall find, upon a nearer examination, that all creative power of the mind amounts no more than the faculty of compounding, transposing, augmenting or diminishing the material afforded us by the senses and experience."[54]

Hume is therefore against the metaphysical justification of the reality of abstract ideae. Unlike Berkeley who thought abstract ideas are generalization of particulars, Hume presents arguments for the impossibility of abstract ideas. The notion of abstract ideas is inconsistent because it cannot make a determinate representation and also because abstract ideas do not respect the copy principle. Mark Collier Concurs with Hume that, "conceivability entails possibility and those of abstract or indeterminate objects cannot exist, in the world, it follows that abstract and indeterminate ideas cannot exist in the mind either."[55] The critique of abstract and innate ideas is further reinforced by Hume's critique of the substance. This constitutes the crux of what Lucien Ayissi refers to as Hume's notion of anti-substantialism. Given that all knowledge to Hume is gotten from impression, Hume thus challenges any proponent of the notion of substance to provide the impression from which he gets such notion from. Lucien Ayissi captures this Humian challenge of metaphysical substantialism as he asserts that:

> « *C'est pourquoi il met au défi le substantialistes qui affirment l'existence de substance de désigner l'impression dont l'idée de substance dérive. Si l'idée de substance ne dérive d'aucune impression, elle ne peut donc être reçue que comme une fiction de l'imagination. Ainsi, la question de la substance (immatérielle ou matérielle) est tout à fait absurde et inintelligible. Les métaphysiciens modernes comme Descartes et Spinoza ont ce vice d'absurdité et d'inintelligibilité en partage avec les théologiens*. »[56]

[54]David Hume, *op.cit*., p. 97.
[55]Mark Collier, "Hume and Cognitive Science: The Current Studies of The Controversy Over Abstract Ideas", in *Phenomenology and Cognitive Sciences*, Dordreicht, Springer, 2005, pp. 197 – 207, p. 198.
[56]Lucien Ayissi, *op.cit.,* p. 81. "That is why he challenges substantialists who affirm the existence of substance to designate the impression from which the idea of substance is derived. If the idea of substance is derived from no impression then it can not be received as a fiction of imagination. As such, the question of substance (immaterial or

The absurdity of metaphysical substantialism to Hume the existence of such notions can not be established by verification. Given that we cannot establish an impression from which the notion of substances defended by Descartes, Spinoza among others, then it is unintelligible for Hume to talk of a metaphysical substance.

The second influence of Hume on the logical positivist anti-metaphysical heritage is in the domain of language. This can be illustrated in the symmetry that exists between the Humean distinction between matters of facts and relation of ideas on one hand and the logical positivists analytic-synthetic distinction. To Hume, there are two types of objects of human reason; relation of ideas and matters of facts. While relation of ideas are intuitively or demonstratively certain and contains no abstract, entities, matters of facts are neither intuitively nor demonstratively certain. While the contradictory of relation of ideas is not possible, the contradictory of matters of facts is possible. The statement "that the square of a hypothesis is equal to square of the two sides"[57] has no contradictory but the statement: "The sun will not rise tomorrow is not contradictory that it will rise."[58] The first example belongs to geometry, algebra and arithmetic while the second corresponds to science and philosophy. While relation of ideas constitute analytical judgment, matters of facts corresponds to synthetic judgment. It is exactly on the analytic and synthetic distinction that the criterion of meaning is established by logical positivism.

Hume's critique of metaphysics is evident in his treatment of the principle of causality. In the Medieval period, Thomas Aquinas' reconciliation of Aristotle's notion of causation and religion, revived the philosophical interest on the metaphysical notion of causation. In his distinction between scientific knowledge and belief, Aristotle held that scientific knowledge is nothing other than knowledge of the causes of things. As such scientific knowledge consists in demonstrating the inherent relation between the cause and the effect in the study of a particular phenomenon. However, Hume is against such causal inference. To him, all reasoning of matters of facts are based on relationship between cause and effect. Thus, traditional metaphysics was grounded on the believe in the necessity of the principle of causality. That is, a cause has more reality than the effect and that the effect necessarily follows the cause. This is evident in the Cartesian causal argument of God's existence. This argument holds that:

> *But now it is manifest by natural light that there must be at least as much reality in the total and efficient cause as in its effect. For I ask from where could the effect derive its*

material) is absurd and unintelligible. The modern metaphysicians like Descartes and Spinoza have this vice of absurdity and unintelligibility in common with theologians" (my translation).

[57]David Hume, *op.cit.*, p. 28.

[58]*Ibid*., p. 27.

reality, if not from the cause? And how could the cause give its reality if it did not also possess it? Hence, it follows both that nothing can come from nothing and that what is more perfect cannot derive from what is less perfect.[59]

This Cartesian defence of God as the causal agent constitutes theological causality that Hume criticizes. To Hume creationism defended by Descartes and theological causality are simply products of pure imagination. The cause in traditional metaphysics is the apriori foundation of the effect and has an ontological pre-eminence over the latter. Causality and teleology then are grounded on the metaphysical premise that there is a necessary connection between a cause and effect.

David Hume's critique of metaphysics centres on the rejection of the apriori, and necessary connection between causes and effects. This criticism attacks physical and psychological causalities. To Antony Kenny, Hume's criticism is appreciated in the following propositions: "(a) Cause and effect must be distinct existences, each conceivable without the other; (b) The causal relation is to be analysed interms of contiguity, precedence and constant conjunction; (c) It is not a necessary truth that every beginning of existence has a cause."[60] This follows that the origin of the idea of causation is not in a particular objects that has an ontological existence and precedence as traditional metaphysicians claim as cause and effect to Hume are two distinct objects. In other words, they are continginous to each other. Since causality is deduced from the relationship between matters of facts and knowledge of the former is attained through impression, then the ideas of cause and effect are also derived from past experience. Hume ascertains that: "The knowledge of relation is not in any instance attained by reasoning a priori; but arises from experience."[61] It is then the observation of the resemblance between contiguous events that gives the distinct ideas of cause and effect. Hume challenges the ontological rejection of his thesis that, "let an object be presented to a man of ever so strong natural reason and abilities; if that object be entirely new to him, he will be unable, by the most accurate examination of its sensible qualities to discovery of its causes or effects."[62] This has the following metaphysical implications that causation is both physical and psychological as it is based on spacio-termporal continguity, on the temporal and not the apriori priority of the cause and the induction of the regularity between two distinct events. This argument nullifies the pertinence of ultimate substance essence, mind among others as causal or fundamental entities. The ideas of these metaphysical causal agents are not

[59]Rene Descartes, *Meditations On First Philosophy, With Selections From Objections and Replies*, Trans. Michael Moriarty, New York, Oxford University Press, 2008, p. 29.
[60]Anthony Kenny, *op.cit*., p. 262.
[61]David Hume quoted by David Fate Norton, *op.cit.*, p. 30.
[62]*Idem*.

epistemologically pertinent because they have not been derived from any impression. This critique of the principle of causality which became known as the problem of induction in the post-humean epistemology, justifies Hume's rejection of metaphysics.

Metaphysics is an obstruse philosophy which lacks the pragmatic attitude that should accompany every practical, humanizing and experimental philosophy. Therefore, metaphysics does not only constitutes a useless branch of philosophy but plays no role in understanding science which is grounded on matters of fact. That is why he affirms that: "It is certain that easy and obvious philosophy will always, with the generality of mankind, have the preference above the accurate and abstruse and by many will be recommended, not only as more agreeable, but more useful than the other."[63] This is the ambition of the logical positivists, which consists in purifying philosophy from metaphysical obscurity and render the latter practical to the daily life of man. It is the verification of the symmetry between the world and scientific language that assures meaning. This semantic twist that animates the logical positivists' anti-metaphysical heritage is evident in Hume's rejection of metaphysics. Hume wonders that: "when we entertain therefore any suspicion that a philosophical term is employed without any meaning or idea we need to enquire, from which impression is that supposed idea derive?"[64] Such meaning is not possible with metaphysical terms and principles. It is in this light that Hume holds that: "Here lies the justest and most plausible objection against a considerable part of metaphysics, that they are not properly a science; but arise either from the fruitless efforts of human vanity, which will penetrate into subjects utterly inaccessible to the understanding."[65] Knowledge is possible only through experience, metaphysics goes beyond impressions, therefore metaphysics is not a science. As such Hume concludes his arguments in the *Enquiry Concerning Human Understanding* that:

> *When we run over libraries, persuaded of these principles, what havoc must we make? If we take in our hand any volume; of duty or school of metaphysics, for instance; let us ask, does it contain any abstract reasoning concerning quantity or number? No. Does it contain any abstract reasoning concerning matter of fact and existence? No. Commit it then to the flames: for it contains nothing but sophisttry and illusion.*[66]

Conclusively, David Hume is emphatic that while mathematics; geometry and algebra enhance physical studies, morality on the other hand enhances moderation in socialization, metaphysics on the other hand is useless and abstruse.

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[63]*David Hume, An Inquiry Concerning Human Understanding and Selections From Treaties of Human Nature,* no. 45, Chicago, The Open Court Pub. Company, 1921, p. 2.
[64]*Ibid*., p. 18.
[65]Hume, *An Enquiry Concerning Human Understanding and other Writings*, p. 8.
[66]*Ibid*., p. 144.

1.1.2 Kantian Criticism and the Trial of Metaphysics

Kant's trail of metaphysics was positively influenced on one hand by the certitude of other sciences like mathematics that was lacking in metaphysics; which pretended to be a science and negatively by David Hume's critique of the principle of causality on the other hand. The symmetry that "dogmatic rationalists"[67] like Descartes and Leibniz established between metaphysics and epistemology seems ungrounded to Kant because the evidence that characterises the science is not found in metaphysical claims. That is why he raises the question, "if metaphysics is a science, why is that it cannot as other sciences attain universal and long-lasting acclaims?"[68] This leads to a double concern, notably, the epistemological one, which is, is metaphysics a science? and a pragmatic because, *"*to ask whether a science is possible assumes doubt about its actuality."[69] In the 18th century, Kant was influenced by the certitude of mathematics, geometry and other sciences. The natural science enjoyed a degree of objectivity in the context of knowledge and in the truth. However, this was not the case with metaphysics. Despite this non-conformism of metaphysics.

The anti-metaphysical project of Kant is influenced by Hume but the former is broad in scope than the latter. This is because while Hume's anti-metaphysical attitude is specifically in his critique of the principle of causality, Kant's anti-metaphysical attitude is seen in his critique of metaphysics as a whole. Kant affirms that, "since the rise of metaphysics as far as the history of it reaches, no event has occurred that could have been mere decisive with respect to the fate of this science than the attack made upon it by David Hume."[70] Hume held that mathematical and geometric statements are essentially analytical while Kant proves that some mathematical statements are synthetic, Hume rejects metaphysics as a whole while Kant's ambition is to question the pertinence of the epistemological connotation, accorded by the dogmatic rationalists to metaphysics.

In the first moment, Kant rejects ontology or what is commonly called general metaphysics. This is the metaphysics defended by Aristotle, Plotinus, Descartes among others. In Transcendental analytic, Kant argues that any attempt to grasp knowledge of objects taken in their general nature using rules of general logic or using the apriori principles of understanding alone,

[67]Kant criticizes rationalism for being dogmatic rationalism. Thus is because the rationalists develop analytical apriori knowledge which does not progress and cannot be criticized.
[68]Immanuel Kant, *Prolegomena to any Future Metaphysics With Selection From Crique of Pure Reason*, 2nd ed.; Edited by Gary Hatfield, New York, Cambridge University Press, 2004, p. 5.
[69]*Ibid*., p. 6.
[70]*Ibid*., p. 7.

is illicit. Principles and concepts of understanding to Kant are empty without intuition or experience. In the second place, metaphysics is considered by Kant as a natural disposition in man. In other words, the inevitable ability of reasons to make cognition beyond its context of knowing. Such attitude deserves rigorous discipline from criticism because it is the very source of contradictions that characterizes dogmatic rationalist metaphysics. That is, "his view that fallacious inferences involved in each of the dialectical syllogisms are themselves somehow rational, inevitable and grounded in the nature of human reason."[71] In his critique of reason, Kant raises the question, can reason know everything?

Kant's answer to the above question is negative. Knowledge to him is a product of both experience and reasoning. The faculty of reason provide categories that give form to knowledge and intuition or sensation provides the content of knowledge. This is an implicit reconciliation of the conflict between rationalism and empiricism. In this way, Kant affirms that:

> *But, though all our knowledge begins with experience, it by no means follows that all arises out of experience. For, on the contrary, it is quite possible that our empirical knowledge is a compound of that which we receive through impressions, and that which the faculty of cognition supplies from itself (sensuous impressions giving merely the occasion), an addition which we cannot distinguish from the original element given by sense, till long practice has made us attentive to, and skilful in separating it.*[72]

In his transcendental analytic Kant asserts that categories are a priori forms of understanding and in his transcendental aesthetics, he affirms that space and time are a priori forms of sensibility while. Thus, to the question what can reason know, Kant's answer is that human reason can know phenomena found within space and time and under the formalization of categories. However, the metaphysical attitude consists in the attitude of applying reason out of the contexts of sensibility and understanding. This natural disposition can only make reason to entangle itself in the web of self-contradictions which Kant refers to as antinomie. Thus the metaphysical attitude is illicit and useless in the application of human reason in the domain of knowledge. The critique of reason thus gives directives on how to immunize reason against this metaphysical disposition when we want to acquire reliable knowledge.

These antinomies are illustrated in the different kinds of metaphysical orientations. In rational psychology, the soul is considered as the first principle of the self. Such metaphysical stipulation to Kant is just to satisfy the need for an unconditional unity of the self. That is why

[71]Michelle Grier, *Kant's Doctrine of Transcendental Illusion*, New York, Cambridge University Press, 2001, p. 4.
[72] Immanuel Kant, *Critique of Pure Reason* (1789), Trans. J. M. D. Meiklejohn, Pennysylavania, The Pennsylvania State University Press, 2013, p. 27.

rational psychologists like Descartes presents the soul like an apriori, simple and fundamental principle for the self. The soul is thus a simple substance. However, Kant holds that we cannot have any knowledge of this substance that is defended by rational psychologists. Any attempt to grasp knowledge of this substance will lead to two irreconciliable contradictory assertions. They are; the soul is mortal and the soul is immortal. To Kant it is the use of reason out of the conditions possible for knowledge that leads to these antinomies.

In his second critique of rationalist metaphysics, Kant attacks rational cosmology in which the world is considered also as the totality of all physical things. While the ideas of the soul and God produce contradictions that are non-sensible, the idea of the world produces empirical contradictions. The idea of the world raises contradictions around preocupations such as; is the world infinite?, are humans free or their actions are cause? In the first antinomy here, the thesis holds that the spacio-temporal world is finite and the antithesis holds that the spacio-temporal world is infinite. In the thesis, the world has an origin in time and thus limited in space and to the antithesis, there is infinitude in time and space. In the second antinomy on rational cosmology, the thesis holds that the world is made up of simple substances while the antithesis holds that the world is made infinitely divisible objects.

The last aspect of special metaphysics that Kant criticises is in the domain of rational theology. The unavoidable metaphysical drive also pushes man to deduce the idea of God. This idea is presented by rational theologists as a supreme, absolute and necessary one. This idea of God is that which humans inevitably get into, then they are in search for the pure unity and possibility of all things. The central question that Kant poses here just like he does in rational psychology and rational cosmology is that of the possibility of pure reason to have knowledge of the idea of God. Eventhough we cannot have any theoretical knowledge of the idea of God, it is important however for practical reason. That is, these pure ideas of reason play regulatory rules and thus enhance morality. That is why Kant asserts that the second and third questions of this triology which respectively are; what can I do? And what am I permitted to hope of? Can only be answered if we postulate these ideas of pure reason. Thus, these ideas are not important in answering the first question of his criticism; which is, what can I know?

Besides, the conception of metaphysics as an attitude, Kant also gives a dual disciplinary definition notably, the speculative metaphysics that he dissociates from epistemology and the metaphysics of experience, which he defends. This distinction is noted by one of his commentators, Sebastian Gardner who holds that, “the metaphysics that Kant attacks that is characteristic of

rationalism, is speculative or transcendent and that which he defends is immanent (internal to experience). Metaphysics of experience is possible and transcendent metaphysics is impossible."[73] Such interpretation is the fruit of the Kantian project of criticism which consists in "a critique of the faculty of reason in general, in respect of all cognitions after which reason might strive independently of experience and hence, the decision about the possibility and impossibility of metaphysics in general."[74] This implies two things; notably the change from realism to idealism which constitutes the crux of his Copernican revolution and the definition of speculative metaphysics as the abuse of the legitimate use of reason. The Copernician revolution enhances Kantian idealism and criticism as he holds that:

> *hence, let us once try whether we do not get further with the problems of metaphysics by assuming that the objects must conform to our cognition, which would agree better with requested possibility of an apriori cognition of them, which is to establish something about objects before they are given to us. This would be just like the first thought of Copernicus.*[75]

To answer the question of the possibility of metaphysic then is to answer the question that of the conditions possible for human knowledge and any metaphysics must conform to these conditions to be considered scientific. This follows that the Copernican revolution enhances the reconciliation of knowability, characteristic of reason and objecthood, that is attained through intuition. That is, while the traditional empiricists argue that knowledge can only be gotten through experience, the rationalist assert that knowledge can only be gotten through reason. However, to Kant, experience provides the content of knowledge while reason provide the form of knowledge. The metaphysics of experience defended by Kant is a product of the application of criticism. From the transcendental analytic and transcendental aesthetics, Kant in an attempt to answer the question of the possibility of knowledge concludes that, "without sensibility, no object will be given to us and without understanding, none would be thought."[76] That is, that intuitions that unfolds in space and time[77] provides the content of knowledge and thought that is grounded on categories[78] prove the form to knowledge. This is why he holds that; "thought without intuitions are empty, intuitions without concepts are blind."[79] Such knowledge is synthetic aprior because it is constructed from

[73]Sebastian Gardner, *Routledge Philosophy Guide Book To Kant and Critique of Pure Reason*, London, Routledge, 2001, p. 24.
[74]Immanuel Kant, *Critique of Pure Reason, In Cambridge Edition of Works of Immanuel Kant*, Trans. Paul Guyer, New York, Cambridge University Press, 1998, p. 101.
[75]*Ibid*., p. 110.
[76]Kant, *op.cit*., p. 193.
[77]Apriori Forms of Sensibility.
[78]Apriori Forms of Understanding.
[79] Immanuel Kant, *op.cit.*, pp. 193-194.

the application of categories, in intuition. Synthetic apriori knowledge then is the metaphysics of experience.

Unlike dogmatic rationalism that was grounded on the conception that all apriori knowledge can only be expressed analytically, Kant justifies the possibility of apriori knowledge that can be justified in synthetic propositions. Leibniz for instance argue that mathematical truths are a priori and analytical. To Kant, the statement 7+5=12 is not true by mere analysis of 7 and 12. We need intuition to derive 12 from 7 and 5 by counting using fingers or other forms of illustrating addition. This mathematical statement could have been tautological and analytical if we took for instance 7+5=10+2 and 10+2=12" but this will seem more metaphysical than mathematical. Kant thus asserts that:

> *For I first take the number 7, and, for the conception of 5 calling in the aid of the fingers of my hand as objects of intuition, I add the units, which I before took together to make up the number 5, gradually now by means of the material image my hand, to the number 7, and by this process, I at length see the number 12 arise. That 7 should be added to 5, I have certainly cogitated in my conception of a sum = 7 + 5, but not that this sum was equal to 12. Arithmetical propositions are therefore always synthetical, of which we may become more clearly convinced by trying large numbers*.[80]

The application of categories of understanding beyond intuition leads reason to self-contradictions. These antinomies that arise from the three noumena, God, the soul and freedom shows the futility of transcendent use of pure reasons. Kant's originality here resides in his epistemological tolerance towards speculative metaphysics. In other words, metaphysics is not useless as Hume affirms but it is not an object of human cognition. The critiques of reason is not then negativist towards the ideas of speculative metaphysics as Kant affirms that: "yet the reservation must be well noted that even if cannot cognize these same objects as things in themselves, we at least must be able to think them as things in themselves."[81] We can think of the ideas of pure reason but we cannot understand them. When we try to understand those noumena, reason finds itself in contradictory affirmations like, God exists and God does not exist, man is free and man is not free and the soul is mortal and the soul is immortal.

The Hegelian critique of Kantian notion of antinomy, does not betray the Kantian project of criticism. To Hegel, contradiction is not negative but positive and they are found in objects and not a property of reason as Kant holds. The inner logic of things to Hegel is contradictions which

[80] Immanuel Kant, *Critique of Pure Reason* (1788), Trans.Werner S. Pluhar, Indiana, Hacket Publishing Company, 2002, p. 35.
[81] *Ibid*., p. 115.

are not just four as Kant holds but are as many as the objects of cognition. That is why a commentator of Hegel holds that, "with this, Kant did not recognize positive aspects of antinomies. He stayed in the negative results of things in themselves that cannot be known and he did not penetrate the knowledge of the real and positive significance of antinomies."[82] Hegel is against the Kantian subject – object dichotomy as he reconciles Being and thinking into the absolute. This equally unites logic, epistemology and metaphysics and consequently taking the connotation of dogmatic metaphysics in his critiques. Consequently, the Hegelian critique does not betray the Kantian ambition.

Even though speculative metaphysics is not useful in the theoretical order, Kant confers a practical role to it. This is what makes him unique from most critics of metaphysics. Ideas of pure reason exist not as objects of knowledge but as necessary conditions of morality. They are necessary conditions for the determination of the human will. The first condition is the idea of freedom because morality is not possible if the will is not assumed to free. That is why Kant affirms that, "all other concepts (those of God and immortality) that, as mere ideas, remains unsupported in speculative reason, now attached themselves to the concept of freedom and acquire with it and through it, stability and objective reality."[83] Kant refers them as the postulates of pure practical reason. That is, they are not useful in theoretical reason but their existence must be hypothesized for the possibility practical reason.

Kant in the same logic holds that: "Their possibility can and must in this practical reference be assumed even without our theoretical cognizing and having insight into them.[84] These postulates enhance the transition from pure reason to practical reason then are not knowable as speculative metaphysicians claim but are conditions possible for the determination of the moral will as he concludes that, "with the practical use of reason, the situation is different. In this use, reason deals with determining the bases of the will."[85]

Finally, the Kantian trial of metaphysics consists in his epistemological adoption of the Copernician revolution. This revolution that consists of the change from realism to idealism, projects the mind or reason as the active pole of knowledge constructing. The best way to attack metaphysics then is to put its source into critique. This criticism becomes the attempt to decipher

[82]Marcos Fabio Alexandre Nicolau, Jose Edmar Lima Fillio, "The Hegelian Critique of Kantian Antinomies: An Analysis based on the Wissen Chaff de Logik" in *International Journal of Philosophy*, vol. 1, no. 3, Dordrecht, springer, 2013, pp. 47-50, p. 49.
[83]Immanuel Kant, *Critique of Practical Reason,* p. 5.
[84]*Ibid*., p. 6.
[85]*Immanuel Kant, Crtique of Practical Reason,* p.23.

the conditions possible for knowledge and the criterion for distinguishing between the legitimate and illegitimate use of reason, that consists in applying the apriori forms of understanding into intuition. Besides metaphysics as the inevitable character of reason to transcend space and time, Kant affirms that the legitimate use of reason leads to synthetic apriori knowledge which constitutes the metaphysics of experience. The illegitimate use of reason leads to speculative metaphysics, which is useless in the theoretical order but useful in the practical order as condition necessary for the determination of the will and the possibility of morality. Michel Bitbol captures this conclusion that: "Kant's motto is that despite it stemming from extravagant claim of speculative reason, metaphysics should not be rejected but disciplined."[86] That is why on the question of the existence of the ideas of pure reason, Kant professes the status of a metaphysical agnostic.

1.2. THE CLASSICAL SOURCES OF LOGICAL EMPIRICISM AND POSITIVISM

After examining the source of the anti-metaphysical attitude of logical positivism, it will be necessary to also investigate into the source of their empiricism. Logical positivism at the same time is a form of positivism and also a form of empiricism. Positivism insists that scientific knowledge is supposed to be concrete, real and practical while empiricism holds that the most acceptable source of knowledge is experience. While positivism is always linked to Auguste Comte, the systematization of empiricism is attributed the British thinkers; notably David Hume and John Locke. Making a conjunction of empiricism and positivism under the same caption seems contradictory if we underline the opposition that Comte establishes between the two notions. This opposition is highlighted Lucien Ayissi, a specialist of Hume. According to Lucien Ayisi, Comte situates positivism in the search for laws that govern natural phenomena while empiricism is not the case for it deals with the chaotic assembly of facts. Thus there is acute order, legality and systematization in positivism that lacks in empiricism. Despite this contradiction established by Hume, empiricism and positivism are common on the insistence on knowledge of facts and verification as the technique of assuring the meaning of knowledge and language. Thus, this sub-chapter examines how Locke and Comtes in their respective empiricism and positivism influenced logical positivism.

[86]Michel Bitbol, "Reflective Metaphysics: Understanding Quantum Mechanics from Kantian Stand Point", in *Philosophia,* New York, Springer, 2008, pp. 53-83, p. 60.

1.2.1. The conflation of classical positivism and empiricism in Locke and Comte

The justification of the innatism arose in the ancient Greek philosophers like in the transmigration of the souls defended by Pythagoras on one hand and the immortality of the soul and the epistemological method of reminiscence defended by Plato. However, the debate on the innate foundation of knowledge was central in the 17thC epistemological pre-occupations. The fundamental claim on which the justification of innatism was based was in the fact that: "Majority took for granted that God in His infinite goodness and wisdom has inscribed in human minds innate principles that constituted the foundation of knowledge, both practical and in theoretical matters."[87]This is the central thesis of innatists defended by Plato and Descartes and the Cambridge Planonist whose attempt was to base knowledge on metaphysics. To Plato, before man is incarnated he lived in a prior life where he had the knowledge of the truth and the good. Thus, the best way to know is reminscience or remembrance. The Socratic irony and Plato's dialectics are logical consequences of this innatism. Given that innatism is a metaphysical concept, it can then be argued that Plato based his theory of knowledge on his metaphysics. This attitude is similar in Descartes who distinguish between innate ideas that are inborn, adventitious ideas that are acquired and fictitious ideas that are fabricated. The empiricism of Locke and his critique of innatism was then an address to this classical metaphysical grounding of knowledge. Knowledge to Locke owes its origin in experience while the innatists held a contrary view by affirming strongly that:

> *All knowledge of the natural supernatural world available to human is based on fundamental speculative axioms, theoretical principles that neither require nor are capable of proof. These principles such as the causal principle were taken to be both universal and necessary and hence impossible to derive from experience.*[88]

Innate axioms, principles and ideas to innatists then pre-dispose knowledge and morality. They are self-evident or intuitive starting points of the development of knowledge and morality. Since they are anterior to experience, knowledge and necessary consequently, innate ideas permits its proponents to avoid moral and epistemological relativism to project knowledge and morality as universal and objective. Most of the innatists like Descartes attribute the intuitive and incontestable attribute of innate ideas to the perfection of a creative God. It is in this light that Descartes in his attempt to prove metaphysical foundation of knowledge affirms that:

> *But once the knowledge of God and soul has made us certain of this role, it is easy to recognize that things we imagine in dreams should not make us doubt the truth of*

[87]Lex Newman, *The Cambridge Companion to Locke's, Essay Concerning Human Understanding*, New York, Cambridge University Press, 2007, p. 30.
[88]*Ibid*., p. 33.

> *experience we have when we are awake. This convinced me that I could take as a general rule that the things we imagine in dreams should not make us doubt the truth of experience we have when awake. This convinced me that I could take as a general rule that the things we conceive very vividly and clearly are all true*.[89]

The tenability of the criterion of certainty to Descartes has a theocentric origin. In order to prove that human knowledge arises from experience, Locke begins by critising the credibility of innate principles and ideas. In the first argument, Locke attacks the logical consistency of claim of the universal consent of innate ideas. This universal consent holds that innate speculative principles dispose every knowing subject, irrespective of their geographical, experience, historical and cultural differences. Innate principles then include the following'; the causal principle which holds that, 'Nothing comes from nothing', the principle of non-contradiction which holds that, 'nothing can both be and not be at the same time', the principle of identity, which holds that, 'a thing is what it is", are revealed to the minds of every knowing subject in the same way. As such, we cannot verify or derive such principles from experience rendering metaphysics to be the foundation of knowledge.

Locke illustrates the logical contradiction of the universal consent of innation using the case of children and idiots. If innate principles were tenable, then children and idiots would have had the mastery of them as it is: "not on the mind naturally imprinted because not known to children, idiots, etc. for it is evident that all children and idiots have not the least apprehensive or thought of them."[90] The above mentioned principles that have been given a universal consent and an innate tag, can not be understood and applied by children and idiots, meanwhile they have minds. It is difficult for a five year old child to differentiate between the principles of non-contradiction and excluded middle. Such a child requires experience and consequently he needs to be taught and teaching itself is a kind of experience. The claim to innatess on the basis of universal consent then is then logically contradictory because:

> *For if they are not notions naturally imprinted, how can they be innate? And if they are notions imprinted now can they be unknown? To say a notion imprinted on the mind and yet at the same time to say the mind is ignorant of it, never took notice of it, is to make the impression nothing.*[91]

[89]Rene Descartes, *Discourse on The Method* (1637), Trans., Jonathan Bernette, Vancouver, Vancouver University Press, 2002, p. 15.
[90]John Locke, *An Essay Concerning Human Understanding*, (1690), Pennysylavania, Pennysylvania University Press, 1999, p. 29.
[91]John Locke, *An Essay Concerning Human Understanding*, p. 29.

Children and idiots have minds and the capacities to know, but yet they do not have knowledge of such principles. It cannot still be the case if one argues against Locke that with the evolution of the mind, these innate principles will be discovered. Such argument will imply that the innate principles are not in reason at first meanwhile such principles are supposed to precede the use of reason. That is why Locke defines reasoning as "nothing else but the faculty of deducing unknown truths from principles or propositions that are already known."[92] Knowledge of these principles is not innate to Locke, but depends on the knowledge of elementary ideas and notions, that constitute them. That is, for a child to understand and apply the principles of logic and mathematics, he must first of all have knowledge of the elementary notions of such principles. That is why Locke holds that: "a child knows not that three and four are equal to seven, till he comes to be able to count seven and has got the name of equality, and then upon explaining those assents to, or rather perceives the truth of that proposition."[93]

The second key argument against innatism by John Locke is on the relativity of moral principles. Moral relativism holds that what is good or bad depends on each and every individual. Thus, the moral good depends on history, experience and culture. The innatists on the moral dimension affirm that innatism is real because of the universality of practical principles that precede human acts. Locke however points out that innate principles are relative because they are not practiced the same by all men. Drawing his argument from the clash of values in history and the cultural diversities that shape the moral conduct of men today, Locke affirms that:

> *There is scarce that principle of morality to be named or rule of virtue to be thought on which is not, somewhere or other, slighted and condemned by the general falicion of whole societies of new governed by practical opinions and rules living quite opposite to others.*[94]

Moral principles then are a matter of contingency and not a matter of necessity, as each community of person enacts laws of action depending on their every day experiences. Moral values also are not pure but interested for each and everyone on a practical sense do good for a purpose. In his empiricism, Locke argues that the senses are the ultimate sources of knowledge. There is no idea in the mind then which comes before experience. Experience is dual, sensation and reflection. Through sensation, ideas are distinctively formed from the external world and through reflection, the mind through its various operations like thinking, doubting, perception, amongst others form ideas. This is clearly asserted by John Locke as he opines that "all ideas come from sensation or

[92]*Ibid*., p. 31.
[93]*Ibid*., p. 36.
[94]*Ibid*., p. 53.

reflection. Let us then suppose the mind to be, as we say, white paper, void of all characters without any ideas."[95]

This follows that the mind is nothing before experience and thinking is impossible without the latter. To Locke, there are no pure ideas in the context of knowledge for the manifold of our knowledge stem from experience. Locke thus reiterates that: "How comes it is to be furnished? Where comes it by that which the busy and boundless fancy of man has painted on it, with at most endless variety? To this, I answer, in one word, from experience." [96] Here, he differentiates between two types of experience; the external experience which is sensation and internal experience which is reflection. However, external experience has precedence over the internal because without our sensorial contact with the external world, we cannot form ideas. This is why he asserts that there is nothing in the mind which did not get there through experience. In this way, Locke affirms that:

> *The mind can neither make nor destroy them. These simple ideas, the materials of all our knowledge, are suggested and furnished to the mind only by those two ways above mentioned, viz sensation and reflection. When the understanding is once stored with these simple ideas, it has the power to repeat, compare, and unite them, even to an almost infinite variety, and so can make at pleasure new complex ideas.*[97]

There is then a plausible difference between Locke who dissociates metaphysics from epistemology and Descartes who grounds epistemology on metaphysics. While the mind cannot think of experience has not furnished it with ideas in Locke, Descartes holds that thinking is the essence of the mind. It is in this light that Verre Chapell, a commentator of Locke affirms that: "It must be remembered however that the Lockean mind unlike the Cartesian is not always thinking. Hence, there are times when it exist without containing or having before it, any ideas, where as there is no thought or thinking."[98] The Cartesian solipsism then valorizes thinking while Locke's phenomenology asserts that thinking is not the essence of the mind but it is dependent on ideas received from experience. Experience then is the source of ideas and ideas are the measure of thinking to Locke.

Locke ends his dissociation of metaphysics from epistemology is in his metaphysical agnosticism. Agnosticism assumes the existence of being but denies the possibility of having knowledge of it. Primary and secondary qualities permit the formation of ideas from percep-

[95]John Locke, *An Essay Concerning Human Understanding,* p. 87.
[96]*Ibid*., p. 87.
[97] *Ibid*., p.102.
[98]Verre Chappell, *Cambridge Companion to Locke*, New York, Cambridge University Press, 1994, p. 29.

appearances of the external world. It is here that Locke assume that there must be a substance that supports these appearances. However, Locke proposes ignorance as the answer to the question of the knowledgibility of such substance. Locke states this emphatically:

> *So that if anyone will examine himself concerning his notion of pure substance in general, he will find he has no other idea of it at all, but only a supposition of he knows not what support of such qualities which are capable of producing simple ideas in us; which qualities are commonly called accidents.*[99]

The notion of pure substance is then a supposition and not an affirmation. It is a supposition which answers the question of the foundation of qualities. Locke holds that the supposition of the existence of the substance is to render the foundation of qualities to be consistent. That is why he affirms that:

> *The idea then we have to which we give the general name substance, being nothing but the supposed, but unknown, supported those qualities we find existing which we imagine cannot subsist sincere substance, without something to support them, we call that support substantia; which according to the time import of the word, is in plain English standing under or upholding.*[100]

We cannot then epistemologically have access to substance and consequently, metaphysics is empirically unwarranted in the process of knowledge acquisition. He thus confesses his agnosticism as he holds that:

> *Substance which we know not, no proof against space without body. If it be demanded (as usually it is) whether this space, void of body, be substance or accident, I shall readily answer I know not; nor shall be ashamed to own my ignorance, till they that ask show me a clear distinct idea of substance.*[101]

This metaphysical agnosticism constitutes Locke's exclusion of metaphysics from knowledge. Metaphysical objects are not objects of knowledge. Locke's heritage that constitutes the point of departure of for logical positivism is not only limited in the context of their anti-metaphysical tendency but he also sets the basis for analysis as an approach in the philosophy of language. The faculties of human language to Locke are natural.

But what makes human language different from the manner in which animals speak is that fact that the sounds uttered by man are signs of the internal cognitive content of man. That is, words are simply signs of ideas. Words do not just materialize ideas but Locke thinks that words

[99]John Locke, *An Enquiry Concerning Human Understanding*, p. 278.
[100]*Ibid.*, p. 278.
[101]*Ibid*., p. 157.

permit us to express our ideas, to make others understand our ideas and help others make us understand their own ideas. Thus, communication is the major function of language to Locke and language is simply the image of our understanding. It is in this line of reflection that John Locke reiterates that*:*

> *To use these sounds as signs of ideas. Besides articulate sounds, therefore, it was further necessary that he should be able to use these sounds as signs of internal conceptions; and to make them stand as marks for the ideas within his own mind, whereby they might be made known to others, and the thoughts of men's minds be conveyed from one to another.*[102]

Words are not only sounds but they are voluntary sounds that man construed to express his ideas. If ideas are derived from the physical world and words reflect ideas then it can be argued with Locke that words represents the reality of the physical world. Locke in this way insists that:

> *Words, in their primary or immediate signification, stand for nothing but the ideas in the mind of him that uses them, how imperfectly so ever or carelessly those ideas are collected from the things which they are supposed to represent. When a man speaks to another, it is that he may be understood: and the end of speech is, that those sounds, as marks, may make known his ideas to the hearer. That then which words are the marks of are the ideas of the speaker: nor can any one apply them as marks, immediately, to anything else but the ideas that he himself hath.*[103]

In the last moment of Locke's influence on logical positivism is his proper theory of knowledge. Eventhough Locke disagreed with the rationalists, he agreed with them that knowledge is acquired from ideas. Ideas are thus the basic units of knowledge. He defines knowledge in the following terms: "Knowledge is the perception of the agreement or disagreement of two ideas. Knowledge then seems to me to be nothing but the perception of the connexion of an agreement, or disagreement and repugnancy of any of our ideas. In this alone it consists."[104]

This agreement or disagreement can take place in different forms but Locke identifies for prominent forms. These forms include identity or diversity, relation, co-existence or necessary connection or of real existence. This agreement or disagreement can take place in different degrees. This is what John Locke calls the degrees of knowledge. The first degree of knowledge is intuitive knowledge. Intuitive knowledge to Locke is, "the mind perceives the agreement or disagreement of two ideas immediately by themselves, without the intervention of any other"[105] for instance the

[102] *John Locke, An Essay Concerning Human Understanding*, p. 387.
[103] *Ibid*., p. 390.
[104] *John Locke, An Essay Concerning Human Understanding,* p. 515.
[105] *Ibid*., p. 520.

disagreement, “black is not white” is self-evident and needs no further justification or demonstration.

The next degree of knowledge to Locke is demonstrative knowledge where the mind perceives the disagreement or the agreement with the intervention of the other. The mind here requires proofs to perceive the relationship between the two ideas. Though the demonstrative degree is different from the intuitive, the proofs in demonstration should be intuitive or self-evident to permit us perceive the agreement or disagreement. This demonstrative knowledge is typical of mathematics. The last degree of knowledge is sensitive knowledge. To Locke, “sensitive knowledge reaching no further than the existence of things actually present to our senses, is yet much narrower than either of the former.”[106] He prefers intuitive and demonstrative knowledge to sensitive knowledge.

One of the anti-metaphysical trends of the 19th century is the scientific positivism of August Comte. Comte does not aim at rejecting metaphysic but at presenting the latter as a necessary state in the minds evolution to the scientific stage. This pragmatic orientation to knowledge which shows the social sterility of metaphysics was largely influenced by the revolution from the medieval to the industrial age. That is why Auguste Comte affirms that: *« En faisant de plus en plus prévaloir la vie industrielle, la sociabilité moderne doit donc puissamment seconder la grande révolution mental qui aujourd’hui élève définitivement notre intelligence du régime théologique au régime positif. »*[107]

This follows that theology and metaphysics were not still contextual and had outlived their time. The positive logic of Comte then contradicts every metaphysical pretension to make a scientific discourse. The word “positive” to Hume implies that which is observable and pragmatic. Comte affirms that: *« Le mot positif désigne le réel, par opposition au chimérique. »*[108]

Positivism then valorises the following pragmatic categories of any discourse that must be considered scientific. A scientific discourse then must be real as opposed to chimerical, useful as opposed to sterile, certain as opposed to mystical, precise as opposed to impressive and positive as opposed to negative. The revolution from metaphysics to science is Comte is most plausibly

[106] Ibid., p. 530.

[107] Auguste Comte*, Discours Sur l’Esprit Positif*, Bussières, Union Générale d’Editions, 1997, p. 109 “In trying continuously to promote the industrial life modern sociability must then strongly follow the great mental revolution which definitely raise our intelligence today from a theological to a positive regime;” (my translation).

[108]*Auguste Comte, Discours Sur l’Esprit Positif,* p. 126. “The word positive designates the real, in opposition to the chimerical” (my translation).

identified in the rapture from the notion of cause and origin to the notion of laws and in the change from the question of why to the question of how. This what Lucien Ayissi refers to as the principle of legality in his analysis of the comptian methodological principles. Lucien Ayissi thus asserts that: « *Cette exigence consiste à substituer à la vaine recherche de causes, celle des lois qui régissent les phénomènes.* »[109] Comte strongly affirms that "in the final, the positive state, the mind has given over the vain search for the absolute notions, the origin and destiny of the universe and the coituses of phenomena and applies itself to the study of their laws. That is, their invariable relations of succession and resemblance."[110]

The notion of cause, origin and finality has characterized classical epistemology. The scientific justification of claims were based on fundamental principles such as causality and finality. The most incontestable example is the four causes of Aristotle which his metaphysics and epistemology are grounded causes transcend the sphere of observation and reasoning and thus are out of the confines of positive knowledge. To explain change, Aristotle uses the four causes. By cause, he refers to the explanatory factor and he identifies the material cause which is the material substractum out of which a thing is made, the efficient cause that refers to the artists behind the fabrication of an object, the formal cause which is the configuration that an object has and the final cause which is the purpose of change or of the fabrication of an object. In this way, Aristotle asserts that: "we should look into the question of how many causes there are, and what they are like. For the point of our investigation is to acquire knowledge, and a prerequisite for knowing anything is understanding why it is as it is – in other words, grasping its primary cause."[111]

While these causes are metaphysical and can neither be justified rationally nor empirically, Comte prefers laws. Laws to him are perceptible relationship that exists between natural phenomena. The search for causes is therefore chimerical and useless because we cannot unveil the logical link between causes and their effects and thus any the attempt to answer the question of the "why" end up in vain. Comte in this light denies the metaphysical and causal attempts to project knowledge as he holds that: "the true positive spirit consists in substituting the study of the

[109]Ayissi Lucien, *op. cit.*, p. 24. "This exigency consists in substituting the vain search for the causes with that of the laws that govern phenomena" (my translation).
[110]August Comte, *The Positive Philosophy*, Trans., Harriet Martineau, vol. I, London, George Bell and Sons, (1896); 2000, p. 28.
[111] Aristotle, *Physics*, Trans. Robin Waterfield, New York, Oxford university press, 1996, p. 38.

invariable laws of phenomena for their so-called causes, whether proximate or primary; in other words, in studying how instead of the why."[112]

It can then be deduced that metaphysics is positively a pseudoscience. This to Comte is because of its semantic insufficiencies and due to the fact that we cannot rationally understand the causes. Moreover, causation is limited because its approach to knowledge is incompatible with the social challenges of man. In the same line of thought:

> *Ontology, even when it was most triumphant in the schools was always limited to subjects of purely intellectual nature and their abstractions, useless in themselves dealt with the case of individual development, the metaphysical spirit being thoroughly incompatible with the social point of view.*[113]

With the passage from the usage of causes to the usage of laws to render the real intelligible Comte proposes the semantic principle of positivism. He stipulates that: « *une telle prévision, suite nécessaire des relations constantes découvertes entre les phénomènes ne permettra jamais de confondre la science réelle avec cette vaine érudition qui accumulent machinalement des faits sans aspirer à les déduire les un des autres »* [114]

Lucien Ayissi refers to this as: « *le principe de signification ou de réduction des propositions à la simples énunciation des faits particuliers ou généraux».*[115] Comte here announces the logical positivism Semantic paradigm of sicenficity as it is the conformity of statements to facts. It is this conformity that assures the meaning of statements. This follows that the structure of scientific language and discourse should be symmetric with the structure of the world of facts. This at the same time early development of logical atomism and the principle of verification, developed by logical positivism. Observation takes the primacy over abstruse speculations and *«la pure imagination perd alors irrévocablement son suprématie mental et subordonne nécessairement à l'observation.»*[116]

The primacy of reasoning and observation over pure metaphysical imagination ensures scientific prevision. This prevision is grounded on the laws of phenomena and that is why Comte

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[112]Auguste Comte, *A General View Of Positivism* (1865), Trans. J. H. Bridges, Cambridge Library Collection, New York, Cambridge University Press, 2009, p. 49.
[113]*Ibid*., p. 10.
[114] Auguste Comte, *op.cit*., p. 74. "Whose fundamental rule holds that any proposition which is not strictly reductible to simple statements of facts whether particular or general cannot confer real and intelligible meaning." (my translation).
[115]Lucien Ayissi, *op. cit*., p. 23. The principle of the signification or the reduction of propositions to simple statements of simple or general facts." (my Translation)
[116]Lucien Ayissi, *Le positivism de David Hume*, pp. 74-75. "Pure imagination irrevocably loses its mental supremacy and submit itself necessarily to observation." (my translation).

defines positive theories as those that, "teach the laws of phenomena and give us the power of prevision."[117] Scientific prevision or determinism proceeds by using the laws and conditions under which a phenomena occur, to predict future occurrences or behavior. It can also take the form of using known statements and facts to deduce new ones. Comte in this light reiterates that, *« c'est dans les lois des phénomènes que consiste réellement la science.* »[118]

The construction of positive theories from facts using laws does not proceed in an anarchical and dogmatic way and prediction of future phenomena is not based on a metaphysical necessity. The mechanical accumulation of facts is not then positive theory of science as Comte affirms that: "Such a necessary prevision, following from the constant relation of discovered between phenomena should not make science to be confused with a rain-erudition which mechanically accumulate facts without aspiring to deduce one from another."[119] It is what Comte calls "direct exploration of phenomena" that scientific prevision is possible. Through observation, the laws of nature; That is, the constant relationship between natural phenomena, permit the formulation of scientific statements from facts. This does not only culminate to the prediction of future behaviour of phenomena studied under given constant relations but it also enables the deduction of new statements. It is this observation, prediction and deduction that render positive theories to be logical and consistent.

The scientific mind then is a positive mind which has passed through three successive states to attain maturity. This law of the three states of the evolution of the human mind illustrates the sterility of theology and metaphysics faced with the positive category of scientificity. Comte attests that the three states consist of "the theological state, in which free play is given to spontaneous fictions admitting of not proofs; the metaphysical stage characterized by the prevalence of personalified abstractions or entities; lastly, the positive stage, based upon an exact view of the real facts of the case."[120] The theological stage is characterized by imagination which manifests itself in fetishism, polytheism and monotheism while the metaphysical state focuses on the origin and purpose of things. This metaphysical stage is pragmatically and semantically limited, thereby playing a transitory role to the positive state, a state of science. The mind to him evolves from the theological stage where explanation of natural occurrences is based on fictive beings to the

[117]Auguste Comte, *A General View of Positivism,* p. 11.
[118] Auguste Comte, *Discours sur l'Esprit Positif,* p. 80. "It is in the laws of phenomena that science consists of." (my translation).
[119]*Ibid.*, p. 81.
[120]Auguste Comte, *A General View of Positivism*, pp. 34-35.

metaphysical stage where fictive beings are replaced by abstract notions and finally to the positive stage which is scientific.

Even though the neopositivists and quantum physics criticize the linearity of Comte's account of the evolution of the mind, Comte's merit resides in the fact that he posed the basic foundation of the great system of logical positivism and the criticism of metaphysics. Auguste Comte's positivism as Lucien Ayissi notes is at the same time is repressive against all forms of theologico-metaphysical explainations and the futile attempts to search for any form of "meta-data."[121] Just like the Lockean empiricism, the Comptian positivism restricts knowledge to the concrete and the physical.

1.2.2. Classical American pragmatism and the defence of Naturalistic Empiricism

The late 18th and early 19th century intellectual landscape in philosophy, was marked by abstruse, abstract and speculative systems of idealism. The subjective idealists for instance posited personal consciousness as the basis of a fixed reality that is not opened to change. In the domain of science, pragmatism was positively influenced by the theory of evolution which defended a biological and dynamic view of the reality. Secondly, the 19th century in the United States of America was marked by the development and expansion of industrialisation. Consequently, there was the need to develop a philosophical world view that ensures the reconciliation of thinking and action. It was then within the context of the general conceptual revolt against idealism and abstract philosophy that the American pragmatism saw the day.

Pragmatism is one of the most controversial concepts to be given an extract definition because not only those it cut across all philosophical approaches; moral, logic, metaphysics, aesthetics and epistemology but it is also vibrant in the development of non-philosophical approaches to the reality such as theology, religion, science, arts among others. Moreover, if we agree that the intention behind pragmatism is to translate thinking into action then all theories of different philosophical approaches can be explicitly linked human action at the level of their being influenced by human conditions or implicitly through hermeneutics. It is in this light that Sami Pihlström affirms that:

> *One major characteristic of pragmatist thought is that pragmatists turn their attention to human practices and habits. Philosophical views and concepts are examined in such*

[121]A term Ayissi Lucien uses in page 28 of his work cited above to refer to metaphysical causes, fictive beings that are metaphysically and theologically used to explain the world.

> *practical, experiential terms. However, this is not to say that practice is "prior to" theory; rather, no sharp dichotomy between theory and practice is presupposed in the first plac*e.[122]

What Sami Pihlströmis implying here is that pragmatism fundamentally refers to the theory-practice conflation. Arguably then any attempt to strike a balance between theory and practice is a form of pragmatism. Given the controversy surrounding a specific definition of pragmatism, it is necessary to proceed etymologically, to set the base of unveiling the classical American pragmatism that influence logical positivism. Pragmatism comes from Latin word 'pragma' meaning action. Unlike British empiricism and continental ratio-nation that opposed each other on the question of the most acceptable source of knowledge, pragmatism aimed at assuring the link between knowledge and human action. Initiated by Charles Sanders Pierce and later developed by William James and John Dewey, the traditional American pragmatism attempts not only a dissociation of epistemology from metaphysics but also to problems.

The motivation behind the erection of this school of thought was the authority that science arrogated itself in the areas of industrialisation, technology and astronomy. With the rise in industrialisation, capitalism became the dominant economic framework of the united leading to the switch of the philosophical attention from metaphysics to science. To John Dewey then, pragmatism arose from the need to naturalise philosophy as he affirms that:

> *New found wealth, the gold from the Americas and new articles of consumption and enjoyment, tended to wean men from preoccupation with the metaphysical and theological, and to turn their minds with newly awakened interest to the joys of nature and this life.*[123]

This revolution took four forms which are; the modern mine, factory, railway, steamship, telegraph, economic and industrial production, and transportation[124]. Classical and early modern metaphysics was based on finding out the ultimate and the purpose of the universe. The universe was considered as all-abiding whole, determined to function in a particular way. Thus the challenge of philosophy at this time was to unveil the ultimate cause of the universe and to determine its purpose. However Dewey argues that this metaphysical approach to the universe was in a serious dilemma of "reconciling the traditional theory of the rational and ideal basis, stuff and end of the universe with the new interest in individual mind and the new confidence in its

[122] Sami Pihlström, Michael Eldridge, James Campbell, *The Continuum Companion To Pragmatism*, New York, Continuum, New 2011, p.2.
[123] John Dewey, *Reconstruction in Philosophy*, New York, Henry Holt And Company, 1920, pp. 40-41.
[124] *Ibid*., p. 43.

capacities."[125] Individualism here refers to man's ability and potentials to create his knowledge. There is no more cosmic and universal idealism of Hegel but individual and epistemological idealism. Dewey thus affirms that: "idealism ceased to be metaphysical and cosmic in order to become epistemological and personal."[126] The influence Kantian influence here then is to have posited that man has the ability to create knowledge.

The great motivation behind pragmatism then is to render philosophy an instrument that man can use to resolve his daily problems. That is why Dewey asserts that "Philosophy starts from some deep and wide way of responding to the difficulties life presents, but it grows only when material is at hand for making this practical response conscious, articulate and communicable."[127]

The universe then is not more an all-inclusive fixed whole but an infinitely complex one that Dewey refers to as a "multiverse". A multiverse is dynamic and complex and man has the ability to exploit and fashion it to suit his interest. This is the great revolution which Dewey captures in the following words :

> *Change rather than fixity is now a measure of Reality; or energy of being; change is omnipresent. The laws in which the modern man of science is interested are laws of motion, of generation and consequence. He speaks of law where the ancients spoke of kind and essence, because what he wants is a correlation of changes, an ability to detect one change occurring in correspondence with another.*[128]

The classical understanding of the universe was from the point of view of causes. This can be well illustrated with the four causes of Aristotl. Instead of causes and essences, the pragmatic conception of the universe is thus scientific. Sami Pihlström situate six trends of American pragmatism. They include:

> *(1) the beginnings, or the prehistory of pragmatism (R. W. Emerson and the other American transcendentalists), the Metaphysical Club, and other early developments (1860–1870s); (2) the discussions, mainly by Charles S. Peirce, William James, and F. C. S. Schiller, on what pragmatism is (1880s–1910s), coinciding with the flourishing period of (Jamesian) pragmatism in the early 1900s and its critical dialogue with Hegelian idealism (represented by Josiah Royce, among others) and other influential currents of thought; (3) the social and political turn of pragmatism in John Dewey and G. H. Mead, in particular (1910s–1940s); (4) the relations between pragmatism and logical empiricism, or early analytic philosophy (Rudolf Carnap, W. V. Quine, Nelson Goodman, Morton White, Wilfrid Sellars), and the simultaneous decades of eclipse of classical pragmatism (1950s–1970s); (5) the rise of neo-pragmatism in Richard Rorty's*

[125] *Ibid*., p.49.
[126] *Ibid*., p. 51
[127] *Ibid*., p53.
[128] *Ibid*., p.61.

and Hilary Putnam's works (1980s–1990s), with interesting connections to (post-) analytic philosophers like John McDowell and Robert B. Brandom; (6) the widening international scope of contemporary pragmatism scholarship (2000s)[129]

The above sketching of the different stages in the evolution of pragmatism, it is evident that Rudolf Carnap, W. V. Quine, Nelson Goodman, Morton White and Wilfrid Sellars developed pragmatism from the point of view of logical empiricism. However, our focus is to establish the link between the views of the founding fathers of such as William James, John Dewey and Charles Sanders Pierce, and the beginning of logical positivism in the 1920s. The classical pragmatic thinkers were concerned with the formulation of the methods and principles of this philosophical approach.

It is in this regard that William James announces the pragmatic method in the following terms. "The pragmatic method is primarily a method of settling metaphysical disputes that otherwise might be interminable. The pragmatic method in such cases is to try to interpret each notion by tracing its respective practical consequences."[130] Thus, action or practice is the condition or criterion, not only of the truth but of the meaning of an idea, a concept, a theory or a system. Thus, when many theories or propositions are construed to explain a phenomenon, their truthfulness is established to William James by asking the question, "what difference would it practically make to any one if this notion rather than that notion were true?"[131] If the divergent views to solve a particular problem has no practical effect, then William James asserts that not only is such debate useless but also the different points of views are useless.

William James just like Charles Sanders Peirce, criticizes the ratio-centric criteria of certainty, developed by different philosophers in normative epistemology. Taking the example of Rene Descartes, they reject the attitude of grounding the criterion of certainty on the mind and not in facts or in the practical context of human existence. The standards to evaluate every philosophical debate and argument should be no other than to assess the practical value of such argument in human existence. That is, why William James asserts that: "to attain a perfect clearness in our thoughts of an object, then, we need only consider what conceivable effects of a practical kind the object may involve what sensations we are to expect from it, and what reactions we must prepare."[132]

[129] Sami Pihlström, *op.cit*., pp .3-4
[130] William James, Writings 1902 – 1910, *The Varieties of Religious Experiences*, New York, Literary Classes of the United States, INC., 1987, p. 506.
[131] Idem.
[132] *William James, Writings 1902 – 1910, The Varieties of Religious Experiences*, pp. 506-507.

By making concessions to sensation and experience, William James identifies pragmatism with empiricism. This evidently because it is in the concrete world of experience that we can evaluate the practicality of our thought and theories. It is in this light that William James asserts that, "Pragmatism represents a perfectly familiar attitude in philosophy, the empiricist attitude, but tit represents it as it seem to me, both in a more radial and in less objectional form if has ever yet assumed."[133] Thus, the pragmatic method ignores abstract thought that makes recourse to the apriori. To William James then, in pragmatism, "abstraction and insufficiency, from verbal solutions, from bad apriori reasons, and pretended absolutes and origins."[134] Such abstract and speculative orientations of metaphysics and dogmatic rationalism, are not epistemologically tenable to pragmatism. On the contrary, a pragmatists, "turns towards concreteness and adequacy, towards facts, towards action and towards power."[135]

To James, when metaphysicians conceive the universe using different apriori principles and substance, they consider that they have established an absolute comprehensible world view. However, James notes that: "if you follow the pragmatic method, you cannot look at such words closing quest."[136] Thus, the world itself is dynamic and theories that x-ray such world should not be projected as absolute and close. According to the pragmatic method, James asserts that, "you must bring out of each word, its practical cash-value, set it at work within the stream of your experience."[137] The establishment of the "cash-value" of each theory renders pragmatism to be one of the first orientations of instrumentalism in the history of scientific rationality. To express this, James affirms that, "Theories thus become instruments, not answers to enigmas, in which we can rest."[138]

In his early pages of his text, origins of pragmatism in the philosophy of Charles Sanders Pierce and William James, Alfred Jules Ayer holds that Peirce, the founder of traditional American pragmatism played an incontestable role in the history of symbolic logic and in the enhancement of logical positivism. That is why he affirms that: "he (Peirce) was among the first to see the possibilities of Boolean algebra he anticipated Sheffer in the discovery of the stroke-function and

[133] *Ibid*., p. 508.
[134] *Ibid*., pp. 508-509.
[135] *Ibid*., p. 509.
[136] *Idem*.
[137] William James, *Writings 1902 – 1910, The Varieties of Religious Experiences,* p. *509.*
[138] *Ibid*., pp. 509-510.

Wittgenstein in the idea that the laws of logic had no factual content and he did original and influential work in the logic of relations."[139]

As the founder of pragmatism in America, the central contribution of Peirce to logical positivism resides in theory of meaning and in the implicit critique of metaphysics. In his theory of meaning, Peirce seeks to develop the criterion for the certainty of ideas, notions, concepts and theories. To him, what makes an idea, theory or proposition meaningful is its practical consequences. When one conceives one idea, he can either find himself in doubt or in belief. While when an idea does not culminate to practical consequences, belief is a satisfaction derived when an idea leads to practical consequences. Consequently, belief to Peirce, links thought or thinking to action. It is in this light that Peirce affirms that "the final upshot of thinking is the exercise of volition, and of this thought, no longer forms a part; but belief is only a stadium of mental action, an affect upon our native due to thought, which will influence thinking."[140]

The practical consequences of thought do not refer to instantaneous, contingent and accidental influence but on the ability of these actions to constitute a habit in an individual. That is why Peirce further explains that, "to develop its meaning, we have therefore simply to determine what habits it involves. Now, the identity of a habit depends on how it might lead us to such acts."[141] Thus, practical effects of every thought should be sensible and determined empirically. Peirce thus insists that "our idea of anything is our idea of its sensible effects. It is absurd to say that thought has any meaning unrelated to its only function."[142] Given that even ideas that are useful and have practical effects on human life today may be useless tomorrow, Peirce recommends the method of fixation of belief as the most suitable to assure the though-practice isomorphism.

The first method of fixing belief to assure meaning to Peirce, is the method of tenacity. It simply refers to, "holding on to one's beliefs",[143] never accepting to give up on them. This expression of the Peirce's first method of fixing beliefs by Ayer, describes the attitude of those who find it hard to get rid of childhood beliefs that have conditioned their lives through out. Such attitude makes one to see the beliefs of the other as irrational. Such method is not then durable,

[139] Alfred Jules Ayer, Origins of Pragmatism, Studies in the Philosophy of Charles Sanders Peirce and William James, London, Palgrave Macmillan, 1908, p. 15.
[140] Charles Sanders Peirce, "How to Make our Ideas Clear", in Michael P. Lynch Edition of, *The Nature of Truth; Classic and contemporary perspectives,* London, The M.T.S Press, 2001, p. 199.
[141] *Ibid*., p. 200.
[142] Charles Sanders Peirce, "How to Make our Ideas Clear", p. 202.
[143] Alfred Jules Ayer, *op.cit*., p. 27.

given the influence of the other and the society. Interpreting Peirce, Ayer holds that: "if one comes into contact with other people, one is bound to discover that some of them at least think differently and that one's confidence in one's beliefs will be shaken."[144] With the influence of the society, an individual using the method of tenacity realizes that only societal consent makes one's weakness of the method of tenacity culminates into the second method, which Pierce refers to as the method of authority.

Given the weaknesses of the method of tenacity, individuals may turn to the method of authority. Expressing the view of Peirce, Ayer captures the method of authority in the following terms: "the traditional method of securing agreement on matters of religions political and moral doctrine, and in the hands of church and state, with adequate provision of force and fraud, it has achieved considerable results."[145]

Peirce connotes the scholastic period as the period par excellence where the method of authority was used. In this period, the authority of God, the church, the state was used as the standard of the legitimacy of epistemology. The method of authority to Peirce is limited because it renders man to be dogmatic.

The limitations of the method of authority to Peirce leads to the third method, which is the apriori reason. It is defended by traditional rationalists like Descartes where in something is true when it agrees with reason. Peirce notes that,

> *When Descartes set about the reconstruction of philosophy, his first step was (theoretically) permit skepticism and to school men of looking to authority as the ultimate source of truth. That done, he sought a more natural foundation of true principles, and professed to find it in the human mind, thus passing in the directest way from the method of authority to that of apriority.*[146]

To Descartes what is true is that which agrees with reason but the problem Peirce poses out with it is the difficulty of reconciling false ideas with the apriori criterion of certainty. Moreover, it is also having a dictatorial tag that the method of authority has. Thus, Peirce goes beyond these first three methods, to propose the method of science.

The scientific method to Peirce is that which establishes the public standard of truth. The first strength of science is its popular appeal and objectivity. When scientists study phenomena,

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[144] *Ibid*., p. 28.
[145] *Idem*.
[146] Charles Sanders Peirce, *op.cit*., p. 194.

they obtain different results on the same context but the more they study and perfect their approaches and techniques they will produce converging results on the same problem. That is why Peirce prioritises the method of science as he notes that: "on the other hand, all the followers of science are fully persuaded that the process of investigation, if only pushed far enough, will give one certain solution to every question to which they can be applied."[147]

This follows that everyone uses the scientific method and that he who does not use it simply lacks knowledge of how science functions. Apart from other methods that still lead to doubt, the scientific method. A. J. Ayer takes the argument further by arguing that to accept any method in science, people must first agree on what types of facts to study. He thus asserts that: "but then the acceptance of the scientific point of view is itself a decision."[148] This conventionalism is not however what Peirce intentionally advocated for. However, it is somewhat linked to his conception of logic as a normative science. His theory of truth is thus grounded on his conception of the scientific method.

Besides Peirce who develops a strictly epistemological view of truth, William James who had exchanges with the members of the Vienna circle, develops the pragmatic view of truth based on logical grounds. In his pragmatic conception of truth, James holds that the criterion of truth, "in short, is the truth's cash value in experiential terms."[149] A true idea then is that which we can verify and a false idea is the converse. Peirce insists that, "True ideas are those we can assimilate, validate, corroborate and verify. False ideas are those that we cannot."[150] There is then no absolute stagnant, static and immutable truth. James here announces both the principles of verification and falsification used by logical positivism and Karl Popper. The verification of an idea implies its confrontation with its corresponding object in experience and the corroboration of an idea implies it veracity can either be confirmed or falsified the truth value is verified from the extra-linguistic world. This correspondent view will be defended by early Wittgenstein, Ayer, Russell and Schlick. It is also a cosmocentric view because to James, the universe is a conjunction of useful and harmful events and processes. Ideas are true when they orientate us towards useful events and processes and help us avoid harmful events and processes. James in this tone notes that: "the possession of

[147] *Ibid*., p. 206.
[148] Alfred Jules Ayer, *op.cit*., p. 35.
[149] William James, *op.cit.*, p. 573.
[150] William James, *Writings 1902 – 1910, The Varieties of Religious Experiences,* p. 573.

truth, so far from being an end in itself, is only a primary means towards other vital satisfactions."[151]

From the above, Peirce advocates for an idea-object isomorphism in the context of pragmatism. Every idea corresponds to an object in the biological world and the practical value of an idea implies the usefulness of an object that, the idea represents. However, while some ideas can be verified, their objects sometimes prove to be useless. For instance, having an idea of a house but which is useless at the moment. William James argues that such stuck ideas are still potentially useful for a possible world of action. He calls them extra-truths. Peirce then does not consider this apparent contradiction as a serious problem as he holds that: "whenever such an extra truth becomes practically relevant to one of our emergencies, it passes from cold storage to do work in the world and our belief in it grows active. You can say of it then either that it is useful because it is true or that it is true because it is useful."[152]

Two pragmatic values that are logical are truth and usefulness. While truth is the result of the verification process of an idea, usefulness is the end point or consequences of such an idea in experience. It should be noted that James' notion of extra truth to define potentially useful truth can be conveniently likened to relative verification in Ayer and Schlick. Relative verification applies to the possible world which in fact does not yet exist. While we can aptly apply the method of verification on ideas derived from facts, this is not the case with relation of purely mental ideas. These truths of mathematics and geometry are absolute to James. This is because we derive them by definition or simply by applying their principles. Taking the example of mathematics, James asserts that: "it is either a principle or a definition that 1 and 1 make 2, that 2 and 1 make 3."[153] Truths of mathematical operations then are eternal in nature. They apply in all possible cases. In mathematical operations, we arrange ideas from the simplest to the complex, leading to greater complexity.

From the above development of the basics of pragmatism by Peirce and James, we can then agree with John Dewey, that pragmatism is either a form of empirical naturalism or a kind of naturalistic empiricism. This is because nature is nothing other our experience. In this way, John Dewey asserts that: "in the natural sciences, there is a union of experience and nature which his

[151] *Idem*.
[152] *Ibid*., p. 575.
[153] *William James, Writings 1902 – 1910, The Varieties of Religious Experience*s, p. 577.

not treated as a monstrosity; on the contrary, the inquirer must use empirical method is his findings are to be treated as genuinely scientific."[154]

Facts and laws of nature to him can only be explained using experience. Nature then exists in so far as we can experience it. Thus, Dewey asserts that, "it is not experience which is experience but nature – stones, plants, animals, diseases, health, temperature, electricity and so on."[155]

The issue at stake however, is how do we make natural laws. Peirce holds that there are two conceptions of the nature of the laws of nature. In the first place, the law of nature to him is a generalization of collected observational instances. Such observation is not exhaustive but simply representative. In the second place, he defines a law of nature as a rule of prediction. He affirms that, a proposition becomes a law of nature when, "its predictive power has been trued and proved so thoroughly that no real doubt of it remains."[156] The law of nature of Peirce is simply a, "prognostic generalisation of observation."[157] Induction to him is not necessary but it proceeds through sampling and then generalisation

To round up the pragmatic approach to the rationality of science, their semantic and logical articulations, it should be noted that in the history of epistemological ruptures, the American pragmatism culminated to the Vienna Circle. For instance, William James' ideas were popularized in the same year that the meeting of the first members of the Vienna Circle was taking place. That is the meeting between Philippe Frank, Otto Neurath and Hans took place when Germany just received the translated work of William James. As such, "the members of the Vienna Circle considered William James as the most influential spokesman of pragmatism."[158]

A lecture was given in the philosophical society of the Viennese in 1908 by a German philosophy; Wilhelim Jerusalem on James. James' instrumentalism, his critique of the apriori influenced logical positivism. His instrumentalism for instance is further developed by Reichenbach in his development of the probability theory of truth.

[154] John Dewey, *Experience and Nature*, London, George Allen and Unwin, Ltd., 1929, p. 2.
[155] *Ibid*., p. 1.
[156] Charles Sanders Peirce, *The Essential Peirce, Selected Philosophical Writings*, vol. 2 (1893-1913), edited by Peirce Edition Project, Bloomington, Indiana University Press, 1998, p. 68.
[157] *Idem*.
[158] Friedrich Stadler, *Logical Empiricism and Pragmatism*, Vienna Circle Institute Yearly Book, Springer, 2017, p. 19.

1.3. THE CLASSICAL SOURCES OF THE LOGICAL POSITIVIST ANALYTICAL APPROACH

One aspect that distinguishes logical positivism from classical empiricism and positivism is their emphasis on language and the logic of analysis. A scientific theory to logical positivism is a system of statement and the scientificity of the latter can only be assured through a logical analysis to assure the meaning of statements and verificationism which attempts to unveil the language-world isomorphism. Even though this analytical spirit is evident already in Hume in his analysis of the contents of knowledge into impressions and ideas and in his distinction between matters of facts and relation of ideas, greater emphasis on this analytical spirit is extensively developed by Ernst Mach and Leibniz. While Ernst Mach commits himself into the analysis of sensation that is later developed by Russell in his theory of acquaintance, Leibniz develops the analytic-syntetic distinction which is paramount in the logical analysis of language by logical positivists.

1.3.1. Psycho-physical Analysis of Ernst Mach and the Thesis of Neutral Monism

In his phenomenology, positivism and the biological conception of knowledge, Ernst March, analysis the adoption of thought to experience or sensation. His analysis consists in investigation into sensation to study its adaptation to facts. Ernst Mach's analysis is grounded on his biological conception of knowledge. In this biological thesis, he affirms that: "this is not the first time I have referred to the fact that ideas and especially scientific ideas are transformed and adapted in the same manner as that which Darwin supposed to be the case for organism."[159]

Scientific ideas then do not constitute a close system but they develop through transformation. The scientific vitality of an idea depends on its persistent adaptation to facts. This psycho-physiological symmetry is based on the law of association. This is the law which holds that through the constant or habitual adaption of our thoughts to facts, future adaptation becomes inevitable. The law of association then guarantees scientific determination and prediction. Ernst Mach in this line affirms that: "when we move in a definite circle of facts which recur with uniformity, our thoughts at once adapt themselves to the surroundings in such a way that they involuntarily reflect them."[160]

[159]Ernst Mach, *The Principles of The Theory of Heat, Historically and Entically Elucidated*; Trans., Thomas J. Mc Cormack (1896), Dordrecht, D. Reidel Pub. Company, 1986, p. 360.
[160]Ernst Mach, *The Principles of the Theory of Heat, Historically and Entically Elucidated*, p. 352.

When the domain of facts is simpler the principle of causality and scientific prediction arise. This is because there is conformity of thought to facts. However, when the field of facts is wider than thought, the crises of thought and facts arise with the corresponding need for adaptation to new facts. Scientific research to Ernst Mach is a product of an attempt to adapt thought facts. This is where Mach differs from the logical positivist in their regard towards meta physics, conceived as the inexplicable. To the logical positivists, the inexplicable is meaningless and thus unscientific but to Mach, the inexplicable is an instance to render the adaptation of thought and facts possible. He thus affirms that: "Once again, we see why science is a natural enemy to the marvelous, for science can only solve its problem by destroying the miraculous through explanation."[161]

Metaphysics as the inexplicable was an obstacle to scientific investigation in the latter logical positivists but it was an instance par excellence for scientific investigation in Ernst Mach. Mach attempts a succinct illustration of the biological evolution of knowledge through adaptation, in the history of science. The astronomic conception that, "each thing seeks its place, heavy bodies bellow and lights above,"[162] was animated by Aristotle and latter. Copernicus, Kepler among others. The crisis of thought and facts arose when it was realized through observation that smoke actually has weight and is bellow but forced up by air, just like water that forces heavy objects like woods up. These new facts were not familiar with thought and a new adaptational theory came up. This theory that was rendered possible by the law of association hold that: "all bodies seek their place below and specific gravity becomes a co-determining new and decisive characteristic on which we base our expectation of the behaviour of several bodies."[163]

This new scientific vision of Galeleo was reduced to the affirmation that acceleration towards the earth is characteristic of tall bodies but that heavenly bodies had perfect motion. Another crisis of thought and fact arose when Newton in the context of observation realized that heavenly bodies do not attract each other, instead of keeping a constant velocity towards each other. He consequently had to adapt his new thoughts to new facts since: "the idea, which includes that of celestial heavy bodies as a special one. The original one was very restricted and this new one contains a profession of facts."[164]

From the above historical illustration of the biology of scientific knowledge, Mach situates transformation of thought at two levels. In the first place, the thought-fact crises demands the

[161]*Ibid.*, p. 353.
[162]*Idem.*
[163]*Idem.*
[164]Ernst Mach, *The Principles of The Theory of Heat, Historically and Entically Elucidated*, p. 354.

search for the identity between new facts and old ones secondly, the situation of crisis equally requires the distinction between old and new facts to identity the differences. This comparison is indispensable because: "in this way, it becomes possible on the one hand, to comprehend a constantly enlarging field with the same kind of habit of thought and on the other hand to make variations of the fields of thought corresponding to our distinction of facts in the field."[165]

The wideness of experience then is a challenge to different men to adapt their thought habit. The problem that arises in this adaption is at two levels. In the first place, there is no universal thought habit and experience among scientists and the ability to compare and identify new facts is not the same. Other men may even proceed for decades without ever identifying, the wrongly held ideas and discovering new ones. Mach in this case proposes the economy of science. He affirms that: "Economy will give gives us a most variable point of orientation form which to direct our scientific actions, just as it does to technicians and we shall be better off if we use it than if we simply abandon ourselves unconsciously to the physical forces of the moments."[166] The economy of science then requires that before confronting facts, we need to have the picture of the world in mind.

Mach's positivism is based on the view that scientific knowledge originates from experience or object in themselves do not exist are sensational which are simply the association of the element. This association is a psychological act connecting observable elements. Ernst Mach affirms: "a colour is a physical object as soon as we consider its dependence for instance, upon its luminous source, upon other colours, upon temperatures upon spaces and so forth."[167] Sensation in this context is not emotional or pleasure because we cannot make an objective analysis of them but experience. What is metaphysically referred to as the ego then is not a thing in itself but a combination of the psychological and the physical. Consequently, what is important is not the ego but elements since the thought habit of an individual reflects the world. These elements render human life to be in constant mutation and that is why Mach rejects the metaphysical idea of the immortality of the ego or the soul.

The question of the personality of the possessor of sensation is not scientific because answering it leads to the projection of complex structures like the ego that cannot be analysed. Ernst Mach then concludes his rejection of the thing in itself by affirming that: "if we regard the

[165] *Idem.*
[166] *Ibid.*, p. 361.
[167] *Ibid.*, p. 17.

ego as real unity, we become involved in the following dilemma: Either we must set over against the ego, a world of unknowable entities (pur poseless) or we must regard the world, the egos of other people included as comprised in our own ego."[168]

Ernst Mach then does not only rejects the affirmation of the existence of the ego but the rejection of the meta-sensational and trans-sensational world. He denies ontology since a thing in itself does not exist to him and he also rejects metaphysics because there is nothing that exists beyond sensation. Mach is therefore a physical phenomenologist as he affirms that: "Experience grows through progressive adaptation of thought to facts. Mutual adaptation of thought produces the ordered, simplified and consistent system that we conceive as the ideal of science."[169] What is scientific is then that which can be analysed and to analyse is to investigate into the symmetry between thought, habit and facts. This is the thesis of neutral monism in which what exists is neither the ego nor the non-ego, but simply sensation. This is one of the positions held by Bertrand Russell in his theory of acquaintance. Descartes metaphysical dualism of the mind and the body brought a great schism between rational psychology that studies the mind and physics that studies the body. This body-mind distinction led to the physics-mechanics demarcation. However, we talk of neutral monism in Ernst Mach because he attempts a reconciliation between the psychical and the physical, the rational and the sensible and the mental and the bodily by reducing all knowledge to sensation. Mach did not only influence in the later logical positivist analytical tendency with his analysis of experience but he also set the pace for the principle of verification.

Mach influenced logical positivism not only at the level of the theory of knowledge but also in his antimetaphysical attitude. Metaphysics creates uncertainty with its introduction of dualism. The dualisms of mind and matter and of the natural and the super-natural obstructs an adequate understanding of the real. That is why Robert Cohen, a commentator of Mach affirms that, "to Mach, then, metaphysics is an illusion of knowledge; a deception of the human spirit."[170] To overcome such dualism, Mach proposes a monistic approach which will construct the realities of mind and matter in a way that there will be mutual dependency between them.

The material monism that is capable of overcoming the epistemologically narrow dualist. Categorization of metaphysics must find its evidence from the given. The given constitute both the content of the physical and the mental composition of the self. These given exists in form of

[168]Ernst Mach, *The Principles of The Theory of Heat, Historically and Entically Elucidated* p. 28.
[169]Ernst Mach, *Knowledge and Error,* (1905), Dordrecht, D. Reidel Publishing Company, 1926, p. 15.
[170] Robert Cohen, "Ernest Mach; Physics Perception and the Philosophy of Science ", in *Synthese*, vol. 18, Dordrecht, D. Reidel Publishing, 1968, pp. 132-170, p. 160.

elements that Mach refers to them as sensational such as colours, sounds and smells. They are also given the mathematical expressions such as spaces and shapes and they are also given physiological expressions such as pressures and temperatures. This a body is simply a collection of elements and sensation on the other hand is produced by elements and not bodies. It is in line with this that Ernst Mach asserts that the world is made up of elements that are unanalyzable such as: "colours, sounds, pressures, temperatures, smell, spaces, terms and so on. These elements depend both on external and internal circumstances; when the latter are involved, and only then, we may call these elements as sensations."[171]

Mach here, bases his epistemology on strictly pure experience. Such experience is given and thus has no casual connection. Moreover, the elements are not fixed but are dynamic and are in constant manifestation. Thus, Milic Capek, a specialist in Mach notes that:

> *Elements of Mach, the basic underlying assumption was the same; experience consists of numerically and quantitatively distinct elements which periodically appear and disappear in our conciseness and which form aggregates of different degrees of complexity and different sensory vivacity.*[172]

The ego is then the total sum of sensation and the world dissolves into the ego. The ego thus is at the same time sensation and the ego. Thus, there is no pure ego for, "an isolated ego exists no more than an isolated object: both are provisional fictions of the same kind."[173] By arguing that the ego is a sum total of elements, Mach initiates the naturalization of the mind and the neutralization of subjectivity. The self is neither pure nor is it absolute. There is no apposition between the mind and the physical. This is because the same elements constitute their formation. Mach thus notes that, "the mental and physical have common elements and are not in stark opposition as commonly supposed."[174] The elements are given and man thinks by adapting his mind to this sensation, the physical and the psychological reconcile into one.

Ernst Mach then rejects the claims of rational psychology. According to rational psychology, the ego or the self is the fundamental principle of a person. Xavier Verley, a commentator of Mach highlights this as he notes that: *« en montrant que l'esprit ne pouvait être étudié indépendamment*

[171] Ernst Mach, *Knowledge and Error*, (1905) Vienna Collection, vol. 3, Dordrecht, D. Reidel Publishing Company, 1976, p. 6.
[172] Milic Capek, "Ernst Mach's Biological Theory of Knowledge", in *Synthese*, vol. 18, Dordrecht D. Reidel Publishing, 1968, pp. 171-191, pp. 171-172.
[173] Ernst Mach, op.cit., p. 9.
[174] Ernst Mach, *Knowledge and Error*, p. 6.

du corps, la psychophysique rend impossible toute théorie de l'absolu fondée sur le pouvoir réflexif de l'esprit à partir du cogito. »[175]

Xavier Verley prefers psychophysics as the best expression of Mach's reconciliation of the mental and the physical. Thus, the sciences of the mind should not be opposed to the sciences of nature as all instances of the mind can also be submitted into natural laws. However, it seems difficult to naturalise the will for modern metaphysics is erected on the notion of the freedom of the will. If the will is not naturalized, then there will be a possibility of causality leading to the dissolution of Mach's neutral monism. This is because if free will is not deduced from sensatory then it will open up avenues for the acceptance of the subject as the cause. However, Xavier Verley asserts that unity according Mach is in the mutual dependency of the mind and the body. That is, *« s'il faut chercher l'unité celle-ci n'est pas dans la 'je' mais dans la relation qu'il entretien avec le corps et avec la nature. »*[176]

The separation of the self rom nature is the greatest fault of metaphysics while metaphysics dissociates the mind and matter, psychophysics unites the two. That is why Xavier Verley holds that *« la métaphysique détache l'en du multiple alors que la perspective physique considère que l'un (sujet, le corps, l'univers) ne se comprend qu'en relation avec le multiple, c'est-à-dire avec le corps, les masses et financement avec l'univers entier. »*[177]

The view that sensation constitutes of unanalysable elements, that are dynamic in nature, renders Mach to be a proponent of psychological atomism, phenomenologg and logical atomism. These are key concepts that were adopted by Russel and Wittgenstein. That is why Milic Capek affirms that: "the logical atomism of Russell and early Wittgenstein is a direct descendant of the psychological atomism of Mach."[178] Thus, the positivism and the anti-metaphysical philosophy of logical positivism were greatly influenced by Ernst Mach.

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[175] Xavier Verley, Mach, *Un Physicien Philosophe*, Paris, P.U.F, 1998, p. 10. "In showing that the mind cannot be studied, psycholophysics makes every theory of the absolute based on the reflexive power of the mind from the cogito to be impossible"; (my translation).
[176] *Ibid*, p. 59. "If we should look for the unity of the latter, it should not be in the "I" but in the relationship that it entertain with the body and with nature"; (my translation).
[177] *Idem*., "Metaphysics detaches one from the multiple while the physical perspective considers only one (the subject, the body, the universe) can only be understood in relation with the multiple, that is, with the body, masses and finally with the whole universe", (my translation).
[178] Milic Capek, *op.cit*., p. 172.

1.3.2. Leibnizian Logical Analysis as the Foundation of the Logical Positivist Analytical Method

Even though Leibniz is a rationalist epistemologically and fundamentally an advocate of metaphysics, he influenced logical positivism at the level of their analytical method. Julius Rudolph Weinberg captures this as he affirms that: "Leibniz made the great advance in this direction. He clearly distinguished between truths of reason and truth of facts, and he emphasized one fundamental property of logical truths."[179] Even though Hume also carries the same analytical operations between relation of ideas and matters of facts, he does so to answer a strictly epistemological question of what types of knowledge are possible while Leibniz gives an analytical and linguistic treatment to them.

According to Leibni, every proposition is of the subject – predicate form. To propose logically, is to accord a predicate to a subject. Since the objective of the predicate is to define the subject, then it is impossible for a predicate not to be identical to the subject. By this very affirmation, every proposition to Leibniz is analytical. The distinction between truth of reason and truth of facts above is synonemous to the distinction between necessary and contingent propositions. According to Leibniz:

> *There are two kinds of truths, those of reason and those of facts. Truths of reason are necessary and their opposites are impossible. Those of facts are contingent and their opposites are possible. When truth is necessary one can discover the reason why it holds by analysis, reducing it to simple ideas and truths until one arrives at primitive ones.*[180]

Unlike Kant, the logical positivist who posed the analytic – synthetic problem, Leibniz above, talks of necessary and synthetic propositions. Truths of reason that constitute the crux of arithmetic, geometry and logical are analytical. Necessary propositions by nature are self-evident and their opposites cannot be affirmed to be true. They are then grounded on the principles of identity and contradiction. For instance, it is impossible to refute that an equilateral rectangle is a rectangle without involving one's self in self-contradiction. Existential truths or truths of facts are grounded on the principle of sufficient reason. The only exceptional existential proposition. Leibniz in this direction holds that:

> *The principle of sufficient reason is but there must be sufficient reason for contingent truths, or truths of facts that is for the succession of things extended throughout the*

[179] Julius Rudolph Weinberg, *An Examination of Logical Positivism*, New York, Kegan Paul, 1936, p. 4.
[180] Leibniz Gottfried Wilhelm, in Anthony Sevile ed., *Leibniz and Monadology*, London, Routledge, 2000, p. 231.

created universe where their resolution into individual reason would know no bounds on account of natures' vastness and the infinite divisibility of bodies.[181]

Based on the will of God and the principle of pre-established harmony and consequently, we cannot analyse truths of facts successfully because of the finitude of the human mind and the infinity of the 'succession' contingent things. The only existential proposition that is necessary in analysis is that of the existence of God. The principle of sufficient reason states that; "nothing exists without these being a greater reason for it to exist than for it not to exist."[182]

From the above, truth to Leibniz is not in the correspondence between the proposition and the world but in the ability of the concept of the predicate to be implied in to the concept of the subject since the determination of the presence of the predicate in the subject requires an infinite investigation and given the finitude of human minds, only God can make an exhaustive analysis of truths of facts. This concept – containment theory of truth then holds that a true proposition is that which can be analysed in terms of subject – predicate. This analysis is finite in necessary propositions and infinite in contingent proposition due to the conflictual principles on which the two propositions are grounded. That is why Leibniz holds that: "for in necessary proposition, when the analysis is continued indefinitely, it arrives at an equation that is an identity, this is what is to demonstrate with geometric rigour. But in contingent propositions one continues the analysis to infinity."[183]

The analyses of necessary propositions logically ends with identical then. These identical are primitive truths that are ascertained by intuition. These identical can be expressed in logical forms such as "A is A" or "what is A cannot be not A". These primitive truths of logic and mathematic requires no further analysis as their truthfulness is self-evident. Necessary truths are therefore grounded on the principle of contradiction as any attempt to deny the necessity between the subject and predicate terms will lead one to logical contradiction.

Leibniz excludes contingency from the existential proposition of God's existence. God's existence is the only truth of fact that is necessary because his essence and existence cannot be dissociated. A commentator of Leibniz, Betrand Russell argues in the Leibnizian way that it will be contradictory to exclude existence from God who is the absolute. That is why he holds that: "thus existential propositions except in the case of God's existence are synthetic, that is, there

[181]"Leibniz Gottfried Wilhelm*",* in *Anthony Sevile ed., Leibniz and Monadology,* p. 233.
[182]Gotfried Wihhelm Leibnez, *On Contingency* (1686) *In Philosophical Essays*, Trans. Roger Ariew and Daniel Garber,Indiana, Hackett Publishing Company, 1989, p. 29.
[183]*Ibid*., p. 28.

would be no contradiction if the subjects which do exists did not exist. Necessary propositions are as such analytic, and synthetic propositions are always contingent."[184]

The analytic-synthetic distinction by Kant, Russell and later logical empiricists and by extension Quine, was not used by Leibniz as the latter used but necessary and contingent. The problem that arises in the Leibnizian accordance of analyticity to contingent proposition poses the problem of the plurality and heterogeneity of the existential world. In other words, should we abide by the affirmation of the relationship between the predicates and subjects of contingent propositions given the different forms that the subject can be predicated? Betrand Russell resolves this logical aporia of inconsistency by interpreting the varied predicates of expressing an individual substance as "expressing their states at different times. Such predicates are called contingent or concrete predicates."[185]

The plural ways of predicating the individual substance or subject does not betray the analytical nature of contingent propositions but shows their determination by temporality. The numerous predicates, expressing a unique substance are not identical but they all together imply the subject by virtue of the rationality of sequences grounded on the principle of sufficient reason.

From the above, we can restate Leibniz's analysis by deducing that the predicate of every proposition is contained in the subject term, no matter the context, form and type of proposition. The problem posed by critics towards such logical view of Leibniz is that of the non-consideration of negative propositions. If all propositions are analytical as Leibniz affirms, it can be logically demonstrate the inclusion of the predicate term in the subject term, when the identity of the two is denied by a negation? It is in this light that a commentator of Leibniz reiterates that: "Louis, conturat, in his *« La Logique de Leibniz »* has shown that Liebniz's effort to develop logical culculi are crippled by a failure to cope adequately with negative propositions."[186]

It is evident that Leibniz was concerned with affirmative propositions and this is what justified his accordance of an analytical nature to all propositions. However, Abdul Muhit attempts to give an analytical interpretation of negative propositions when he affirms that:

> *However, it is to be mentioned here that Leibniz does recognise the existence of negative necessary truths and he attempts to fit them in his identity theory of necessity. Examples*

[184]Betrand Russell, *A Critical Exposition of The Philosophy of Leibniz (*1900), 2nd ed., London, Routledge, 1937, p. 11.
[185]*Idem.*
[186]Abdul Muhit, "Leibniz on Necessary and Contingent Truth" in *The Arts Faculty Journal*, vol. 4, Dahka, University of Dahka, 2010, pp. 117-135, p.121.

of negative identities are the following: "what is A cannot be not-A", "An equilateral rectangle cannot be a non-rectangle", "it is true that every man is rational, therefore, it is false that there is a man who is not an example.[187]

The propositions above are not implicitly negative. For instance, to state that, what is A cannot be a non-A" is to affirm that "A is A". "Non-A", says nothing about A and does not logically or semantically predicate it. Double negation is implicitly an affirmation and thus corroborates the view that Leibniz was more concerned with affirmative propositions and did not successfully prove the possibility of according an analytic nature to negative propositions.

Despite the underlying limitations of Leibniz's analysis, his contribution to the analytical method of logical positivism is based on his distinction between truths of reason and truths of facts that is why Julius Rudolph Weinberg affirms that: "the division of propositions into truths of reason and truths of fact, together with the first approximation to an analysis of the former, places Leibniz among the sources of logical positivism."[188] This implies that the logical analysis of Leibniz is an indispensable start-point of logical positivism, even though they differ the nature of analysis the nature of truth and their views on the metaphysical foundation of knowledge.

[187]Abdul Muhit*, "Leibniz on Necessary and Contingent Truth",* p. 122.
[188]Julius Rudolph Weinberg, *An Examination of Logical Positivism*, p. 4.

CHAPTER TWO:

THE LOGICAL POSITIVISTS' SEMANTIC PARADIGME OF SCIENTIFIC RATIONALITY

The criterion which we use to test the genuineness of apparent statements of fact is the criterion of verifiability, we say that a statement is factually significant to any given person, if we, and only if, he knows to verify the proposition which it purports to express.[189]

2.1. THE CORRESPONDENCE THEORY OF MEANING THROUGH VERIFICATIONISM

We talk of the semantic paradigm because to logical positivism, what determines the scientificity of a theory is its meaning. A scientific theory to them is a system of statements and scientific rationality consists in finding out if these statements are meaningful. The first moment in the logical positivists dialectics of meaning is in the correspondence theory of meaning. This theory is defended by Early Wiitgenstein, Russell and Schlick. The point of departure of the correspondence theory of meaning is the notion of logical atomism. According to logical atomism, the structure of scientific language reflects the structure of the factual world. Thus to assure the correspondence of language to the world of facts, there is need for the analysis of language from the complex to the simplest structure. This analysis is the necessary condition for the principle of verification, which consists in observing the factual world to make sure that language is a representation or the picture of the world. It is in this reflection of the factual world that the meaning of a language is assured. The crux of this sub-chapter then is to examine logical atomism and the principle of verification as the main articulations of the correspondence theory of meaning.

2.1.1 Logical Atomism and the Simplicity of Analysis in Russell, Early Wittgenstein and Schlick

The notion of logical atomism is central in logical positivism because meaning in the correspondence theory is inferential from the isomorphism of language and the world. Given the fact that Russell and Early Wittgenstein[190] asserts the reality of the external world which is language-dependent, it is but logical to determine the unanalysable units of language that

[189] Alferd Jules Ayer, *op.cit*., p. 16.

[190]It should be noted that Early Wittgenstein refers to his views in the Tracatus, where he develops the verifiactionists view and is parochial that the role of language is to represent the world. However, in late Wittgenstein that constitutes his Philosophical investigations, he develops the theory of language games in which he accords many functions to language. Thus, it the philosophy of early Wittgenstein that is our concern in this part of the work.

correspond to the simplest aspects of the external world. That is why Wittgenstein affirms that: "if the world had no substance, then whether a proposition had sense would depend on whether another proposition was true. In that case, we would not sketch any picture of the world "true or false."[191] This implies that logical atomism also solves the problem of induction and infinite regress of inductive inferences since nature is a system of atoms whose representation is the function of language. Historically, the theory of logical atomism stemmed from Wittgenstein's critique of the formalism and logicism that characterized the *Principia Mathematica*. Infact,

> *The explicit purpose of the principia was to demonstrate that the concepts and assertions of mathematics are entirely derivable from the concepts and assertions of symbolic logic The construction of an exact language to serve is solving the philosophical problems and in presenting a complete shematisation for representing the structure of the world of science and experience.*[192]

The logicist ambition of Whitetehead and Russell reiterated above by Weinberg, was limited because of its lack of empirical and pragmatic character. It is empirically paralysed because the sequence of various propositional forms that constitute it is not informative about the world. That is, they assert nothing about the empirical world. Such sequence only has notational value and cannot be empirically verified from the world. Thus, the need to establish the link between propositions and the world is the logical motivation of logical atomism.

The central pre-occupation of Russell and Wittgenstein then is to determine the last residue of the logical analyses of language. According to them, there is a symmetry between the way we dissect facts on one hand and the way we analyse language. Unlike the psychological atomism of Hume that breaks down thought and ideas into impressions, Russell and Wittgenstein dedicate their logical atomism to the analysis of complex statements to their simplest form. However, Russell and Wittgenstein disagree on the nature of the fundamental residues of the dual analysis of language and the world, for while Wittgenstein talks of objects, Russell talks of sense data.

The pivotal assertion of logical atomism in Wittgenstein holds that: "the world is the totality of facts, and not of things".[193] Wittgenstein is implying that any logically meaningful statement can only be made about facts and not things. A fact is not specific object as, "fact is the logical space are the world."[194] By 'logical space', he identifies facts with the possibility of experience.

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[191]Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, Trans., D. F. Pears and B. F. McGuinness, (1922), New York-London, Routledge Classic, 2001. props. 2.0211-2, p.4
[192] Julius Rudolph Weinberg, *op.cit.*, p. 33.
[193]Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, Prop. 1.1., p. 5.
[194]*Idem*. prop. 1.13.

They are then actual facts, which are the logical confirmation of possible facts. Facts then denote 'states of affairs' or possibility of experience.

The world to Wittgenstein is dissected into facts. The latter is dissected into state of affairs which are later divided into things or objects. The differences between the fact and an object, is grounded on the following; facts are expressed in propositions while things are denoted by names. Moreover, facts are independent from each other while objects depend on facts to exist. Given that a logically meaningful statement is an affirmation or a negation between two terms, it is then logically impossible to make an assertion about the empirical world using names or terms or objects. However, when objects are combined, they form atomic facts, whose combination constitute general facts. Objects on their own then do not play any logical function. That is, they are not the fundamental unites of analysis because they are simply possibility of forming facts. However, atomic facts constitute the bases of the analysis of the world as Michael Morris affirms that: "these atomic facts are the fundamental organic unities of the world, the entities whose existence depend on no other entity of the same kind."[195]

Atomic facts are the last residues of the analysis of the world but the unanalysable aspect of the world are objects. Objects then can be referred to as the substances of the world. Wittgenstein affirms that: "objects constitutes the possibility of all situations."[196] This follows that, atomic facts are determined by the manner in which objects are formed. The structure of atomic facts is then a product of the form of objects. The world then is logical because there are objects common to facts which render the world to be fixed and orderly. That is why Matthew B. Ostrow affirms that: "the atomic fact is in its essence an arrangement of objects. To say that these objects hang in one another like the links of a chain is to emphasise that no further elements are involved in this configuration."[197]

In the analysis of language, Wittgenstein assert that language is a system of propositions. These propositions which are general or atomic, consist of names. The fact that names occur only in propositions also reinforces the ontological dependency of objects on facts. While facts are expressed in propositions, names refer to objects. The atomism of Wittgenstein is then a form of linguistic and structural realism. It is a form of linguistic realism because atomic propositions are

[195]Michael Morris, *Routledge Philosophy Guide Book To Wittgenstein and Tractatus*, London, Rouledge, p. 31.
[196]Ludwig Wittgenstein, *op.cit.*, Prop. 2.0141, p. 7.
[197]Matthew B. Ostrow, *Wittgenstein's Tractacus A Dialectical Interpretation*, London, Cambridge University Press, 2002, p. 31.

independent from each other and it is a form of structural realism due to the independence of atomic facts.

It is clear that Wittgenstein's view of logical atomic lacks pragmatic underones as he does not give practical examples. This is highlighted by David Sterner who asserts that, "Wittgenstein concluded that every significant statement must be composed of logical atoms, yet was unable to give any example."[198] This critique does not reduce the logical weight of Wittgenstein's logical atomism for he is more concerned with logical language and not ordinary language.

To Betrand Russell, the unalysable base of analysis is acquaintance, sense-data or direct experience. The power of analysis then ends at the bottom, where reference is made to self-evidence. Unlike Wittgenstein who talks of the independence of atoms in the Tractatus, Russell envisages the interconnectivism of atoms. By logical atoms, he refers to the "last residue in analysis."[199] These atoms to him refer to momentary things, particulars, predicates and relations. His empiricism is a form of phenomenology and also a logical consequence of the neutral monism and the psychological atomism of Ernst Mach.

In this definition of a fact, Russell affirms that, "when I speak of a 'fact', I do not mean one simple in the world; I mean that a certain thing has a certain quality or that certain things have certain relation."[200] This follows that every fact has two or more constituents. These constituents which have the triadic denotation notably the thing, the relation and the quality are united in a particular form to constitute a fact.

Facts to Russell are not individual objects in the world because the latter cannot determine the truth of a proposition. The name of an individual like "Socrates" can not render a proposition to be true or false because of the inexpressibility of context. This reiterated by Russell who affirms that: "we express a fact for example when we say that a certain thing has a certain property or that it has a certain relation to another thing."[201] While names play the role of reference to objects, facts can only be expressed in propositions.

Facts are truth-makers that have objective existence. When one asserts for instance that, "it is raining" to Russell, the statement is true if certain weather conditions exists as stated and false

[198]David Stener, "The Middle Wittgenstein " from Logical Atomism to Practical Holism," in *Synthese*, vol. 87, no. 2,Dordreicht, Springer, 1991, pp. 203-226., p. 219.
[199]Betrand Russell, *The Philosophy of Logical Atomism*, (1972), London, Routledge, 2010, p.3.
[200]Betrand Russell, *Our Knowledge of the External World; as a Field For Sceintic Method In Philosophy*, London, George Allen and Unevin Ltd., 1914, p. 60.
[201]Betrand Russell, *The Philosophy of Logical Atomism*, p. 7.

if certain weather conditions exist which do not correspond to the proposition. Facts are then so varied as the contexts of occurances. We can identify psychological facts, astronomical facts, arithmetical facts. The simplest of all facts are particular facts. Particular facts to Russell express quality such as, "this is white."[202] General facts are characterized by universalisation of particulars such as "all men are mortal."[203] Positive facts to Russell is the affirmative expression of possibility such as a "Socrates is alive"[204] and negative facts is the negation of possibility such as "Socrates not alive."[205] The constituents of facts to Ressell are particulars, predicates, properties and relations. The atomic facts are those that deal with qualifies like, "This is white. The next simpler ones are facts dealing relation, like "this is to the left of that"[206] and the classification grows as complex as particulars and relations become complex.

Atomic facts are not individual objects, Russell however identifies these simplest base of analysis to sense-data. The simplest or atomic fact like, "this is yellow", can only be asserted when we are empirically presented with a particular yellowish thing. The manner in which an individual becomes aware of sense-data to Russell is called acquaintance. He defines it by asserting that, "I say that I am acquainted with an object when I have a direct cognitive relation to that object, that us, when I am directly aware of the object itself."[207] This cognitive relation is not of the mental order but of the phenomenological order. That is the cognitive relation is based on the manner in which the object manifest itself to the mind.

The objects of acquaintance are not individual objects in the world for "Russell thought that 'sense-data' are the objects of sensations and they serve as the physical evidentiary data for inference concerning physical objects."[208] Acquaintance is characterized by complexity given the multiple contexts of the presentation of sense-data to the mind acquaintance can be derived from outer senses called sense-data, inner senses called introspectum from stored outer or inner sense called memory and from general ideas called the universals. That is why one commentator of Russell affirms that Russell's acquaintance consist of:

> *(1) Sense-data (2) Memory – data (3) introspectum-data, including both mental facts like seeing the sun, my desiring food and feeling like those of pain and pleasure (4) possibly*

[202]Betrand Russell, *The Philosophy of Logical Atomism*, p. 8.
[203]*Idem.*
[204]*Ibid.*, p. 9.
[205]*Idem.*
[206]*Ibid.*, p. 26.
[207]Betrand Russell, *Mysticism and Logic and other Essays* (1919), Loss Angeles, Peruse Press, 2014, p. 149.
[208]Logical Atomism, Available on https://www.cambridge.org/core, consulted on 18th April 2019, at 21:09:28.

our own self, though Russell is unsure of this and (5) universals including, sensible properties like whiteness, blackness and abstract properties take diversity.[209]

In this linguistic atomism, Russell holds that atomic propositions express one fact, such as, Socrates' "mortal" while Molecular proposition express two or more facts. What enhances the construction of molecular proposition are logical connectives such as 'or, if, and'.

Wittgenstein and Russell's empirical realism is rendered pragmatic by Moritz Schlick. While early Wittgenstein acknowledges the existence of objects whose form determine the structure of atomic facts, early Russell, is agnostic about the logical significance of objects. Objects to early Russell are only logically significant insofar as they dispose of properties or enter into relation. That is why he privileges sense-data to sensible objects. Moritz Schlick attributes Russell's agnosticism about the existence of individual things to absurdity when he affirms that, "so, if positivism is understood to mean a view that denies reality to bodies, I should simply have declared it absurd."[210] Unlike some positivists who excludes realism from science, Schlick asserts that all logical positivists must adhere to empirical realism, that is, the acceptance of a physical world that exists independently of our power of sensation. That is why he asserts that: "in contrast to the internal world, which covers memories, thoughts, dreams, wishes and feelings, the external world means nothing else here, but the world of mountainous and trees, houses, animals and men."[211] The external world, the world of scientific language to Schlick is nature.

Conclusively, Wittgenstein, Russell and Schlick, develop logical atomism to insist on the correspondence criterion of evidence which states that there is correspondence between the way we analyse the reality and the way we analyse our scientific language. Scientificity is determined by meaning, deduced from the isomorphism between language and the reality.

2.1.2 Verification Principle of Meaning in the Language – World Isomorphism

In the *Oxford Dictionary of Philosophy*, the verification principle is "the principle central to logical positivism, according to which the meaning of a sentence is its method of verification."[212] In the *Cambridge Dictionary of Philosophy*, verificationism is defined as, that theory according to

[209]Bertrand Russell, *The Philosophy of Logical Atomism*, p. 11.
[210]Moritz Schlic;, "Positivism and Realism", Trans. Peter Heath, in Moritz Schlick, in *Philosophical Papers*, vol. 2, no. 4, (1925 – 1936), London, Kluwer Academic Publishing, 1979, pp. 259-284., p.263.
[211]*Idem*.
[212]Simon Blackburn, *Oxford Dictionary of Philosophy*, (1994), 2nd ed., Oxford, Oxford University Press, 2008, p. 379.

which "the meaning of statement consists in its method(s) of verification."[213] In his discussion with members of the Vienna, Wittgenstein is noted to have ceaselessly held the view that "the sense of a proposition is the method of its verification."[214] This celebrated statement cited by Weinberg is re-echoed by Moritz Schlick who asserts that: "The meaning of a proposition is the method of its verification."[215]

From the above definitions, it can be deduced that the verification principle defines meaning by establishing the correspondence between the constructed language and the etra-linguistic reality. Even though Russell, Wittgenstein and Schlick disagree on the mode of correspondence, they all agree that the meaning of scientific language is assured if we logically ensure that there is an evidential reference of the structure of language from the external world. Russell, Wittgenstein and Schlick here agree that empirical verification is at the heart of the development science. While Russell develops the techniques of acquaintance and definite description, Wittgenstein elaborates on the technique of representation while Moritz Shclick presents verification as a logical and not an empirical possibility.

There is a coincidence of meaning and truth in Bertrand Russell as characteristic of the language – world isomorphism. In this argument from truism, Russell affirms that: " the world contains facts, which are what they are whatever we may choose to think about them, and that there are also beliefs, which have reference to facts and by reference to facts are: either true or false."[216] The epistemic belief we develop from facts are expressed in propositions of science. These propositions are true or false depending on either on their agreement or disagreement with facts. A fact then is a truth-maker or that to which corresponds a proposition that is either true or false. Truth and falsity then mediates between facts and proposition.

The central question that Russell like every other proponent of the correspondent theory of meaning grapples with is to verify what aspect of language corresponds to that aspect of the extra-linguistic reality. Russell responds to this in his theories of analysis and understanding using the techniques of acquaintance and definite description. This is x-rayed in his affirmation; "Every proposition which we can understand must be composed wholly of constituents with which we are

[213]Robert Audio, *The Cambridge Dictionary of Philosophy*, (1995), 2nd ed., Cambridge, Cambridge University Press, 1999, p. 953.
[214] Julius Rudolph Weinberg, *op.cit.*, p. 101.
[215] Moritz Shclick, "Meaning and Verification", in *Philosophical Review*, vol. 45, no. 4, Durham, Duke University Press, 1936, pp. 339-369, p. 341.
[216]Betrand Russell, *The Philosophy of Logical Atomism*, p. 6.

acquainted."[217] The fundamental epistemic structure of the world to Russell are sense-data. That is why William Lycan states that: "Russell took it as self-evident that sense-data are epistemological atoms and that ordinary objects are epistemological fictions."[218]

Russell does not have any ontological commitment to the justification of the reality of physical objects. That is why physical objects have the status of epistemological fictions. However, the atoms which constitute the basic level of the language – world isomorphism to him are sense-data. The basic level of coincidence propositions and sense-data is self-evidence attained through acquaintance. Acquaintance is knowledge of physical things. It is immediate knowledge and direct awareness of the meaning of statement. Russell re-iterates that: "when we ask what are kinds of objects which we are acquainted, the first and most obvious is sense-data. When I see a colour or hear a noise, I have direct acquaintance with colour or noise."[219] We can be aware of particulars as well as universals. For instance, when we are aware of individual yellowish things, that can create the awareness of yellow in us. Given that proposition are descriptive phrases, determining the meaning of the former implies the prior determination of the meaning of constituents which are particulars, relation or properties. The first level of determining meaning of proposition then is acquaintance that is why to Russell, "an atomic proposition is which mentions actual particulars not merely describe them but actually name them and you can only name them by means of names."[220]

It is clear then that at the level of actual facts, the relationship between language and the world is through verification of states of affairs expressed in a proposition. Each atomic fact has two corresponding propositions, one that asserts it as true and the other that asserts it as false. For instance the fact that 'Socrates is alive' is expressed by two propositions. One which asserts that he is alive and the other which asserts that he is not alive.

The second phase of determining meaning is Russell is his theory of definite description which consists in analyzing vague statements in which we have no acquaintance of into meaning sentences. Russell's theory of definite description then is not yet the abandonment of acquaintance but an attempt to show how we can derive meaning of statement containing vacuous description that we are not acquainted with. It is the major break-away from the formalism of Frege. This is

[217]Betrand Russell, *Mysticism and Logic and Other Essays*, p. 153.
[218]William Lycan, "Logical Atomism and Ontological Atoms", in *Synthese*, vol. 46, no. 2, Dordrech, D. Reidel Publishing, 1981, pp. 207-229, p. 210.
[219]Bertrand Russell, *op.cit.*, p. 148.
[220]Bertrand Russell, *Philosophy of Logical Atomism*, p. 28.

because "Frege had treated descriptions simply as complex names so that, 'the author of Humlet was a genius had the same logical structure as Shakespeare was a genius'."[221] Statement with such vacuous description had meaning in Frege's arbitrary formal logical schemes. However, the lack of actual experience, acquaintance and precision influenced Russell to create possible experience through definite description. While Frege treated definite description as names and symbols of particulars, Russell treated them as complexes worthy of analysis to define meaning. For instance, the description, "the author of Warerley"[222] to Frege was the same like "Scott" who is the actual writer of the book. Even though Scott is the author of, "Waverley, the combination of the isolated meaning of the description does not have a semantic symmetry with "Scott". That is, anyone who is acquainted, with English language easily understand the meaning of the description, "the author of Waverley" but he who has never been acquainted with the person called "Scott" will not understand when the statement is substituted by the name.

Since individual objects to Russell, cannot be objects of meaningful expressions, any statement containing an individual must be denoted or described. This description does not make us understand things as they are but it gives us knowledge of things as having certain relation. Acquaintance derived from the description of incomplete symbols or individual objects then is about their relationship and not about their ontological existence.

There are three forms of statements that denote. They include: "(1) A phrase may be denoting and yet not denote anything, e.g. "The present king of France"; (2) A phrase may denote one definite object e.g. the present king of England "denotes a certain man"; (3) A phrase may denote ambiguously for example. "A man" denotes not many men but an ambiguous man"[223] what is similar in the three forms of descriptive statements above is the absence of direct acquaintance meaning by acquaintance is immediate and self-evident and meaning by description is mediate. Russell brings up this distinction by asserting that: "when there is any which we do not have immediate acquaintance, but only by definition by denoting phrases, that the proposition in which this thing is introduced by means of denoting phrases do not really contain this thing as constituent, but contain instead the constituents expressed by several words of the denoting phrase"[224] objects

[221]Anthony Kenny, *An Illustrated brief History of Western Philosophy* (1998), 2nd ed., London, Blackwell Publishing, 2006, p.
[222]Bertrand Russell, *Philosophy of Logical Atomism*, p. 80.
[223]Bertrand Russell, "On Denoting " In *The Mind*, vol. 14, no. 411, London, Oxford University Press, 1905, pp. 479-493, p. 492.
[224]*Ibid.*, p. 493.

that constitutes descriptive phrases do not have meaning in themselves. They only have meaning in use and through the understanding of their descriptive, relations or properties.

To avoid impression and confusion in describing, individuals, Russell proposed a tenseless, linguistic technique in what he calls, the propositional function. In the description, "the author of Waverley exists", meaning can only be inferred, two properties must be stated; That someone once wrote Waverley and that Waverley was written only by one person The proportional function follows that, the statement: "(1) it must be true for at least one X. (2) It must be true for at most one X."[225] Individuals in statements cannot have meaning though naming but through description.

As concerns general statement like all men are mortal, Russell claims they can be analysed correspondingly to general facts. The general fact "All men are mortal" can be inferred from the sequence mortality of men. This however lacks logical cogenly to him since it is rationally difficult to infer general statements from particular ones. That is why he expresses his agnosticism towards the analysis of general statements by asserting that: "I do not profess to know what the right analysis of general fact is."[226] Existence-statements like "all Greeks are men", have meaning only when existence is interpreted as a property of a propositional function and not an empirical function. A propositional function is characterized by undetermined constituents which when determined, constitute a proposition. It can be necessary when it is always true, possible when it is sometimes true and impossible when it is never true.

Russell's view of meaning and correspondence between language and the world is reduced to acquaintance when we have direct awareness of the sense-data of the objects expressed and description when we have acquaintance of the properties or relations of undetermined particulars through definite description. The view of Russell was later altered because of the abandonment of acquaintance for neutral monism to avoid the distinction of the mental and the physical and to avoid the problem of the subsistence of physical things after the act of sensation. That theory of neutral monism consists in presenting the contents of knowledge as constituants. This makes Russell a phenomenologist. To the question to know if sensible objects continue to exist after perception; "Russell recalled that his adoption of neutral monism required the abandonment of a conscious subject or the "self" and this put an end to his theory of "sense-data" are immediate

[225]Bertrand Russell, *Philosophy of Logical Atomism*, p. 86.
[226]*Ibid.*, pp. 71 – 72.

objects of mental acts of sensation."[227] The phrase neutral monism here implies that both mind and matter constitute one neutral stuff which cannot be reduced to any of the two.

Wittgenstein theory of correspondence between language and the world is representative. Wittgenstein rejects the denotational view of meaning of Russell and Russell's conception of a sentences as collections. That is why he affirms that: "A proposition is not a blend of words. (Just as a theme in music is not a blend of notes). A proposition is articulate."[228] Words that designate objects can only exist in propositions. They do not have any ontological identify and can not confer meaning. Wittgenstein affirms then that; "only facts can express sense, a set of names can not."[229] There are no relations between individual objects to produce state-of-affairs. What constitute objects is, "Instead, they have their intrinsic possibilities of combination with each other into states of affairs."[230] Meaning in language then should be sought from the independence of facts and their correspondence with propositions and not names.

The central pre-occupation to Wittgenstein then is, how does language represent the world. According to him, "language represents the world in two ways: (1) in that propositions are true or false (2) in that whether true or false, a proposition must have something in common with the world in order to be right or wrong; e.g. a photo may represent distribution of light in black and dark to represent all."[231] From the above, the first moment of relationship between a proposition is the level of truth /false dualism. When a proposition agrees with facts, it is true and when it disagrees, it is false. The second level of correspondence above is that of structural symmetry. That is, there must be identity of structure between a proposition and a fact, for there to be correspondence and representation. This follows that the world on one hand and language on the other hand must have logical form to facilitate representation. That is why Michael Morris asserts that:

> *Language depends for their meaningfulness on correlation between certain linguistic items on the one hand and extra linguistic items on the other. The extra-linguistic items with which those linguistic items have to be correlated for languages to be meaningful are items in the world.*[232]

[227]Landimi Gregory, *Wittgenstein's Apprenticeship with Russel,* Cambridge, Cambridge University Pess, 2007, p. 34.
[228]Ludwig Wittgenstein, *Tractalius Logico-Philosophicus*, Prop. 3.142, p. 14.
[229]*Ibid.*, prop. 3.142, p. 14.
[230]Hans Sluga and David G. Stern, *The Cambridge Companion to Wittgenstein*, New York, Cambridge University Press, 1990, p. 76.
[231]Ludwig Wittgenstein, *Lectures, From The Notes of Moore* (1930 – 1933), Cambridge, Cambridge University Press, 2016, p. 20.
[232]Michael Morris, *Routledge Philosophy Gruidebook To Wittgenstein and Tractatus*, p. 114.

Drawing inspiration from the Paris court room model, where motor-car accidents were represented with dells, Wittgenstein develops the language - World correlation in the picture theory. According to this model, "in the proposition a world is as it were put together experimentally. (As when in the law court in Paris a motor-car accident is represented by means of dolls, etc).[233] The relation between the model, which is the proposition is essentially pictorial. As such "the essential propositional sign is very clearly seen if we imagine one composed of spatial objects (such as tables, chairs and books) instead of written signs. Then the spatial arrangement of these things will express the sense of the proposition."[234] What guarantees the correlation between the reality and the picture is the symmetry of the components of the two. The linguistic components must correspond to the component of the reality to render the proposition to be meaningful. Wittgenstein asserts that, "in the picture and the pictured, there must be something identical in order that the one can be a picture of the other at all."[235] He reiterates that, "a picture depicts reality by representing a possibility of existence and non-existence of states of affairs"[236] when a proposition agrees with state of affairs, it is true and the representation is correct and when it does not agree with states of affairs, it is false and the representation is incorrect. It is not the whole picture that corresponds to state of affairs as Russell claimed but elements of the picture or proposition.

The simplest structure of the world are objects which have no definite relationship and properties as Russell claim but on the form or the possibility of combining to form states of affairs. The simplest structure of language on the other hand are names which also have the possibility of combining to form propositions. The correlation between language and the world is ensured by sameness of possibility of combination of components on one hand and sameness of form on the other hand. Names or symbols refer to objects in the world and same as objects have the possibility of combining to form facts, names also combine to form propositions.

Language to Wittgenstein is built up from propositions which are constructed from atomic propositions whose structures are determined by names. The structure of language reflects the structure of the world to Witgenstein. This is because the world on the other hand is made up of facts which can be reduced to state of affairs that are formed from the possibility of the combination of objects. A.C Graying, schematize the language word isomorphism of Wittgenstein bellow:

[233]Michael Morris, *Routledge Philosophy Guidebook To Wittgenstein and Tractatus,* p. 118.
[234]Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, Prop. 3.1432, p. 14.
[235]*Ibid*., prop. 2.161, pp. 10-11.
[236]*Ibid*., prop. 2.201, p. 11.

"Language <----------> World"

↕ ↕

Proposition <----------> facts

↕ ↕

Elementary Propositions <------> Atomic facts

↕ ↕

Names <----------> Objects"[237]

The picture theory then is an attempt to construct a perfect language of science. The correlation between language and the world is essentially of the formal order. That is why a commentator of Wittgenstein affirms that: "modeling does not require pictorial elements and represented objects share the common possibility of combination. It only requires a formal "isomorphism between the possible configurations of pictorial elements into pictures and of objects into facts."[238]

The sense of the proposition is not intrinsic in its nature but it is simply its ability to represent facts. Prepositions in themselves have no meaning if they do not express the possibility of a fact. Unlike Russell who identifies truth with sense, Wittgenstein asserts that the two are distinct. The truth of a proposition is when there is actual agreement between the sense and the state of affairs. Wittgenstein re-iterates that, "a proposition, therefore does not actually contain its sense, but does contain the possibility of expressing it."[239] This follows that the meaning of a proposition can be understood without knowing whether it is true or false. Meaning is possibility of representation while truth is actual representation. Truth is the qualification of a proposition while meaning is the propositional projection of state of affairs. Wittgenstein affirms then that, "the sense of a proposition is its agreement and disagreement with possibilities of existence and non-existence of state of affairs"[240] In his linguistic realism, Wittgenstein posits propositions as facts "A picture is a fact".[241] The correlation of language and the world then is guaranteed by the correlation of the elements of the picture and the element of the pictured. That is why Wittgenstein asserts that:

[237]Anthony Clifford Grayling, *Wittgenstein*, New York, Oxford University Press, 1988, p. 29.
[238]Hans Sluga and David G. Steven, *The Cambridge Companion to Wittgenstein*, p. 78.
[239]Wittgenstein, *Tractatus*, prop. 3.13, p. 13.
[240]*Ibid.*, prop. 4.2, p. 36.
[241]*Ibid*., prop. 2.141, p. 10.

> *The fact that the elements of a picture are related to one another is a determinate way represents that things are related to one another in the same way. Let us call this connexion of its element, structure of the picture and let us call the possibility of this structure the pictorial form of the picture.*[242]

The isomorphism between the pictorial fact and the world fact is that of possibility. The pictorial form or the logical form then is "the representational possibilities of any picture."[243] Logical language then determines the world. Language indicates and represents the world and also defines the world and also defines the limit of the world. This then is a kind of solipsism which Wittgenstein himself estates that, "the limit of my language means the limit of my world.[244]

Just like Russell whose idea later witnessed a great revolution, Wittgenstein from the mid 1930s till his death witnessed great revolution from the simplistic view of language in the Tractatus. In his philosophical investigation, he shifts from defining meaning as language-world isomorphism to conceive language as a form of life with varied functions. What matters in understanding language then is to understand its use. This is the purpose of his technique of language games. This however does not distort our arguments above, for the Wittgenstein of the Tractatus is that of the representational function of language and the verificational definition of meaning.

In the last moment, Moritz Schlick defends verification as a logical and not empirical possibility. Verification to him is the possibility of meaning and not the criterion of meaning. This to him is to avoid the, "here and now predicament"[245] which negatively tag verification for being an untrusted instantaneous criterion. Moritz Schlick asserts that: "we conclude that there is no way of understanding any meaning without ultimate reference to ostensive definition and this is means in obvious sense reference to 'experiences' or possibility of verification."[246] He qualifies this as an experimental method of meaning. The method of verification should not be applied only to the immediately given but also to statements expressing possible experience which we do not yet have apt apparatus to observe them now. Facts are not only actual but also possible. Shlick here affirms that, "I call a fact or a process 'Logically possible' if it can be described, that is, if the sentence which is supposed to describe it obeys the rules of grammar we have stipulated in our language."[247]

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[242]Wittgenstein, *Tractatus*, prop. 2.15, p. 10.
[243]Matthew B. Ostrow, Wittgenstein's Tractatus, *A Dialectical Interpretation*, p. 46.
[244] Wittgenstein, *op.cit.*, prop. 5.66, p. 68.
[245]Moritz Schlick, "Meaning and Verification", in *Philosophical Review*, vol. 45, no. 4, Durham, Duke University Press, 1936, pp. 339- 369., p.342.
[246]*Idem.*
[247]*Idem.*

The verification of a statement is logically possible if there is a compactibility between the definition given to it and its application. Statements like, "my friend died the day after tomorrow. The lady wore a dark red dress, which was green"[248] are logical impossibilities and these are not verifiable. However, statements like, "there are 10.000ft mountains on the far side of the moon"[249] cannot be practically be verified since there are no instrument to observe the state of affairs that it expresses. However, the states of affairs expressed are logically possible. There are other statements that are empirical impossible but they are meaningful on grounds of their logical possibility, such as, "Rivers flow uphill." The proposition is an empirical impossibility and thus false but it is meaningful as a logical possibility because it talks of a certain reality occurring in a certain space.

There is then actual experience which is empirical and possible experience which is logical. Schlick concludes that: "we know the meaning of a proposition when we are able to indicate exactly the circumstances under which it would be true."[250] Alfred Jules Ayer has a view similar to Schlick when he distinguishes between verification in principle and practical verification. A statement is practically verifiable when we can point at matters of facts which are expressed by the statement. He uses the same example of Schlick, "that there are mountains on the other side of moon"[251] is not practically verifiable because we do not have sophisticated astronomical instruments to carryout actual observation.

Ayer insists on the relativity of verifiability because it is not a sharp and exhaustive method. He affirms that: "it seems to me that if we adop conclusive verifiability as our criterion of significance, as some positivists have proposed, our argument will prove too much."[252] He is criticizing Shlick's conclusive verifiability in which general propositions are non-sensical. General propositions such as, "All men are mortal" to Ayer can be verified from a finite series of human mortality. Such verification proceed by probability. That is why Ayer differentiates between strong and weak verifiability. He affirms that, "A proposition is said to be verifiable in a strong sense of

[248]*Moritz Schlick,* "Meaning and Verification", p. 342.
[249]Moritz Schlick, "Facts and Proposition", in *Analysis*, vol. 2, no. 5, reprinted in Moritz Shlick, 1979, Moritz Schlick, Philosophical Papers, (1925-1936), eds. H. Mulder and B. F. B Van de Velse-Schlick, London, D. Reidel Publishing Company, 1935, pp. 65 – 70, p.71.
[250]Moritz Schlick, "The Future of Philosophy", in *Proceeding of the Seventh International Congress of Philosophy*, vol. 1, no.1, Oxford, oxford university press, 1932, pp. 45 – 62, p.52.
[251]Alfred Jules Ayer, *Language Truth and Logic*, 1st ed., London, Penguim Books, 1936, p. 17.
[252]*Ibid*., p. 18.

the term, if and only if, its truth could be conclusively established in experience. But it is verifiable in the weak sense, if it is possible for experience to render it probable."[253]

Conclusively, the correspondence model of meaning expounded by Russell, first Wittgenstein, Schlick and Ayer, presents different variations of correspondence between scientific language and the world. Despite their intrinsic differences, they are synthetic on the view that the meaning of scientific statement can only be established by confronting it with extra-linguistic elements, which could be sense-data in Russell, state of affairs to Wittgenstein, possible experience to Schlick and actual and possible state of affairs to Ayer.

2.2 THE PHYSICALIST THEORY OF MEANING THROUGH RATIONAL RECONSTRUCTION

The second articulation in the logical positivist dialectics of meaning is in physicalism that is projected through rational reconstruction. Physicalism as defended outstandingly by Carnap and Neurath, arises from the critique of the correspondence theory of truth and meaning. It is a language-centred approach to logical analysis, which rejects the correspondence criterion because it makes concessions to metaphysics. Otto Neurath in his critique of the correspondence theory of meaning asserts that: "language is essential for science; with language, all transformation of science takes place."[254] Language is not meant to reflect the world for such approach leads to realism and idealism which are metaphysical. In the correspondence theory, the attempt to establish and the reality was fruitless because of the inexpressibility of the language world structural identity. Wittgensteim in his final statement of the Tractatus instead proposes silence as the solution to that which we cannot express. This refers to the famous thesis of mysticism in Wittgenstein's philosophy of language. To avoid the controversies arising from the correspondence theory, Carnap and Neurath propose a language-centred approach; which consists in constructing a universal language of science, in which all statements of different sciences can be translated from one to another. Physicalism can be expressed in the language of physics. Julius Rudolph Weigner asserts the same thing when he holds that: "According to this doctrine, all sentences may be translated into a universal language which is similar in form to the language of contemporary physics."[255]

[253]Alfred Jules Ayer, *Language Truth and Logic*, p. 18.
[254]Otto Neurath, *Philosophical Papers*, Vienna Collection, vol. 16, Dordrecht, D. Reild Publishing, 1983, p. 53.
[255]Julius Rolph Weinberg, *An Examination of Logical Positivism*, p. 228.

2.2.1 Rational Reconstruction and Structuralism as Rudolph Carnap's Approach to Physicalism

Rational reconstruction can be defined as, "the replacement of vague informal concept by precise ones defined in terms of a standard logical language in which all our knowledge can be expressed."[256] This reconstruction through definition and reduction was influenced by Bertrand Russell in his book, *Our knowledge of the External world*. To Russell, the best logical approach that can guard against the vagueness and chaotic nature of experience, "was not by analysis of experience but by constructing using principles of abstraction."[257] The possibility of science then is not in making reference to any extra-linguistic framework but it is guaranteed by rational construction. In rational reconstruction, there is a concept-object identity. Objects are classes, properties, things, relation, extensions and intentions. To Carnap, an object is "anything about which a statement can be made."[258] Constructionism of Carnap is a kind of reductionism and to reduce a stamen of a particular object to transform it to statements of other objects. Carnap in this way affirms that, "if an object is reducible to object a is b, c, then all statements about a can be transformed into statements about b and c."[259] There is therefore an interconnection and relation between types of objects in science arise from the plurality of different construction system.

There are four main problems that when overcome, will permit the construction of an ideal and universal language of science. They include the problem of the basis, the problem of the ascension form, the problem of the object form and the problem of the system form. It is then a question of determining a solid base on which the system is to be grounded, determining the adequate logically procedure to enhance the construction from the simplest to the complex objects, determining how the various types of objects in the world can be constructed using the identified base and the chosen logical procedure of construction so as to finally determine the general forms of the constructional system. By resolving the fourth problem; that is the problem of the general form of the constructed system, we arrive at: *« connaitre le principe unificateur générale de toute science. »*[260]

[256]Michael Friedman and Richard Creath, *Cambridge Companion to Carnap*, Cambridge, Cambridge University Press, 2008, p. 28.
[257]*Ibid*., p. 25.
[258]Rudolf Carnap, *The Logical Structure of The World and Pseudoproblems In Philosophy*, (1928) Tran. Rolf A. George, Chicago, Open Court Publishing Company, 1928, p. 5.
[259]*Ibid.*, p. 6.
[260] Jean-François Malherbe, *La Philosophie De Karl Popper et Le Positivisme Logique*, Québec, Liber, 2011, p. 51. "Knowing the universal principle of the whole of science" (my translation).

Practically, the question of the base of the logical construction of the world to Carnap is intandem with that of the origin and development of scientific language. Carnap in his thesis of linguistic phenomenology, posits two moments in the development of scientific language. These moments connote the two types of language; "Thing-language" and "physical language." Thing-language contents observation statement; that is the uncontroversially true basis of science referred to as protocol statements. The thing-language or protocol language to Carnap, is, "that language which we use in everyday life in speaking about the perceptible things around us."[261] Protocol language is then a record of daily experiences. This auto-psychic basis of rational reconstruction translates methodological solipsism, given the fact that people at this fisrt level test theories using their own experiences and those of other people that they are acquainted with. The basis of Carnap's aufbau or constructability are observation statements which are used to verify and certain the meaning of other statements. This doctrine to Greg Frost-Arnold is a kind of semantic foundationism because it posits basis statement, whose meaning is uncontroversally evident. He thus affirms that: "just as epistemic foundationlist holds that there are unjustified unjustifier that function as the ultimate source for all claims justification a semantic foundationalist hold that there are sentences and or terms that function as the altimate source of meaning for all sentences."[262]

The base of rational reconstruction is dual; notably the basic elements which are our subjective perceptions and the relationship of these elements. Every protocolising statement is therefore, either a property description or a relational description. Carnap affirms that: "a property description indicates the properties which the individual objects of a given domain have, while a relational description indicates the relation which holds between objects, but does not make any assertion about the object as an individual"[263] basic experience then determine the properties while relational description is restricted only at the formal level. That is, it is not a metaphysical but a formal relation of objects that render science to be possible. Relation description then is the base of all sciences for transformation or reduction of objects to one to one another depends on the relationship between these objects.

The problem that arises with methodological solipsism is that of subjectivity betraying scientific objectivity. Unlike Wittgenstein who left this problem unsolved, Carnap proceeds in the translation of statement from protocol language to physical language based on the similitude that

[261]Rudolf Carnap, "Testability and Meaning" in *Philosophy of Science*, vol. 3, no. 4, Chicago, Chicago University Press, 1936, pp. 419 – 471, p. 452.
[262]Greg Frost-Arnold, *Carnap, Taski and Quine at Harvard. Conversation On Logic, Mathematics and Science*, Chicago, Open Court, 2013, p. 127.
[263]Rudolf Carnap, *The Logical Structure of The World, and Pseadoproblems In Philosophy*, p. 19.

exist between protocol statements. Intersubjectivity which is characteristic of the language of physics then, is a form of objectivity.

The first sets of objects constructed using relational description are physical objects. Physical objects either are bodies that are spacio-temporally bound and are determined by categories such as space, size, shape, place and position or they also refer to qualities of sensory perception like colour, weight, temperature among others. From physical objects, he is able to construct psychological and cultural objects leading to a unifying system of all possible scientific objects. This is asserted by Jean-François Malherbe as he posits that: *« appliquant alors la procédure logique des définitions constructives, il montre que les objets les 'hétéro-psychologiques' peuvent être définis à partir des objets physiques et les objets 'culturels' à partir des hétéro-psychologiques.»*[264]

This triadic construction of objects is possible due to the similitude between them. For instance, physical and psychological objects can be determined within time. However, the determination of psychological objects; that is, all acts of human consciousness such as thoughts, feedings, willing, etc. is difficult given the fact that psychological objects do not exist by themselves and cannot be determined within space. However, expressive relations between gestures and psychological processes permit the determination of psychological objects. That is why Carnap holds that: "though voice, facial expressions, and other gestures, we can understand what goes on within a person."[265] As for the relationship of simitude between cultural and psychological objects in the fact that they are all bored by individuals of the same group. This constructive unification of objects leads to the unity of science since the interconnection of objects permits the reduction from one object to another. This is why the criteria of the unification of sciences to Carnap and Neurath is not based on the unification of laws but on the universal language of physics. Carnap consequently affirms that: "there is at present us unity of laws on the other hand, there is unity of the language in science viz common reduction basis for the terms of all branches of sciences."[266] This unity scientific language is guaranteed by the interconnection between objects and the transtability of protocol language to universal language of physics. The language of physics is then universal because its statements can be translated to one another. This

[264]Jean-François Malherbe, *op.cit*., p. 53. "Applying then the logical procedure of constructive definition, he demonstrates that hetero-psychological" objects can be constructed from physical objects and "cultural objects from the hetero-psychological"; (my trasnlation).
[265]Rudolf Carnap, *op.cit*, p. 33.
[266]Rudolf Carnap, "Logical Foundations of the Unity of Science" in *The International Encyclopedia Of Unified Science*, vol. 3, no. 1, O. Neurath ed., Chicago, Chicago University Press, 1938, pp. 42 – 62, p. 53.

universal language of physics comprises terms that are backed by observation and are confirmed when reduced to predicate.

The auto-psychological bases of the construction system are not constructed but are given. In his methodological solipsism, Carnap asserts that these psychological basis have no subject and are neutral. Notions like the "self", the "other" make meaning only when the construction has been completed. This is why Carnap affirms that, "Likewise, the characterization of the basic elements of our constructional system as "auto-psychological", that is as psychological and as "mine" become meaningful only in the domains of the non-psychological (to begin with the physical) and of the "you" have been constructed."[267]

In the question of how to attain objectivity in this construction, Carnap gives a dual connotation to objectivity. Firstly, "it could mean objectivity in contrast to arbitrariness"[268], where in the fact that knowledge does not depend one's subjectivity. Secondly, Carnap affirms that "by objectivity sometimes meant independence from the judging subject"[269] which in other words implies that word have the same signification to other knowing subjects. Carnap prefers inter-subjective criterion because it "distinguishes reality from dream and deception"[270] given the chaotic nature of experience, inter-subjectivity or possible due to the analogy of certain structural properties between the heterogeneity of experiences. Thus, objectivity is attained though relational description which facilitates the comparison between the multitude of experiences.

The construction of scientific systems is synthetic and not analytic because the general constructional for as an ascension form. The construction begins with the unanalysable unit of experience and construct classes of elements in an ascension order, until the whole system is generated. Carnap in this way asserts that,

> *on the first constructional level, classes of elements and relations between elements, on the second level, only (1) classes of such classes or classes of relations of the level and (2) relations between relations on the first level or relations between classes of the first level and elements.*[271]

If the construction of a scientific system is synthetic to Carnap, the testability of this system is analytical. Carnap rejects the correspondent criterion of verification on grounds that complete

[267]Rudolph Carnap, *The Logical Construction of the World*, p. 104.
[268]*Ibid.*, p. 106.
[269]*Idem.*
[270]*Idem.*
[271]*Ibid.*, p. 110.s

verification of a scientific system is impossible and it is also difficult to verify universal statements and laws of experimental science. That is why he affirms that: "we cannot verify the law but we can test it by testing single instances, that is, the particular sentences which we derive from the laws and from other sentences established previously."[272] In testing a theory then, we observe the state of affairs and if we have an increasing degree of positive instances, the theory is gradually confirmed and not verified. This confirmation does not exist in confronting theories with extra-linguistic entities but in examining sentences deduced from the statements under experimentations. These deduced statements are prediction, of future happenings whose indefinite nature makes it impossible for us to establish a complete and definite principle of verification.

Given the subjectivity involved in methodological solipsism, Carnap goes beyond observation to propose conventionalism because there is always a theoretical possibility of refuting and statement under observation. He therefore affirms that: "thus the acceptance and rejection of synthetic sentence always contains a conventional component."[273]

Carnap's theory of confirmation is a form of reductionism. This reduction consists in breaking down the content of experience into 'sufficient' and 'dispensable' parts. Factual or empirical content then is the first conclusion of meaning. That is, "The meaning of a statement lies in the fact that it expresses a state of affairs."[274] This criterion permits science to guard against the intrusion of pseudo statements into its system. This factual content is expressed by observational words. Unlike earlier positivists who reduced sense data into consciousness, Carnap insists that the language of science is reduced to the words of sense-data. These words of sense-data are predicates which serve as spacio-temporal referent. They constitute the base of confirmation by reduction. Consequently, "every word of the language is reduced to other words and finally to the words which occur in the so-called "observation sentences or protocol sentences. It is through this reduction that the word acquires its meaning."[275] The condition for the meaning of words in a sentence is the possibility of the sentence to reduce to protocol sentences. Given the fact that the class above the other in a constructed system includes the lower classes the confirmation of a system consists in the analysis from the higher class known to the unalaysable protocol statements. Carnap reiterates this as he asserts that: "If now a class C of sentences contains a finite sub-class C1 such that the sentence S is a consequence of C1, then if the sentences of C1 are found to be

[272]Rudolf Carnap, *Testatibility and Meaning*, p. 452.
[273]*Ibid.*, p. 454
[274]Rudolf Carnap, *The Logical Structure of The World*, p. 325.
[275]Rudolf Carnap, "The Elimination of Metaphysics though the Logical Analysis of Language", Trans. Arthur Pap., in *Erkennis*, vol. 2, no. 24, New York, Springer, 1932, pp. 60 – 81, p.72.

confirmed to a certain degree, S will be confirmed atleast the same degree. In this case, we speak of complete confirmation."[276]

Scientific language then is a calculus that is, a mechanism which permits the construction of sentences from others and the reduction of sentences to observation sentences to determine their meaning. With the interconnection between scientific objects, the connection between different classes of the construction system and the possibility of the translation of sentences to one another, Carnap envisages the possibility of a universal language for science and the possibility of the total elimination of metaphysics from science. It is in this physicalist language that the meaning of sentences is determined. Carl G. Hempel captures Carnap's physicalist thesis by affirming that it is theory "according to which a "thing-language", or more broadly the language of physics affords a unitary language for all empirical science in the sense that all scientific terms can be introduced on the basis of a physical vocabulary, by means of definition or of reduction of sentences."[277] Karl Popper who agrees with Carnap that testability is the criterion of meaning, will reject most of the basic tenets of Carnap's theory of meaning.

2.2.2. The Coherency Theory in Otto Neurath's Physicalist Approach and the Construction of a Unified Science.

In the first moment of the development of his thought, Neurath undermines the correspondence theory of meaning developed by Russell, Early Wittgenstein, Schlick and Ayer, on two grounds. Firstly, he asserts that such theory posits the existence of an extra-linguistic world; which to him is metaphysical and secondly it does not logically demonstrates how language can successfully represent the world. The scientific view of the world is not supposed to be fundamentalist in character; like in philosophy but it is suppose to be intandem with the spacio-temporal contexts of human existence. In other words, it has to be historical, sociological and pragmatical. That is why Otto Nearath affirms that the scientific world conception in specific in that:

> *It recognizes no 'worlds as a whole', it does not aim at comprehending a mighty world-picture in its totality, at a world-view. If one speaks of a scientific world – 'conception'*

[276]Rudolf Carnap, *Testability and Meaning*, pp. 459.
[277]Carl G. Hempel, "Rudolph Carnap, Logical Empiricist" in *Synthese*, vol. 3, nos. 3-4, Dordrecht, D. Reidel Publishing Company,1973, pp. 256 – 268, p. 263.

in contradistinction to a philosophical world – 'view', 'worlds is not an indicate a definite whole, but the daily growing sphere of science.[278]

Knowledge in a scientific world view is then constructed from sensation and their thinking is always a product of our space-time situation. Neurath in this way present the apparent divisions within the sciences as a product of the same scientific world conceptions which however differs in relation to the choice of object of study and space-time situation. That is why he asserts that, even though sciences cannot completely relinquish themselves from the germs of metaphysics, exactitude and precision can be attained if we give an encyclopedia connotation to science. He thus affirms that:

we have a science that deals with rocks, another that deals with plant, a third that deals with animals but we need a science that unites them ,all our knowledge is controlled by sight, hearing, tasting-our sense organs. In such consistent empiricism, psychology must concern itself with human behaviour just as mineralogy (together with chemistry, physics, etc.) is concerned with 'behaviour' of stones.[279]

The necessity to create a unified science to Otto Neurath has a dual connotation Firstly, it is negative because it aims at eliminating the senseless and metaphysics from science and secondly, it is positive because of the inter-disciplinary functions of different branches of science in the context of scientific predictions. No one department of science can successfully make a prediction using only it jargons and laws In scientific predictions such as "the fire in the forest will soon be out",[280] the results can only be successfully determined, if we males recourse to meteorological sentences that will record the weather conditions, botanical sentences to record the different plants and the forest, and also sociological and psychological sentences from observable behaviour of people in this context of scientific predictions. Neurath affirms that, "These must be capable of being combined with the others into a chain of inferences terminating in a sentence. Therefore, the fire in the forest will soon be out."[281]

The main aim of science then is, to predict. That is, "making predictions is what all of science is about."[282] This follows that statements of science are 'observation statements' out of what scientific laws are curved for predictions. He rejects Carnap's episodal conception of language, by proposing a monistic conception in which language has no pre-linguistic episode and language

[278]Otto Nearath, *Philosophical Papers 1913 – 1946*, Vienna Collection, vol. 16, D. Reidel Publishing Company, Dordrecht, 1983, p. 33.
[279]*Ibid*., p. 48.
[280]Otto Neurath, *United Science*, Vienna Collection Trans. Hans Kaal, Dordrecht, D. Reidal Publishing Company, 1987, p. 2.
[281]*Ibid*., p. 3.
[282]Otto Neurath, *op.cit*., p. 53.

does not need a meta-language for, "scientific language itself is a physical formation whose structure, as physical arrangement (ornament), can be discussed by means of the very same language without contradiction."[283] This follows that the correspondent theory defended by Wittgenstein and others is somewhat metaphysical and thus the best physicalist approach consist in the affirmation that: " statements are always compared with statements, certainly not with some 'reality' nor with 'thing' as the Vienna Circle also thought till now."[284] Neurath thus defends the coherency theory of truth which has the greatest merit of securing logical empiricism from the critique of induction. This is because we do not need to use particular statements to justify universal statements as what matters here is the logical coherency. He expresses this coherency theory of truth by affirming that:

> *If a statement is made, it is to be confronted with the totality of existing statements. If it agrees with them, it is joined to them; if it does not agree, it is called "untrue" and rejected, or the existing complex statements of science is modified so that the new statements can be incorporated. The latter decision is mostly taken with hesitation.*[285]

If statements of all sciences can be built into this coherent whole, then it will be possible to arrive at a law of the predictions of universal science. There are three conditions for a linguistic which is epitomized by observation statements, the special which is determined by where the change will take place and the temporal which determines the time of the change.

In a coherent encyclopedia model, the discourse on language is possible within language itself. This is contrary to Carnap who asserted that physicalism consists in translating statement from protocol to physicalist language. To Neurath, it is meaningless to make assertions of pre-linguistic techniques. That is why he affirmed that, "Carnap who has so far probably advanced the work of the Vienna Circle must towards empiricism, made an attempt to create a constructive system; in this, he distinguished two languages: a monolingising and an inter-subjective"; [286] firstly, Neurath's physicalism is not axiomatic like Carnap's and secondly, he gives a monistre linguistic framework in which there is only one language which transverses the whole human experience of science, which is the physicalist language.

There is no meta-language that can ascertain the precision of a physicalist language. Neurath affirms that: "statements are the beginning and end of science."[287] Scientists are thus makers of

[283] Otto Neurath, *Philosophical Papers 1913 – 1946, Vienna Collection,* p.53.
[284]*Idem.*
[285]*Idem.*
[286]*Ibid.*, p. 54.
[287]Otto Neurath, *Philosophical Papers,* p. 61.

statements and should not use extra-linguistic frames to judge the statements construed. Neurath thus reiterates that: "as makers of statements, we cannot so to speak, take up position outside the making of statements and then be prosecutor, defendant and judge at the same time."[288]

On the nature of protocol statements, Neurath insists that the protocolising statement is characterized by complexity and spacio-temporal determinations. However, he asserts that there are no special uncontroversial basic sentences which serve as check-points for other statements. Language at the starts is not essentially protocolar and protocol statements do not enjoy special semantic privileges for the evolution of scientific language by always been a mixture of precise and imprecise statements. Factual propositions at the start of science are both protocolar and non-protocolar. Protocol sentences should have space-time coordinates and linguistically, they should bear names of people. For instance, the statement, "Otto's protocol at 3:17pm was: Otto's verbalised thought at 3:16pm was: A man A-87 metres tall, who perceived Otto, was in the room at 3:15pm."[289] The statement above then records the protocol keeper and perceptual terms. The bases of science then are protocol sentences and non-protocol statements which have spacio-temporal expressions.

Given the imprecisions that characters both protocol and non-protocol statements, reductionism as advocated by Carnap is not the best approach to physicalism, this is because we cannot express the process of reduction to experience but it is possible to deserve sentences from the "observation sentences."

Neurath's approach is very pragmatic and sociological. This is because it is intandem with human development. It is the very logic of scientific progress which he describes as: "The process of change in science is like: statements that were used at a certain age drop out at a later age are often replaced by other statements."[290] When these statements are compared, they can be rectified through contradiction. The contradiction approach holds that when statements are compared, a system and they are contradictory to the system, they are replaced and if they do not contradict, then they are integrated.

[288]*Idem.*,
[289]Otto Neurath, *Unified Science*, p. 2.
[290]Otto Neurath, *Op.cit.*, p. 95.

The coherency theory of Otto Neurath then is anti-foundational because it permits the revision of both protocol and non-protocol sentences when rectification is necessary. That is why a Cameroonian philosopher, Malolo Disake affirms that:

> *« Ainsi, la prévisibilité des énoncés scientifique exclut la possibilité de confrontation avec se révèlent donc n'étant plus fonction que de leurs accord avec les autres énoncés de système s'il y a désaccord, l'hypothétisme offre l'alternative soit modifier l'énoncé à l'intégrer, soit de modifier certains parties des systèmes.»*[291]

The verification of statement is attained through the incorporation of statements into a coherent model. If these statements contradict the model, they are rejected and the greatest part of the system can be adjusted when they do not agree again.

The first problem Neurath attempts to solve from the coherent model is that of objectivity. Neurath mere proposes traditional objectivity. This traditional objectivity which is translated by the public and democratic character of the scientific method. That is why a commentator of Otto Neurath affirms that, "objective means something like detached, disinterested, unbiased, impersonal, not having a point of view."[292] In his own word, Neurath affirms that: "now either the protocol statement has to be replaced by another or the machine has to be reconstructed. Who reconstructs the machine, whose protocols statements are thrown in, is of no consequence at all; everybody can test his 'own' as well as 'others' protocol statements."[293] A unified science is not a system then but a flexible, public observable non-hierarchical. The history of epistemological reconstruction from Descartes to Kant is that of the erection of hierarchical or architectonic systems. This approach to knowledge is rejected by the unificatory logic of Neurath.

On the question of truth and falsity, Neurath insists that they are intra-linguistic. Neurath asserts that: "thus if a genuine sentence contradicts accepted genuine sentences and is sacrificed, we call it 'false' to ask for the further criterion of 'truth' makes no sense. There is no court of appeal outside the totality of the given."[294] In other words, a statement is false when it can no more be consistently integrated into the system and true when it is consistently adapted into the coherent

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[291] Emmanuel Malolo Disake, « Objecté et pureté le cercle de vienne et son opposition officielle » in *African Philosophical Review*, no. 2, Paris, Mâat, 2000, pp. 63-99, p. 70. "As such, the predictions of scientific statements excludes the possibility of confronting it with the real. The statement of science reveal themselves and are therefore function of their agreement with other statements of the system, when there is disagreement, the hypothetism offers the alternatives to either modify the statement to integrate or modify certain parts of the system"; *(*my translation*)*.

[292]A. Ibarra, T. Mormann, "Engaged Scientific Philosophy In The Vienna Circle: The Case Of Otto Neurath " *In Technology In Society*, vol. 25, no. 2, Amsterdam, Elsivier, 2003, pp. 235 – 247, p. 241.

[293]Otto Neurath, *Philosophical Papers*, p. 98.

[294]Otto Neurath, *Unified Science*, p.6.

system. This not the absolute theory of truth and meaning for what is considered as "reality statement" now can turn to "hallucination statements" when they cannot consistently integrate the consistent system. Truth and sense are equivalent and this also applies to falsity and senselessness.

The final problem Neurath answers in this physicalist thesis is that of the possibility of rendering psychology into physicalists expressions. Unlike Carnap who deprived the physcalist connotation from psychological states and processes Neurath's attempts a physical interpretation of it. The problem there is that of the possibility of the observation and carrying out successful predictions in the science of psychology. He approaches psychology from a strictly Marxist point of view. In drawing inspiration from the behaviourism of Watson, Neurath asserts that human behaviour can be predicted through conditioning. The physicalist approach to psychology then is behaviourism as he affirms that: "anyone who is concerned with the behaviour while employing the language of physicalism will be called a 'behaviouristician' an advocate of behaviourism on the other hand will be called a behaviourist."[295]

The great ambition of unified science then implies that the disparity between the various sciences can be overcome if; psychology is reduced to behaviourism, vitalism is removed from biology, if sociology is purified from transcendental metaphysics and if clergies are replaced by physicians.

2.3 THE PROBABILITY THEORY OF MEANING THROUGH INDUCTIVE INFERENCES

The third positivist orientation of the semantic criterion of scientificity is in the concept of probability. It is in the probabilistic theory of meaning that the logical positivist handles the problem of induction. This follows that the probability determination of theories is semantically symmetric with inductive logic. Most proponents of the probability conception of science hold that David Hume is the first to pose this question. According to Friedrich Waismann, the problem of induction is that of the attempt to give an account of the regularities between events. He thus affirms that, "we said E was called the effect of a cause C if in many cases, it was observed to follow C each time without exception."[296] The problem is that the reliability of this principle of causation. That is, will the effect always follow from the cause? What if the future contradicts the

[295]Otto Neurath, *Unified Science*, p. 23.
[296]Fridrich Waismann, *Causality and Positivism*, Dordrecht, Springer, Vienna Yearly Book 15, Dordrecht, Springer, 2011, p. 102.

regularity established between cause and effect? The problem of induction then incorporates probability because in an attempt to project the cause-effect connection of the present to the future, is a matter of probability. Even though the advocates of the correspondent and physicalists theory of meaning also attempted an answer to the problem of production, the philosopher that detailly treated the problem and developed the probability theory of meaning is Hans Reichenbach. This sub-chapter thus seeks to unveil Rechenbach's probabilistic orientation of logical positivism. What then are the major tenets of the probabilistic orientation of logical positivism?

2.3.1 Reichenbach's Critique of Meaning and the Defence of the Probability Theory of Meaning

Reichenbach's probability theory of meaning stems from his critique of the correspondent and physicalist conceptions of meaning. In fact, the proponents of the correspondent as well as the physicalist are synthetic on the view that meaning is conferred to a scientific theory by confronting basic statements to facts. In other words Hans Reichenbach rejects any possibility of ascertaining the meaning of scientific statements through verification.

The critique of verification as a principle of meaning begins with the analysis of experience into physical facts and impressions. Facts are furnished by observation and can be expressed in direct or indirect sentences. A direct sentence is that of an observable fact while the probability of indirect sentences depend on their relationship with direct sentences. A fact then must have space-time determination and constitutes the content of observation. That is why Reichenbach affirms that, a fact is, "a single event, occurring at a definite spactio-temporal point."[297]

While facts have objective existence to him, impressions have subjective existence. Reichenbach's conception of impression is the blend of Hume's view and Russell's view on sense-data. The subjectivity of impressions reside in the fact they are effects created in our minds by the physical world. Reichenbach in this way holds that: "impressions are phenomena according within my mind, but produced by physical things outside the mind."[298] The impression – fact distinction translates Reichenbach's realism and the defence of the existence of an external world.

Analyzing knowledge into factual and impressions, expressed in direct or indirect observation sentences poses the problem of establishing meaning through verification. While his

[297]Hans Reichenbach, *Experience and Prediction, An Analysis of The Foundations and Structure Of Knowledge*, Chicago, University of Chicago Press, 1938, p. 84.
[298]*Ibid*., p. 90.

predecessors assert that the meaning of observational sentences can be established through verification, Reichenbach's skepticism alienates verification from its semantic logical confidence. The question then is that of the verifiability of physical facts. According to Reichenbach, a physical fact cannot be verified because statements concerning these facts always have predictions. Reinchenbach illustrates this affirming that: "If we say, there was a table in my room, before my eyes, at 7:15pm; this contains the prediction; 'if I put a book on the table, it will not drop."[299] We may observe a fact but the prediction intrinsic therein, renders absolute verifiability to be difficult. Predictions that are implicit in observation statements are always about the future and given the uncertainty, observing a prediction in the future it becomes difficult to even establish the truthfulness of observation statements. This problem was not explicitly stated by the proponents of verification. The logical atomism that constitutes the base of verification assets an illucidatory isomorphism that exists between the unalysable basic statements and simple facts. The verificationist philosophers did not attribute the inevitable predictive character to basic statements of science. Any attempt to remove this predictive character so as to guarantee the possibility of verification, is illicit to Reichenbach because it makes scientific statements to loose their definite character.

The attribution of predictive character to observational statements to Reichenbach also assures the materially of the objects under observation, distinguishing them from dreams and illusions. Reichenbach thus affirms that: "the difference between the material object and the illusion cannot be otherwise formulated; it is only the consequences that is; the future observations which distinguish these two categories."[300] A statement: "this table exist", is not a prima facie, an observational statement. The table expressed in the statement could be in a dream or simply a product of a reflection by the mirror. The materially of the object expressed in the statement "assured by implications such as; "I can touch the table", "if I put a book on the table, it will not fall", among others.

It is the uncertainty involved in the verification of physical objects that influenced Reichenbach to propose the probability theory of meaning. In the probability theory of meaning, Reichenbach replaces the traditional value of truth with weight. Given the fact that our present observation of statements is controlled by future observation, that is of predictions, the acceptance

[299]Hans Reichenbach, *Experience and Prediction*, pp. 85 - 86.
[300]*Ibid.*, p. 86.

of present statements is not because of their truth but because of their weight. Reichenbach thus affirms that:

> *But, strictly speaking this is not a case of truth but of weight; even the observation sentences judged by the predicate of weight instead of predicate of truth. The probability theory of meaning, therefore is to be applied even to observation sentences of physics, or of daily life, of such sentences are to have meaning.*[301]

The probability value of Reichenbach is weight. Weight refers to the probability of obtaining the observations of a statement. Reichenbach develops a frequency interpretation of probability because to him; "The probability inference proceeds from a known frequency to an unknown."[302] Given that his frequency will be treated under the problem of induction in the next sub-chapter, our reflection here remains within the confines of the determination of meaning of scientific statements.

The second moment in Reichenbach's probability of truth is in his projective construction of the world, which is antithetical to the reductive construction of Rudolf Carnap. Carnap's reductionism in his rational reconstruction is to avoid the problems that arise in given meaning to scientific statements by confronting them to the world. Some of these problems, such as the metaphysical undertones of correspondence, the impossibility of developing a discourse on language and the impossibility to demonstrate how language practically reflect the world, influenced Carnap to reject the external world, insisting that science is scientific theories, are strictly language-bound. Reichenbach agrees that the physical objects can be reduced to immediate data. Carnap refers to the statements that carry this unanalysable data as protocol statements while Reichenbach's analysis proceeds from observational statements to statements of impressions.

The problem Reichenbach points in Carnapian reductionism is that its claim to truth. It is a somewhat truth theory of meaning because it posits that the relationship between the reductive complex and its elements is logical. That is reductionism claims that the reductive whole and the elements are equivalent. Reduction thus establishes equivalence between the concrete and the impressions. Reichienbach proceeds analogically to demonstrate that the complex and the elements are not logically equivalent. In the analogy of the constructed wall and the bricks, he observes that while the wall depends on the brick to exist, the converse is not true. That is, if blocks of bricks are destroyed, the wall ceases to exist but if the wall is destroyed, bricks will not stop existing. The non-existence of the elements thus implies the non-existence of the complex does

[301]Hans Reichenbach, *Experience and Prediction.*, p. 87.
[302]*Ibid*., p. 339.

not imply the non-existence of the elements. That is why Reichenbach affirms that: "There is consequently an asymmetry between the complex and its internal elements.[303]

Reichenbach changes the paradigm in which the complex is suppose to be made up of a disjunction of elements. In such a complex, "the propositions concerning the complex are equivalent to a disjunction of the propositions about the elements."[304] There is need then to give form to the elements, that is a constructive relation. It is not the ontological identities of the elements that guarantees the existence of the complex but their constitutive relation. Consequently, such relation is possible between elements that are given and not construction like in Rudolf Carnap. Consequently, physical objects are not construction but they have an objective and mind-independent existence. The relationship between the complex and elements is that of the relationship between physical things and impressions. Given that impressions are simply the way physical things strike the mind, Reichenbach replaces construction with projection as he affirms that: "this relation is thus a projection and not a reduction; the existence of external things is not reducible to the existence impressions; the external things have an independent existence. It is the same kind of independence that the birds have with their shadows."[305] Taking the analogy of the bird and the shadow, Reichenbach holds that the two do not imply each other. This is because natural processes are chaotic and thus we cannot foresee them with certainty; observing a shadow does not imply the bird because the latter can be destroyed and observing the bird does not necessarily imply the shadow. Therefore, the relationship between projective complex and its elements is that of probability. Reichenbach thus affirms that:

> *A projection is a co-ordination of propositions, by means of a probability connection, in such a way that one term or set of terms, called the 'complex', occurs only on one side of the co-ordination and another term or set of terms, called the 'external elements' occurs only on the other side of the coordination.*[306]

Giving logical meaning to science then is not tenable because in comparing the hypothesis bird, the projective complex and the shadow, the element, we do not say that their hypothesis are true or false but it is convenient to assert that the hypothesis of the bird has more weight to the hypothesis of the shadow. Since weight is the predicate of all observational statements, "we cannot say then, that we accept a theory of a physicist as meaningful because it has logical meaning. We accept it because it has physical probability meaning."[307] Logical meaning then is a deduction from

[303]Hans Reichenbach, *Experience and Prediction* , p. 106.
[304]*Idem.*
[305]*Ibid.*, p. 111.
[306]*Ibid.*, p. 110.
[307]*Ibid.*, p. 124.

absolute verifiability whose pertinence is betrayed by the uncertainty involved in the predictive character of scientific statements. Probability theory of meaning is the most tolerant because it allows the scientific activity to operate and project beyond the immediate world of observation.

Weight has a tradic schematisation that can be likened to the truth theory of meaning. When a hypothesis has higher weight, it corresponds to the truth, when it has lower weight, it corresponds to falsehood and when it is in-between or intermediary, it becomes indeterminate. Reichenbach thus concludes that: There is no Archimedian point of absolute certainty to which to attach our knowledge of the world; all we have is an elastic net of probability connections floating in an open space.[308] Since we cannot reduce the complex to elements and given we cannot certainly determine complex from elements, meaning thus is a matter of probability.

2.3.2 The Probability Approach to the Problem of Induction

The problem of induction that was posed by Hume has constituted the nerve-centre of every positivist theory of knowledge. The problem of induction is that of the logical attempt to justify the regularity between events. Friedrich Waismann gives a triadic formulation to this problem. He thus wonders:

> (*a) How do we come to transfer a connection between events observed in past to cases in the future which have not yet been observed? (b) What sort of validity can be chained for such generalisation? (c) Have we any right to generalize in this way? Can induction be justified?*[309]

The problem of induction arises from the instrumentalist approach to the question of the aim of science. While realism assert that the aim of science is to explain, instrumentalism argues that the role of science is to predict future events from the observation of the present cases. The future events which are expressed in general statements are infinite while the observed cases are fruite. The problem of induction is then an attempt to demonstrate how the fruite observed cases can guarantee the prediction of the infinite unobserved cases. David Hume posed the problem and however concluded that the claim that we can infer from event C called the cause to event E referred to as the effect is not logical but psychological. According to him, there is no necessity between the cause and effect as what creates such conclusions is the psychological act of

[308]Hans Reichenbach, *Experience and Prediction*, p. 192.
[309]Friedrich Waismann, *Causality and Positivism*, p. 102.

association. It is the habit of seeing one even occur after the other that the first is referred to as the cause while the second is referred to as the effect.

To unveil the logical positivist attempts to solve the problem of induction, it is incumbent to state the logical positivist justification of instrumentalism. The view that aim of science is to predict renders science to be practical, making positivism, a form of pragmatism. Heinrich Hertz justifies instrumentalism by affirming that: "the most direct and in a sense the most important problem which our conscious knowledge of nature should enable us solve is the anticipation of the future events, so that we may arrange our present affairs in accordance to such anticipation."[310] The most import feature of a scientific theory then is its practicality; that is science is a system of symbols and rules to predict the occurance of the futures unobserved events.

The central problem induction is then that of the justification of the scientific attempt to predict the future using the present. Given that predictions are expressed in general statements and due to the fact that they are infinite in nature, Waismann affirms that: "we may conclude from this factual statement, if it is general, has to two characteristic features: (a) It can never be proved (verified) completely by experience; (b) It can never be proved by logical reasoning alone."[311] This skepticism towards the scientificity of general statements that constitute prediction has been approached differently by different logical positivists. Ludvich Wittgenstein using the theory of the independence of facts asserted that the problem of induction is not a real scientific problem because general statements are not laws but simple tools for predictions. Consequently, general statement say nothing about the world which to him is not a system but a collection of independent facts. That is why he affirms that: "the so-called law of induction cannot be a logical law. For it is obviously a significant proposition and cannot be a law apriori either."[312] The general statements then like, all men are mortals is not a law but a significant statement that can be evaluated to be false. The truth of such general statements is attained through probability. That is, by making an infinite observation cases of mortal men today, we can conclude that, "all men are mortals." Such process of inferring the future from the present to Wittgenstein has but psychological and not logical basis. That is why in a Humean tone, he affirms that, "this process however, has no logical foundation but only a psychological one."[313]

[310]Heinrich Hertz, *The Principles of Mechanics in New Form*, Trans. D. E. Jones and J. Walley, London, Macmillan, 1899, p. 1.
[311] Friedrich Waismann, *op.cit.*, p. 105.
[312]Ludwig Wittgenstein quoted in, *Routledge Philosophy Guidebook To Wittgenstein and Tractatus*, prop. 6.363, p. 314.
[313]*Ibid*., p. 314.

Moritz Schlich does not consider general predictive statement of science as laws. According him general statement are simply a scheme that enable scientific prediction contains Moritz Schlich in the same way asserts that the laws of science do not exist in the world but a construction of man scientific laws are arbitrary for they are the functions of particular experiments. To him, it is when predictions corroborates that we talk of causality. Consequently, there is no apriori determination of cause-effect relationship and this also excludes necessity. That is why Schlick affirms that:

> *For the physicist as investigator of reality the only thing of importance, the only determining test, that which is the sole essential is that the equations derived from certain data also hold good for new data. Only if this is the case does he regard his formula as a natural law. In other words, the true criterion of regularity, the essential characteristic of causality is the realization of predictions is therefore the only criterion of causality.*[314]

The regularity then is assured by the formulae of successful predictions. Afred Jules Ayer's approach to the problem is agnostic in nature. To him, a problem is scientific, only if it is solved and the fact that the problem of induction has no solution implies that it is not a scientific problem. He reformulated the problem by affirming that: "the problem of induction is, roughly speaking, the problem of finding a way to prove that certain empirical generations which are derived from past experience will hold good also in the future."[315] He challenges the two famous approaches; one which purports for the uniformity of nature and the other which is grounded on independent limited variety. Each of these justifications to Ayer claims that the future will continue to resemble the present can not be justified on empirical bases. He consequently asserts that the problem of induction belongs to philosophy and not to science. Science to Ayer should preoccupy itself with its pragmatic objective, which is the need to control the environment as he affirms that, "we are entitled to have faith in our procedure just so long as it does the work which it is designed to do. That is, enables us to predict the future experience, and so to control the environment."[316] Even though it is not logically possible to assert that present successful predictions will hold same for the future, we should not ask for a guarantee where it is logically impossible. He redefines scientific rationality by asserting that; "for when we come to define 'rationality' we shall find that for us 'being rational' entails being guided in a particular fashion by past experience."[317] Justifying that the present regularity will hold same for the future cannot be done through experience and thus the problem of induction is not a problem of scientific rationality.

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[314] Friedrich Waismann, *op. cit.*, p. 193.
[315] Afred J. Ayer, *Language, Truth and Logic*, p. 34.
[316] *Ibid.*, p. 35.
[317] *Idem.*

Rudolf Carnap gives a probabilist solution to the problem of induction. According to him, the problem of induction can be resolved if we establish a tenable definition of logical probability. The solution to the problem of induction then is the proposal of the most adequate theory of observation statements which are those of probability. That is why he asserts that: "I believe that if it were possible to find a satisfactory definition of logical probability this could at last supply a clear rational basis for the controversial procedure of inductive inference. I therefore called the theory of logical probability, "inductive logic."[318] Probability to him is the degree of the confirmation of a theory. Since theories cannot be absolutely verified, then the scientificity of a theory is its degree of confirmation. When we make a statement like: "There is a white sheet of paper on a table"[319], its scientific status can be tested through a series of observations or experimental test. These testing examine statements deduced from the statement under experimentation. Given that such predictions are infinite, it is difficult to carry out the complete verification of the observation statement. That is why he asserts that, "therefore, no complete verification is possible but only a process of gradually increasing confirmation."[320]

Every inductive reasoning to Carnap is grounded on probability. Jean-François Malherbe reduces Carnap's conception of probability into the following words : *« Tout raisonnement inductif est un raisonnement en termes de probabilités et pas conséquent, la logique inductive s'identifie à la logique des probabilités. »*[321]

When a scientific hypothesis is stated, its acceptance depends on the degree of confirmation provided by the observational statements. Hypothesis have universal character and probability is judged from the empirical support that observation statement brings in favour of the universal statement. Inductive statements are thus probability statement and a probability statement is that which accords a degree of confirmation to the universal statement. Consequently, Carnap does not aim at offering a universally acceptable principle of induction but he instead attempts to justify the procedure involved in the predictive and confirmative role to science. Given that every inductive reasoning is probability reasoning, then it is scientifically unsound to ask for a necessary universal principle that undercuts inductive reasoning. Carnap thus gives a logical interpretation of probability to show how inductive influences proceed.

[318]Rudolf Carnap, *Intellectual Auto-Biography In The Philosophy of Carnap*, ed., Paul Aurthur, Peru, Public Court Publishing Company, 1963, p. 71.
[319]Rudolf Carna, *Testibility and Meaning*, p. 555.
[320] *Idem*.
[321] Jean-Francois Malherbe, *op.cit.*, p. 80. "Every inductive reasoning is reasoning in terms of probabilities and consequently, inductive reasoning identities itself with the logic of probabilities;" (my translation).

Another logical positivist who scientifically undermines the problem of induction is Otto Nearath. Even though he asserts that "making predictions is what all science is about"[322], he at the same time holds that: "induction that leads to laws is a matter of decision, it cannot be deduced of the attempt to give 'induction' a logical foundation is therefore bound to fail."[323] This is not a contradiction when circumscribed with Otto Nearath's physicalist construction of a universal language for all sciences. The unity of science is not the unity of laws but the unity of statements. These therefore, to carry out a successful prediction, there is need for the consideration of the respective laws of the departmental sciences that intervenes in the context of justification. The principle of induction then should not be logical but a conventional schema of scientists. This is what Friedrich Stadler refers to as social probability when he asserts that: "therefore, if we are to obtain a reconstruction or philosophical analysis of scientific method based on probability, the probability assignment must be interpersonal or consensual one rooted in the social reality of the scientific collective."[324]

Otto Neurath's social probability thus claims that there is no ideal reference for scientific predictions. Social probability consists in combining the probabilities of each member of the scientific society. This follows that it is not the aim of scientific rationality to find an ideal principle of induction.

Reichenbach's probability approach to the problem of induction begins with the justification of instrumentalism; that is the predictive role of science. That is why he affirms that: "the passive man might sit and wait for what will happen. The active man who wants to determine his own future, to ensure his food, and his dwelling, and the life of his will, is obliged to be a gambler because logic offers him no better way to deal with the future."[325] The uncertainty involved in predicting the future from the present should not make scientists to decline from prediction. This is because the latter translates the pragmatic nature of science. Predictions permits science to have impact on humanity. The problem of induction to him is then intrinsic in the theory of probability. He thus affirms that: "the theory of probability involves the problem of induction and the solution of the problem of probability cannot be given without an answer to the question of induction."[326] Reinchenbach develops a frequency interpretation of probability and induction. In the frequency

[322]Otto Nearath, *Philosophical Papers*, p. 53.
[323]*Idem*.
[324]Friedrich Stadler, *Scientific Philosophy: Organisation and Developments*, Dordrecht, Springer, 1993, p. 150.
[325]Hans Reinchenbach, *Experience And Predictions*, p. 316.
[326]Hans Reinchenbach, *Experience and Predictions,* p. 339.

interpretation, probability does not hold between propositions as in Carnap's logical approach but it holds between events. Thus, the statements involved express events.

The frequency interpretation of probability is obtained by dividing the number of instances an event takes place with the number of expected opportunities of its occurrence. The frequency approach to the problem of induction asserts that: "the probability inference proceeds from a known frequency to an unknown."[327] That is, after observing the frequency of occurrence of an event, we can predict the rate of frequency when more observations are carried out. According to him, "the aim of induction is to find series of events whose frequency of occurrence conveys towards a limit."[328] This limit can not be determined with exactitude given the chaotic nature of nature. However, the approximate of this limit to Reichenbach is the goal of inductive inferences. The rule of induction to him is a pragmatic and not a logical one. This is because it instead offers a sufficient reason why inductive inferences should be carried out. The frequencies of the occurrence of events may not converge at a limit, but the search for this limit, is a sufficient reason for predictions. Analogically, he illustrates his claim by affirming that:

> *We may compare our situation wants to fish in an unexplored part of the sea. There is no one to tell him whether or not there are fish in this place. Shall he cast his net? Well, if he wants to fish in that place, I should advise him to cast the net to take the chance at least. It is preferable to try even in uncertainty than not to try and be certain of getting nothing.*[329]

Probability thus has no logical law but there is a pragmatic rule, which is, the search for the approximation towards a limit of frequency. The limiting relative frequency here, refers to a fixed, that can be attained by a portion of experiments in a context of the increasing length of a series of trails. Such fixed value is not attainable in such a chaotic nature. Thus, probability should be practiced not because of the reason for its logical justification for the pragmatic justifications.

From the above, it is clear that the different logical positionists are in accord with the fact that, there is not rational principle of induction. Such principle cannot be established using induction. They however assert that, inductive influences have meaning within the context of probability. The great challenges of induction is that of justification. To make this probability theory of meaning tenable, Reichendach undertake the attempt to state the role of induction and its justification. He argues that, "it must be realized that there is no other method for epistemology

[327] *Idem*.
[328] *Ibid*., p. 350.
[329] *Ibid*., pp. 362 – 363.

than to discover the principles actually employed in knowledge."[330] He prefers the inductive approach to the deductive method. Reichenbach insists that: "the method is inductive insofar as it is tied to the actual empirical data."[331] The inductive method is then the logical vector of empirical science and empirical knowledge. It thus grounds theories of knowledge that are factual and informative. This is not the case with the deductive method in which the conclusion drawn from premises add nothing new to our knowledge. He taxes the deductive method for its emptiness as he asserts that: "the value of deduction is grounded in its emptiness. For the very reason that deduction does not add anything to the premises, it may be applied without a risk of leading to a failure."[332] This critique of deduction by Reichenbach is similar to Kant's critique of the apriori knowledge of dogmatic metaphysicians of rationalism. Reichenbach thinks that we cannot count on deduction in our attempt to develop a scientific theory of his critique on deduction by asserting that: "they state nothing about the physical world. They are rules for our description of the world but do not contribute to the content of the description; they determine only its form, that, is, the language of our description."[333]

With the critique of deduction, Reichenbach then engages into the determination of inductive logic and how to solve the problem of induction using probability logic. Reichenbach begins by going beyond David Hume to differentiate between causal laws of classical empiricism and probability laws of modern empiricism. The causal laws permit scientists to "understand a relation of the form if – then, without the addition that the same relation holds at all times."[334] Causal laws then are difference from coincidence or from laws of chance. While causal laws permit the repetition of occurrences, this is not the case with coincidence and chance. He accepts Hume's contention that laws of nature are simply exception less statements of repetitions. However, this does not apply to the laws of statistics that constitute modern science. The statical laws have succeeded to explain the thermic processes in the light of irreversibility. For instance,

> *Everybody knows that heat flows from the hotter body to the colder one, and not vice versa. When we throw a cube into a glass of water, the water becomes colder, its heat*

[330] Hans Reichenbach, *The Theory of Relativity and a prioiri Knowledge*, Los Angeles, University of California Press, 1965, p. 75.
[331] *Idem*.
[332] Hans Reichendbach, *The Rise of Scientific Philosophy*, Los Angeles, University of California Press, 1968, pp. 37-38.
[333] Ibid, p. 38.
[334] *Ibid*, p. 157.

wandering into the ice and dissolving it. This fact cannot be derived from the law of the conservation of energy.[335]

The law of the conservation of energy is the first law of thermodynamics. This law states that energy can neither be created nor destroyed for it can only be converted from one form to another. This implies that unless energy is added from outside, a thermic system always has the same quantity of energy. Thus from the example above, it can be explained by the law of irreversibility which to Reichenbach is based on statistical regularity. Thus quantum physics and a greater part of modern physics are based on probability laws and not causal laws. For instance, the indeterminacy law of Heisenberg. Thus, Reichenbach differentiate between causal and probability laws in the following terms: "causality was to be formulated as a law of exceptionless generality, as and if – then always relations. Probability laws care laws that have exceptions, but exceptions that occur in a regular percentage of instances."[336]

Causal laws in the understanding of the problem of induction to Reichenbach should be considered as ideals. It is thus difficult to realize scientific determinism or predictions in macrophysics without recourse to probability. For instance:

When a physicist calculate the trajectory of a bullet fired by a gun, he figures it out in terms of some major factors, such as the powder charge and the inclination of the barrel; but because he cannot take into account all the minor factors like the direction of the wind and moisture of the air, his calculation is limited in its exactness.[337]

With the influences of powder charges, the inclination of the barrel, the intervention of the moisture and the fluctuation of the direction of the wind, the scientist can only predict the point to be hit by a bullet on grounds of probability. In this light, Reichenbach thinks that even in causal systems, it is difficult to carryout an exhaustive descriptin. Thus, the problem of induction should not be understood in causal terms as Hume did but in terms of probability.

Reichenbach then orientates the inductive method to the domain of probability. However, most philosophers of science like Karl Popper hold that in the context of discovery, we use the hypothe-teco-deductive method to discover new theories. Thus, Popper replaces the inductive method of learning with his trial and error elimination method. On the contrary, Reichenbach rejects this approach because to him, "the inductive inference is employed not for finding a theory, but for justifying it in terms of observational character."[338] Thus, it is illicit to criticize the method

[335] Hans Reichendbach, *The Rise of Scientific Philosophy,* p. 159.
[336] *Ibid*, p. 164.
[337] *Idem*.
[338] *Han*s Reichendbach, *The Rise of Scientific Philosophy,* p.164.

of induction by situating it in the context of discovery because lotic to him deals with the justification and not the invention of theories. He therefor insists that: "the study of inductive logic for these reasons, leads into the theory of probability. The inductive conclusion is made probable, not certain, by its premises, the inductive inferences must be conceived as operation belonging in the framework of the calculus probability."[339]

Given that the strength of induction over deduction is its informative and predictive strength. If induction is necessarily probabilistic, then how informative and predictive is probability logic? To Reichenbach, when a coin is tossed, and we state that the probability of heads to turn up is equivalent to one-half, we are not making an empty statement but we are making a claim about the future. Given that inductive logic is essentially probabilistic than what is the probability law of induction and how can we justify it?

It is evident that Hume's critique of induction is restricted to causality. He argues that there is no necessary connection between the effect and the cause. However, after changing the form of induction from that of causality to that of probability, Reichenbach holds that habit that Hume considers as psychological and not logical is a powerful and useful in inductive logic. He holds that: "perhaps the inductive inference is a habit – the logician wants to know whether it is a good habit."[340] What then is the law of induction? The law of induction to Reichenbach is a rule of derivation. The rule of induction to him is, "a directive for the construction of sentences. I have therefor called a rule of derivation."[341] The rule of derivation indicates how we can move from already verified statements to predictive ones. In deduction, the rule of derivation is justified by the transfer of the truth from the premises to the conclusion as Karl Popper argues, but how does it work with probability? To Reichenbach, we can inductively justify the rule of derivation in the frequency interpretation of probability. To him, "with the interpretation of probability statements, as posits, makes possible to give a justification of the rule of induction."[342] Classical induction makes inference that can be applied to every individuals of a series while the statistical makes generalization by attempting to predict the whole sequence. This distinction is expressed by Reichenbach as he holds that:

> *The classical conception entails the question whether the rule of induction leads to true conclusions, but the statistical version deals only with the question whether the rule of*

[339] *Ibid*., p. 233.
[340] Hans Reichenbach, *The Theory of Probability, An Inquiry Into The Logical and Mathematical Foundations of The Calculus of Probability*, trans. Ernest, Los Angeles, University of California Press, 1949, p. 470.
[341] *Ibid*, p. 471.
[342] *Ibid*.

induction leads to a method of approximation, whether it leads to posits that, when repeated, approach the correct step.[343]

Reichenbach proposes that we use posit and not statement in the frequency approach to solving the problem of induction. A posit is a statement about a probability. Event that we do not know the sequence in which it is found. Thus, event hough the truth -value of a posit is unknown, we treat them as being true. Given that probability assertions are about infinite series, the aim of making predictions is to situate the limit of such a series. Reichenbach thus holds that: "if a limit of the persistence of the frequency is justified because this method, applies repeatedly, must finally lead to a true statement."[344] The limiting relative frequency refers to the fraction of the frequent experiments which when gotten form an increasing length of a series of trials, in which a fixed value is approached from the occurrence of a given event. Thus, without this limit of frequency, it will be difficult to apply the method of approximation.

Classical induction treated the problem of induction from the principle of the uniformity of nature. Without such uniformity, they hold that prediction is impossible. Reichenbach however thinks that the limitation of frequency is synonymous to the principle of the uniformity of nature. Thus justifying the rule of derivation implies that when the limitation of frequency is determined, it is possible to obtain true statements.

[343] Hans Reichenbach, *The Theory of Probability*, p.471.
[344] *Ibid.*, p. 472.

CHAPTER THREE

THE LOGICAL POSITIVISTS' REJECTION OF METAPHYSICS

Logical analysis, lead to a positive and to the negative result […]. In the domain of metaphysics including all philosophy of value and normative theory, logical analysis yields the negative result that the alleged statements in this domain are entirely meaningless.[345]

3.1 THE LOGICAL POSITIVISTS' DUAL DEFINITION OF METAPHYSICS: AS ATTITUDE AND AS THE CONCEPTION OF THE REAL

This sub-chapter is an answer to the question, what do logical positivists mean when they talk of metaphysics. The sub-chapter thus focuses on the two fundamental approaches of metaphysics, notably: as the attitude and as the conception of the real. The definition of metaphysics as attitude consists in presenting metaphysics as a natural and an unavoidable attitude that erroneously pushes man to go from the physical to the transcendent world. This is an emotive or psychological definition of metaphysics. The second definition of metaphysics as a conception of the real consists in the justification of an extra-linguistic and transcendent realitt that. The aim of criticizing the second approach is to show the scientific sterility of the realism –idealism debate on the nature of the real.

3.1.1. The Emotive and Unscientific Origin of the Metaphysical Attitude

This definition of metaphysics was formulated by Carnap, Ayer and Moritz Schlik. According to them, metaphysics as an attitude does not have a scientific or rational origin. Immanuel Kant also affirmed that reason has a tendency of illicitly going beyond the phenomenal, leading to antinomies or self-contradictions. The logical positivist on their part attempted to make psychological justice to the wide history of metaphysics by attributing its origin to the inevitable attempt by man to express his attitude or feeling towards life.

Rudolf Carnap asserts that the metaphysical impulse originates from the attempt by man to express his attitude towards life. He thus affirms that:

The (pseudo) statements of metaphysics do not serve for the description of state of affairs neither existing ones (in that case there would be true statements) nor non-existing ones

[345] Rudolf Carnap, "The Elimination of MetaphysicsThrough Logical Analysis Of Language", pp. 60-61.

> *(in that case there would be at least a false statement). They serve for the expression of an attitude towards life.*[346]

There is no experience that can be envisaged as a possible context to either confirm or negate metaphysical statements. Thus, such statements do not originate from the empirical world or science. To Carnap, such statements have mythical origin in explanatory systems like animism and polytheism. This is somewhat similar to August Comte's evolution of scientific mind. However, the mind of science to Carnap cannot be subjected into such phenomenology as it is constructed from experience. Thus, he gives an emotive origin to the metaphysical impulse which to him, essentially consists in "the personification of natural phenomena which are quassi-poetic expressions of man's emotional relationship to his environment."[347] Poetry here, is the inevitable production of myths by man while theology is the systematization of myths. The impatience to inculcate the scientific culture then pushes man to give human and divine qualities to natural phenomena. Besides, the impatience to use the scientific culture man adopts the metaphysical attitude to account for his existential quagmires. It is in this respect, that Carnap affirms that:

> *We find that metaphysics also arises from the need to give expression to man's attitude in life, his emotional and volitional reaction to the environment, to the society, to the task to which he devotes himself to the misfortunes that befall him. This attitude manifest itself unconsciously as a rule in everything a man does or says.*[348]

Given that the metaphysical attitude of expressing one's emotion is unconscious and avoidable, Carnap justifies why we have a wide range of metaphysical systems, develop by philosophers whose impatience to practice science has pushed them into such pseudo-systems. To avoid this inevitable attitude, Carnap instead advises those who are not patient to practice science, to express their attitudes to arts; which is adequate than expressing it in metaphysical theories that are inadequate. Musich is apparently the best form of such artistic expression because it does not make reference to objects. Carnap thus privileges music over metaphysics ss he affirms that: "metaphysicians are musicians without musical ability."[349] This is because metaphysicians attempt to express a feeling but instead make claims to theories, concepts and systems that do not offer knowledge.

Rudolf Carnap thus valorises arts poetry and music, presenting them as the adequate alternatives for the metaphysical inadequate expression of attitude. This justifies his admiration

[346]*Rudolf Carnap*, "The Elimination of MetaphysicsThrough Logical Analysis of Language", pp. 60-61
[347]*Idem.*
[348]*Idem.*
[349]*Idem.*

for Nietzsche who to Carnap, orientated his metaphysical attitude into poetry. That is why he affirms that:

> *Our conjecture that metaphysics is a substitute albeit an inadequate one for art seems to be further confirmed by the fact that the metaphysician who perhaps had artistic talent to the highest degree, viz-Nietzsche almost entirely avoided the error of that confusion. A large part of his work has predominantly empirical content in the works, however, in which he expresses most strongly that which others express through metaphysics or ethics, in thus spakes Zarathustra, he does not choose the misleading theoretical form, but openly the form of art, of poetry.*[350]

Moritz Schlick in the same way asserts that the use of metaphysical words such as "the absolute reality ", "the transcendent Being" have psychological and not scientific motivations. The aim of using such words strictly is to express one's feeling consequently, metaphysical statements evoke feelings and not state affairs. He thus affirms that: "the fact of the matter is, that employment of the words 'independent existence', "transcendent reality, and so on, is simply and solely the expression of a feeling, a psychological attitude of a speaker."[351]

A. J. Ayer, has the same account for the origin of the metaphysical impulse. Metaphysics to him originated in the human attempt to express his feeling about the world. He thus affirms that: "metaphysics results when men attempt to extrapolate their emotions: They wish to present them not as feelings of their own but somehow objectively as facts.[352] Such is an illicit way of approaching the world which renders metaphysics to be an inadequate way of expression. Unlike Carnap who prefers the poetic to the metaphysical orientation of the expression of one's feeling. Ayer identifies metaphysicians to poets as the affirms that: "we need not go to the length of saying that all the great men who have written books of metaphysics are poets who have chosen what seem to us an unsuitable medium of expression.[353]

Ayer equally affirms that metaphysics also originates from the need to unify knowledge by giving a unique identity to a progeneity of experience or appearances. This is the source of the metaphysical notion of substance. He thus affirms that:

> *Logical analysis shows that what makes these 'appearances' the 'appearances of' the same thing is not their relationship to an entity other than themselves, but their*

[350]Rudolf Carnap, "The Elimination of MetaphysicsThrough Logical Analysis of Language*",* p. 60-61.
[351] Moritz Schlick, *Positivism and Realism*, p. 42.
[352]Alfred Jules Ayer, "Demonstration of The Impossibility of Metaphysics", in The *Mind*, vol. 1, no. 2, New York, Oxford University Press, pp. 335 – 345, p. 340.
[353]*Idem.*

relationship to one another. The metaphysician fails to see this because he is misled by a superficial grammatical feature of his language.[354]

From the above presentation of the emotive origin of metaphysics, the logical positivists proceeded to give a transcendent definition of metaphysics, taxing such approach for lack of scientificity. Carnap gives a transcendent definition to metaphysics by asserting that "this term is used as usually in Europe, for the field of knowledge of the essence of things which transcends the realm of empirically founded, inductive science. Metaphysics in this sense includes systems like those of Fichte, Schellinhg, Hegel, Bergson, Heidegger."[355] Carnap thus identifies the transcendental approach to metaphysics to the subjective idealism of Fichte, the objective idealism of Schelling, the absolute idealism of Hegel, the spiritualism of Bergson and the phenomenology of Heidegger. A. J. Ayer, has the same definition of metaphysics as he asserts that: "I define a metaphysical enquiry as an enquiry into the nature of the reality underlying or transcending the phenomena which the species sciences are content to study."[356]

This is the same definition accorded to metaphysics by Moritz Schlick. He thus affirms that: "as has mostly been done from time immemorial, we assert that metaphysics is the doctrine of 'true being', of 'reality in itself' or of transcendent being."[357]

According to A. J. Ayer, the best method of showing how scientifically sterile the transcendent approach is, is to show how bogus the question of the reality underlying the world is. Thus, by showing how nonsensical the expression of the transcendent reality is, Ayer hopes to demonstrate the impossibility of the whole of metaphysics. Given that testability is the criterion of meaning, metaphysical expressions expression of the reality beyond the phenomenal are nonsensical. That is why he affirms that: "for if it is the aim of metaphysics to describe the reality lying beyond experience, and therefore any proposition which could be verified by empirical observation is ipso facto not metaphysical."[358]

Scientific hypothesis to Carnap are not metaphysical, though they have a general character. The difference is that while general statements, that is, laws exhibit the possibility of verification, this is not the case with metaphysics. He thus rounds up his critique of the transcendent by asserting

[354]A.lfred Jules Ayer, *Language, Truth and Logic,* p. 25.
[355]Rudolf Carnap, *op.cit.*, p. 343.
[356]Alfred Jules Ayer, *op.cit.*, p. 25.
[357]Moritz Schlick, *"*Positivism and Realism*"*, p. 41.
[358]Alfred Jules, "A Demonstration of The Impossibility of Metaphysics", p. 341.

that: “So the conclusion is not that metaphysical assertions are uncertain or arbitrary or even false but that they are nonsensical.”[359]

Unlike Ayer, who asserts the nonsensicality of statements about the transcendent, Schlick instead argues that the question of the reality that underlies the phenomenal world should not be posed at all, in a scientific context. While Ayer attacked statements about the transcendent reality, Mortitz Schlick instead attacks the question about this reality. According to Schlick, to question whether there is a real transcendent being is to imply that “ a non-true, lesser or apparent being stands opposed to it, as has indeed been assumed by all metaphysicians since the days of Plato and the Eleatics.”[360]

This attempt to go beyond experience then leads to the dualism of Being which is the reality and the seeming being which is appearances. If we proceed by this illicit metaphysical dualism, it will imply that scientific knowledge is knowledge of the seemingly being and it is false and also inferior to metaphysical knowledge. Schlock criticizes the question of the transcendent reality because we cannot successfully state the circumstances under which it can be resolved affirmatively or negatively. He thus affirms that:

> *To talk of metaphysical external world is meaningless does not say ‘there is no metaphysical external world’, but something too different. The empiricist does not say to the metaphysician: ‘Your words assert something false’ but ‘your words asserts nothing at all’. He does not contradict the metaphysician but say, ‘I do not understand you. ’*[361]

Consequently, the question of the true transcendent Reality of metaphysics is bogus and does not merit a place in science. It should not be posed by scientists because we cannot establish state of affairs under which the question can either be negated or affirmed.

3.1.2. The Critique of Realism and the Rejection of the Reality of the External World

Anti-realism is one of the logical positivist anti-metaphysical orientations. According to the *Oxford Dictionary Of Philosophy*, realism is a theoretical position which holds that: “a sub-matter S may hold (i) that he kinds of things described by S exists; (ii) that their existence is independent of us, or not an artifact of our minds, or our language or conceptual scheme.”[362] Realism then posits the existence of a mind and language – independent reality whose conception does not

[359]*Alfred Jules*, “A Demonstration of the Impossibility of Metaphysics*”*, p. 341.
[360] Moritz Schlick, *op.cit*., pp. 39.
[361]*Idem*.
[362]Simon Blackburn, *Oxford Dictionary of Philosophy*, p. 308.

depend on both the categories of the knowing subject and those of language.[363] This in other words is the problem of the existence of the external world.

The problem of the reality of the external world has received a problematic solution by the empirical realist defenders of logical positivism. By empirical realism, they imply that verification is possible only if there exist a language -independent state-of-affairs. This is evident in the correspondence theory of meaning, where facts are presented either as relation between objects or properties. In most cases, like in Frege, Wittgenstein, and Russell, words denoting objects have meaning only in statements. This does not answer the question of the reality of objects sine what is intelligible about the latter is only the expression of their relation and properties.

In the theory of logical atomism, Wittgenstein affirms that the existence of objects as substances of world is the necessary condition for the formation of picture of the world. He objects to him are simple as he holds that: "objects form the substance of the world. Therefore, they cannot be compound."[364] Such their object cannot be known and it is their relationship that creates states of affairs. That is why he holds that: "in a state of affairs objects fit into one another like the link of a chain."[365] Thus, what we can express in scientific language is the relation between objects. This view of early Wittgenstein is defended by early Russell.

Moritz Schlick rejects the identification of the external world to the relation between objects in his thesis of empirical realism. That is why he argues that: "The statement the dollar in my pocket' is round has totally different logical form from the statement 'the dollar in my pocket is actual."[366] To Schlick, existence is not a property and what logical empiricisit should verify while making statements are actual physical states and occurrences. The external world to Schlick is nothing other than nature, characterised by actual physical objects. To reject the existence of such a world to him is to render logical empiricism to be logically absurd, for it carries the implicit impossibility of verification. That is why he affirms that: "in contrast to the internal world' which covers memories, thought, dreams wishes and feelings, the 'external world', "means nothing else here but the world of mountains and tress, houses, animals and men."[367] The empirical realism of Schlick then is the affirmation of a mind-independent physical world that can be expressed in

[363]This should be differentiated from realism in the problem of the aim of science. The aim of science to epistemologically grounded realism is to explain this mind -independent realism. This view has been dealt with, in the probabilitt theory meaning where the logical positivist defends instrumentalism.
[364] Ludwig Wittgensteinn, *Tractatus,* prop. 2.021, p. 7.
[365]*Ibid*., prop. 2. 03, p. 9.
[366]Moritz Schlick, "Positivism and Realism", p. 46.
[367]*Idem.*

scientific statements. Such realism is not synonymous to the metaphysical realism, whose mind independent reality is transcendent. The role of empirical realism is to give the empirical interpretation of the reality of the external world. Schlock thus conclude that: "logical positivism and realism are therefore not opposed, anyone who acknowledge our principle must actually be an empirical realist."[368]

Bertrand Russell criticised empirical realism, proposing the neutral monism, that he derived from Ernest Mach's psychophysics. Given that the self is a bundle of data, Russell identifies two problems with empirical realism. Firstly, how does the self as a bundle know another external data? And how can we prove the subsistence of physical objects after observations? He answered the first question using his theories of acquaintance and description. However, the second problem persists because we cannot be certain whether physical objects that Schlick purports in empirical realism, continue to exist after observation. This controversy made Russell to abandon acquaintance and adopted the neutral monism of Ernest March, where there is the elimination of the disjunction between the mental and the physical events. Objects of science then are logical fictions which he refers to as constituants. The physical world of Schlick then is simply systems of classes and thus the product of logical construction. The variation between appearances and the fleeing sense-data is due to the fact that these appearances constitute different classes. In this way, Russell identifies man to a string of experiences as he asserts that:

> *Therefore we shall say that a person is a certain series of experiences, we shall not deny the metaphysical ego. We shall merely say that it is a question that does not concern us in any way because it is a matter about which we know nothing and can know nothing and therefore, cannot be a thing that comes to science in anyway."*[369]

Given that what we can know of the external world is sense-data, Russell proposes the logical re-construction of the world from sense-data. This is the project that is elaborated by Rudolf Carnap leading to that rejection of language -independent world and a complete denial of realism as a scientific position.

The aim of science to Carnap is to describe the property or relation of objects. Such description says nothing about the essence of the object or their reality. He thus affirms that: "a property description indicates the properties which the individual objects of the given domain have, while relation description indicates a relation which holds between these objects, but does

[368]Moritz Schlick, "Positivism and Realism ", p. 46.
[369]Betrand Russelll, *The Philosophy of Logical Atomism*, p. 120.

not make any assertion about the objects as individuals."[370] Thus, the problem of science is that of the relation between objects and not the problem of the essence of objects. The attempt to avoid the intrusion of the notion of essence and thus the notion of thing-in-itself by Russell, meets difficulties in his constructional system. Carnap avoids this, by distinguishing between the constructional essence and the metaphysical essen: As concerns the constructional essence, he affirms that the: "we wish to know the constructional context of this object within the system, especially how this object can be derived from the basic objects."[371] The constructional essence is thus linguistically bound and logically determined. The metaphysical essence on the other hand is an answer to the question of being in itself.[372] It is the constructional essence of the object that determines the truthfulness or the falsity of the statements that bears the object. That is why he affirms that: "we can make an unambiguous assessment of the truth or falsity of a sentence, not of the nomination of a sign, not even of an object sign."[373]

Carnap's critique of the metaphysical thing-in-itself, independent of the mind and language also tackles the mind-body dualism. Unlike Russell who proposed neutral monism, Carnap's rational reconstruction is a kind of pluralism. The body-mind problem to him is the problem of the relationship between the physical and the psychological objects. The problem to him is a narrow one because it reduces object types into two, the physical and the metaphysical. Contrary to this narrow view, Carnap presents other objects types like the cultural, the biological, which have independent status. He presents the self as the highest level of the construction of heteropsychological types. He is against the pure ego of metaphysicians and affirms that: "the self is a class of elementary experience."[374] The self is not an ego then for it does not proceed basic experience as it "is constructed only later."[375] It is then logically improper to assert that "I experience" because there is no scientific "I" that is a priori to experience. Carnap thus affirms that: "the more fitting expression than, "I experience" would be "experience" or still better, "this experience."[376] At this point, Carnap proposes a change of paradigm from the Cartesian *Corgito* as he concludes that: "thus we ought to replace the Cartesian dictum by "this experience, therefore

[370]Rudolf Carnap, *The Logical Construction of The World*, p. 19.
[371]*Ibid.*, p. 256.
[372]*Idem.*
[373]*Ibid.*, pp. 256 – 257.
[374]*Ibid.*, p. 260.
[375]*Ibid.*, p. 261.
[376]*Idem.*

this experience is."[377] This critique of the body-mind dualism, rejects the existence of the internal – external world's distinction.

On the realism-idealism debate, Rudolf Carnap affirms, that such debate does not belong to the scientific domain. He disqualifies realism from scientific rationality as he affirms that: "the concept of realty (in the sense independence from the cognising consciousness) does not belong within (rational) science, but within metaphysics."[378] The problem of science on the other hand seeks to find out if the concept of the reality to be constructed can "be expressed through objects of the most important types."[379] These object types which are the autophysychological, the physical, the heterophsychological and the cultural are language-bound and as such do not have ontological independence. Given that rational reconstruction is a conscious out, it is impossible to construct a consciousness-independent reality. Defining metaphysics here as "the extra scientific domain of theoretical form"[380], Carnap argues that the concept of reality is strictly a metaphysical notion. Constructed objects are language-bound, real and intersubjective. They are real because they can be reduced to basic experience and are intersubjective because they can be adequately expressed in constructional systems of other language. This is a kind of linguistic realism as he affirms that: "construction systems and realism do not contradict each other in any point."[381] This does not mean that science preoccupies itself with the debate on the problem of the external world. Thus, the scientific real is language-bound and the metaphysical real is language-independent. The debate between realism and idealism then cannot be settled scientifically. The thesis of two schools of thought can be validated only after thorough investigation of the meaningfulness of their expressions. Given that we cannot establish the meaning of realism in experience, Carnap affirms that: "in realism, science can take neither an affirmative nor a negative position since the question has no meaning."[382]

The choice of the philosophical stand point; whether realism or idealism has no impact on the content of science. While philosophers and metaphysicians disagree on the existence of the reality, scientists do not disagree on the existence of the empirical results. Scientists only disagree on their interpretations of such results. Carnap illustrates this by using the analogy of two scientists

[377]Rudolf Carnap, *The Logical Construction of The World,* p. 261.
[378]Ibid., p. 282.
[379]*Idem.*
[380]*Ibid.*, p.284.
[381]*Ibid.*, p. 285.
[382]*Ibid.*, p. 333.

who carry out their study in a mountain in Africa. The philosophical conflict between these scientists can not alter the reality of the object. This philosophical conflict unfolds in this way:

> *Then the realist says: "Thus the mountain, which the two of us have found, not only has the ascertained geographical properties, but no addition, it is real", and the 'phenomenalist' (variety of realism) says: "The mountain which we found is supported by something real which we cannot itself know". The idealist on the other hand says: on the contrary, the mountain itself is not real, only our perception and consciousness are real.*[383]

This divergence to Carnap is strictly philosophical as scientists are unanimous in the recognition of the empirical reality. Since none of the disputants in the analogy above proposes an experiment to test his views, Carnap concludes that realism and idealism are not scientific approaches. Their theses do not have empirical content that is, corresponding observable states of affair. They are therefore meaningless thesis and cannot then be inscribed into scientific rationality.

3.2. THE LOGICAL REJECTION OF METAPHYSICS AS NONSENSE

While the rejection of metaphysics above is based on the very definition or nature of metaphysics, the logical rejection on the other hand is a consequent of the definition of science. In other words, in the development of the scientific methodology, metaphysics is presented as nonsense. The logical positivist's logical rejection of metaphysics is rooted in the verifications methodology, on one hand and the logical syntax approach on the other hand. In the verification approach, the confrontation of language with the factual world enhances the elimination of metaphysical elements from language. The logical syntax approach on the other hand consists in analysing the structure of language and eliminating metaphysical expressions and words from their non-respects of the stated laws of the grammar of the language of science.

3.2.1. The Verificationist Approach to the Rejection of Metaphysic as Nonsense

The verificationist theory meaning results with the rejection of metaphysics as nonsense. Given that a statement is meaningful only when we can observe the state of affair expressed by it, then metaphysical statements are nonsensical given they cannot be observed in any possible state of affairs. Is the verificationist approach an absolute elimination of metaphysics? None of the verificationist thinkers defended verificationists as absolute. First Wittgenstein thought

[383]Rudolf Carnap, *The Logical Construction of The World,* p.333. .

verification is absolute but he latter abandoned this view in the philosophical investigation. To Moritz Schlick, verification is a logical possibility while Ayer gives a relativist connotation to it.

Verificationism to Wittgenstein applies to propositions. In his picture theory, a proposition mirrors facts. The arrangement of components of the picture reflects the arrangement of things in the reality. Verification to Wittgenstein is in form of elucidations. Since there is no possibility of an extra-linguistic discourse on language "a proposition is a picture of a reality; for if I understand a proposition, I know the situation that it represents. And I understand the proposition without having had its sense explained to me."[384] Verificationism is attained when the proposition shows its form of representation. Wittgenstein thus asserts that: "a proposition must restrict reality to two alternatives: yes or no. In order to do that, it must describe reality completely. A proposition is the description of a state of affairs."[385]

Wittgenstein's aim in his verificationist approach to the elimination of metaphysics is more therapeutic than destructive. That is, unlike the logical positivists whose aim is to completely eliminate metaphysics, "his aim, rather, is to pull away from certain metaphysical and philosophical practices that distort ordinary language use, thereby generating non-sensical pseudo-problems" [386]

Metaphysical statements then are nonsensical as their claims cannot be verified. It is in this way that Wittgenstein wonders "where in the world is a metaphysical subject to be found?"[387]

Given that language limits the world, then what is out of the world cannot be meaningfully expressed in language. Wittgenstein says the same of the metaphysical self: "the philosophical self is not the human being, not the human body or the human soul, with which psychology deals, but rather the metaphysical subject the limit of the world – not a part of it."[388] According to Chon Tejedor, a commentator of Wittgenstein, Wittgeinstein's objective is to purify scientific language from all philosophical and metaphysical absurdities.

Pictorality to Wittgeinstein is the essence of representation and language to him should serve in communication. Such communication is enhanced by propositions. Thus, the aim of propositions is to communicate thought. These propositions are signs used to express thought and

[384]Ludwig Wittgenstein, *Tractatus*, Prop. 4.021, p. 24.
[385]*Ibid.*, prop. 4.023, p. 25.
[386] Chon Tejedor, *The Early Wittgenstein on Metaphysics*, Natural Science and value, New York-London, Routlegde, 2015, p. 15.
[387]*Ibid.*, prop. 5.633, p. 69.
[388]*Ibid.*, prop. 5.641, p. 70.

that is why Wittgeinstein asserts that: "we use the perceptible signs of a proposition (spoken or written, etc.) as a projection of a possible situation. The method of projection is to think of the sense of the proposition"[389] propositions are therefore logical or propositional signs. There are contingent, tautological and contradictory propositions. Contingent propositions constitutes the language of science for they describe contingent states of affairs. States of affairs are contingent when:

> *i) either determinately obtain or determinately fail to obtain; ii) are both capable of obtaining and capable of failing to obtain iii) ultimately decompose into states of affairs that are logically independent from each other and that are exclusively made up of simple objects.*[390]

Chon Tejedor in the above assertion implies that atomic propositions are also independent from each other. To illustrate this, we can consider three atomic propositions, p,q,r and a non-elementary proposition (p.v)⊃ (p ≡ r). We can obtain the truth values of p,q,r independently and by confronting them to atomic facts but the truth function of the compound statement depends on the truth values of constitutive atomic propositions. Atomic propositions are thus senseful because they make assertions about possible states of affairs.

Wittgenstein notes that there are senseless propositions that are tautological in nature. Senseless propositions are those that do not refer to any possible states of affairs. Tautological propositions for instance, do not have truth condition and are thus true in every instance. Wittegenstin thus asserts that: "Propositions show what they say: tautologies and contradictions show that they say nothing. A tautology has no truth-conditions, since it is unconditionally true: and a contradiction is true on no condition. Tautologies and contradictions lack sense." [391]

Tautologies do not give information about the world but they do convey information about the nature of logic. He thus affirms that "Therefore the propositions of logic say nothing. (They are the analytic propositions)."[392] Propositions of logic are easily identified. They should not be treated on the same ground with propositions of natural science. Thus, "The fact that the propositions '$p \supset q$', 'p', and 'q', combined with one another in the form '$(p \supset q).(p):\supset:(q)$', yield a tautology shows that q follows from p and $p \supset q$."[393]

[389] Ludwig Wittgenstein, *Tractatus*, prop. 3.11, p.13.
[390] Chon Tejedor, *op.cit.*, p. 22.
[391] Ludwig Wittgenstein, *op.cit.*, prop. 4. 461, p. 41.
[392] *Ibid*., prop. 6.11, p. 71.
[393] *Ibid*., prop. 6.1221, p.72.

In the same proposition, he asserts that, "For example, the fact that the propositions 'p' and '$\sim p$' in the combination '$\sim(p.\sim$p)' yield a tautology shows that they contradict one another" [394] we can illustrate this, using the truth table below :

p	$\sim p$	p . $\sim p$	$\sim (p . \sim p)$
T	F	F	**T**
F	T	F	**T**

From the above traditional truth table, it is evident the substitutive instances of the compound statements are all true, implying that it is a tautology.

In Wittgenstein solipsism, metaphysical statements cannot be verified since they express states out of the world of linguistic expressibility. Metaphysical expressions are statements of the meaning of life. There is no scientifically possible life to Wittgenstein apart from the world. That is why he affirms that: "The sense of the world must lie outside the world. In the world, everything is as it is, and everything happens as it does happen: in it no value exists – and if it did exist, it would have no value."[395]

According to A. J. Ayer, experience is the base of defining the scientificity of statements. However, metaphysical statements are nonsensical because they cannot be situated within possible human experience. He thus affirms that:

> *No statement which refers to a 'reality' transcending the limit of all possible sense-experience can possibly have any literal significance. From which it must follow that the labours of those who have strove to describe such a reality have all been devoted to the production of nonsense.*[396]

Metaphysical formulations cannot be verified from facts. Thus, they are a collection of statement expressing nonsense. The metaphysician cannot then claim the identity of a scientist given that scientific statements are justified by empirical reference while a metaphysician on the other hand "produces sentences which fail to conform to conditions under which alone a sentence can be literally significant."[397]

[394] Ludwig Wittgenstein, *Tractatus,* prop. 6.1221, p.72.
[395]*Ibid.*, prop. 6.42, p. 86.
[396]Alfred Jules Ayer, *Language, Truth and Logic*, p. 14.
[397]*Ibid.*, p. 15.

Ayer insists that a distinction should be made between metaphysical statements and scientific statements that are significant but we do not yet have adequate tools to verify them. He refers that to this method as verifiability as opposed to practical verifiability. An example of such statement that cannot be verified practically is "there are mountains on the further side of the moon."[398] Moritz Schlick used the same example in his thesis of verifiability as a logical and not an empirical criterion. No instrument has been invented to verify to go and verify the above statement. Thus, it translates possible and not actual facts and should not be likened to metaphysical statements.

Metaphysical propositions to Ayer then excludes possibility of conceiving possible experience to verify them. He takes the example of a metaphysical proposition "the absolute enters into, but is itself incapable of, evolution and progress"[399], used by F. H. Bradley in his *Appearance and reality.* There is no possible experience that can be conceived to observe if the Absolute enters or cannot exhibit evolution and progress. Such statements expressed by metaphysicians are scientifically dumped; for, "until he makes us understand how the proposition he wishes to express would be verified, he fails to communicate anything to us."[400]

Through verification, the various metaphysical tendencies and their theoretical conflicts are rendered to be epistemologically title. This involves the question of substance which seeks to find out how many substances are there and how many of such substances exist. This question is answered by Morists, dualists and pluralists.[401] The questions and theses of those conflicting metaphysical positions cannot be verified from actual and possible experience. Ayer thus affirms that: "But the metaphysical question concerning 'substance' is ruled out by our criterion as spurious.[402] Metaphysical problems and theoretical positions constitutes a system of nonsense in the verificationist logical dimension of logical positions.

[398]Alfred Jules Ayer, *Language, Truth and Logic,* p. 17.
[399]*Idem.*
[400]*Idem.*
[401]Monism. It is the metaphysical theory which holds that there is only one substance that exists. Parmenides and Spinoza are examples. Dualism. It holds that there are only two self-subsistent realities. An example of Descartes Bod-min dualism. Pluralism. It holds that there are many subsistent substances. An example is Leibniz's monadology and Empedocles.
[402]Alfred Jules Ayer, *op.cit.,* p. 22.

3.2.2. The Logical Syntax Approach to the Rejection of Metaphysics.

The *Oxford Dictionary of Philosophy* defines syntax as: "a language in its grammar, or the way its expression may be put together to form sentences."[403] Syntax then ignores the material to deal with the formal aspect of word combination in definite language. Syntax thus defines meaning from the relationship between statements and words used to form them. Thus, Rudolf Carnap affirms that "A language consists of a vocabulary and a syntax, i.e. a set of words which have meanings and rules of sentence formation. These rules indicate how sentences may be formed out of various sorts of words."[404]

The syntax approach to the elimination of metaphysics is developed by Wittgenstein and Rudolph Carnap. This syntax approach does not employ verification but eliminates metaphysics through the analysis of scientific statements. Elsewhere, Carnap asserts that: "By 'logical syntax' (or briefly syntax), of a language we shall understand the system of the formal (that is, not referring to meaning) rules of that language as well as the consequences of these rules."[405]

The syntax approach to Carnap is important because the manner in which words are put in a sentence can render it to be meaningless. That is, if meaningful words violates the rules of syntax, they can not produce a meaningful sentence. He thus asserts that: "accordingly, there are two kinds of pseudo-statements: either they contain a word which is erroneously believed to have meaning or the constituents are meaningful, yet are put together in a counter-syntactical way, so that they do not yield a meaningful statement."[406]

It should be noted that these are the later views of Carnap and Wittgenstein. They all agree that nonsense arise from the abuse of the grammar science. That is why the commentators of Wittgenstein affirm that: "Wittgenstein and Carnap both thought that the philosophical nonsense results from the violation of the logic that governs the meaningful use of language."[407]

Carnap's conception of non-sense holds that words can have meaning in isolation. That is the meaning of words is not determined apriori by the sentence in which it occurs. This is because meaningful words exist in preudo-propositions. The first condition for a word to be significant to

[403]Simon Blackburn, *Oxford Dictionary of Philosophy*, p. 357.
[404]Rudolf Carnap, "The Elimination Metaphysics Through The Logical Analysis Of Language", p. 71.
[405]Rudolf Carnap, "On the Character of Philosophic Problems", in *Philosophy Of Science*, Vol. 1, No.1, Philosophy of Science Association, Chicago, Chicago University Press, 1934, pp. 5 – 19, p.10.
[406]Rudolph Carnap, *op.cit.*, pp. 60 – 81.
[407]Alice Crary and Rupert Read, *The New Wittgenstein*, London, Routledge, 2000, p. 316.

Carnap is that, the syntax of the word must be fixed."[408] The syntax of a word is the mode in which it occurs in an elementary sentence. For instance: "The elementary sentence form for the word 'stone' e.g. 'X is a stone'; in sentences of this from some designation from the category of things occupies the place of 'X' for example, 'this demand', 'this apple'."[409]

The second condition to determine the meaning of a word is to identify a definite statement S that can be deduced from the word and to determine which other statements can be deduced from the mode of verification and the meaning of S. Carnap illustrates this, using the word "anthropeds". He thus affirms that: "anthropodes are animals with segmental bodes and jointed legs."[410] This is the elementary sentence in which the word 'anthropode' can occur. The mode of occurrence of the word 'anthropodes' can be expressed as: "the thing X is an anthropde."[411] From this statement from, other statements can be deduced such as: "X is an animal, X has a segmented body, X has jointed legs."[412] The aim of this stipulation and deducibility is to give a fixed meaning to the word "anthropodes". Carnap thus concludes that: "in this way, every word of the language is reduced to other words and finally to the words which occur in the so-called "observation sentences" or "protocol sentences". It is through this reduction that the word acquires its meaning."[413]

The stipulation and deducibility which Carnap refers to as the criterion of applicability renders metaphysics as nonsense. The metaphysical concept like "the principle" does not respect this syntactic principle of application. This principle is presented as the ultimate cause of things. However, a metaphysician can not establish under what condition the truth or falsity of "X" is the principle of "Y" can be established. The possible metaphysical answer to the question is simply nonsense as Carnap affirms that: "the metaphysician replies approximately as follows: "X is the principle of Y" is to mean "Y arises from X", "the being of y rests on the being of X", "Y exist by virtue of X" and so forth. But these words are ambiguous and vague."[414]

Such expression could have meaning if the relationship between "X", the principle and "Y" the effect was an empirical one. In this case, the temporality of the relation could be observed. But, this is not the meaning attributed to this causation by metaphysicians. Words that become metaphysical when they lost their original meaning and are not given new meaning. The word

[408]Rudolph Carnap, *"*The Elimination of Metaphysics Through The Logical Analysis of Language*"*, p. 71.
[409]*Idem.*
[410]*Idem.*
[411]*Idem.*
[412]*Idem.*
[413]*Idem.*
[414]*Idem.*

"principium" to Carnap, originally has the meaning "beginning". As it is deprived of this original meaning, it falls into metaphysics and becomes meaningless. This applies to the word, "God" which has a mythical use "to denote physical beings which are enthroned on mount Olympus, in Heaven or in Hades and which are endowed with power, wisdom, goodness and happiness to a greater extent."[415] This concept becomes useless and meaningless when it acquires the metaphysical use. Thus, the metaphysical definition of the word; "God" is the simply the illegitimate combination of words, violating the conditions of syntactical determination.

The syntax approach to the meaning of words then seeks to find out conditions under which a statement having such words can be true or false. Given that metaphysicians do not always establish such conditions, Carnap thus concludes that: "the allege statements of metaphysics which contains such words have no sense, assert nothing, are merely pseudo-statements."[416]

The second phase of this critique concerns pseudo-statements with meaningful words. Carnap here privileges logical over linguistic syntax since "the syntax of the grammatical syntax of natural languages, however, does not fulfil the test of elimination of senseless combinations of words."[417]

This is because there are many metaphysical statements that are not easily detectible as pseudo-statements. Carnap gives two examples of statements that are "(1) 'Caesar is and' (2) 'Caeser is a prime number'."[418] The first case requires a predicate and not a connective and this is counter-syntactical case, Caesarean not be predicated by a "prime number" but it is syntactically connected. Carnap thus asserts that "if grammatical syntax differentiated not only the word categories of nouns, adjectives, verbs, conjunctions, etc., but within each of these categories made the further distinction that are logically indispensable, then no pseudo-statements could be formed."[419]

The task of logicians of science then is the formation of adequate logical syntax to avoid admitting pseudo-statements of metaphysics into science. The difference between the earlier anti-metaphysical positions and the logical syntax version is that the former insisted on the empirical element while the latter insists on the logical aspect. The form vies metaphysics as simple speculations or fairy tales. However, Carnap insists that: "The statements of a fairy tale do not

[415]Rudolph Carnap, *"*The Elimination of Metaphysics Through The Logical Analysis of Language*",* p. 71.
[416]*Idem.*
[417]*Idem.*
[418]*Idem.*
[419]*Idem.*

conflict with logic, but with experience; they are perfectly meaningful, although false."[420] Metaphysical statements on the other hand, conflict both with experience and logic. Carnap rejects the attempt by scientists to treat pseudo-metaphysical statements as working hypothesis or conjectures that are necessary because of our cognitive finitude. According to him, such conjectures are possible in non-empirical but true and meaningful statements. It can never be applies in pseudo-statements of metaphysics because,

> *What we do not know for certain, we may come to know with greater certainty through the assistance of other beings; but what is unintelligible, meaningless for us, cannot become meaningful through some one else's assistance, however vast his knowledge might be. Therefore no god and no devil can give us metaphysical knowledge.*[421]

Wittgenstein's view of error is also grounded on the abuse of the logical syntax of language. In the Tractatus, Wittgenstein asserts that: "Frege says that any legitimately constructed proposition must have sense. And I say that any possible proposition is legitimately constructed, and, if it has no sense, that can only be because we have failed to give meaning to some of its constituents."[422] Wittgenstein then thinks that nonsense is a product of the use of meaningless expressions unlike Carnap who argues that nonsense emerges from the illicit use of meaningful words.

Wittgenstein's logical syntax approach was influenced by Frege's context principle. According to this principle: "Never ask for the meaning of a word in isolation, but only in context of a proposition."[423] He drifts from Carnap's isolation approach where words have meaning in isolation and asserts that the latter is the cause of confusion. The commentators of Wittgenstein thus assert that: "For Frege, the meaning of a given word is the logical contribution, it makes to the sense of the sentences in which it appears."[424] This follows that the meaninglessness of a sentence implies the meaninglessness of the constitutive words. This context principle is stated by Wittgenstein in the Tractatus as he affirms that: "Only propositions have sense; only in the nexus of a proposition does a name have meaning."[425] We cannot then give meaning to words as Carnap asserted. Even in his later works, Wittgenstein does not depart from his context definition of the meaning but naming is not expressive to have meaning. He thus affirms that:

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[420]Rudolph Carnap, "The Elimination of Metaphysics Through The Logical Analysis of Language", p. 71.
[421]*Idem*.
[422]Ludwig Wittgenstein, *Tractatus*, Prop. 5.4733, p. 57.
[423]Gottlob Frege, *The Foundations of Arithmetics*, 2nd ed. Trans. J. Austin, Illinois, North Western University Press, 1980, p. x.
[424]Alice Crary and Rupert Read, *The New Wittgenstein*, p. 323.

For naming and describing do not stand on the same level: Naming is a preparation for description. Naming is so far not a move in language -game-any more than putting a piece in its place on the board is a move in ideas. We may say: Nothing has so far been done, when a thing has been named. It has not even got a name except in the language-game. This was what Frege meant too, when he said that a word had meaning only a part of a sentence."[426]

This is a kind of sentential minimalism given that a sentence is a minimal limit of the expression of sense. In the philosophical investigation, a sentence has sense in the context of their use. It can be deduced from the above that whether it is the context approach of Wittgenstein or the Isolation approach of Carnap, the essence is to construct a language that respects both laws of linguistic and logical syntax. Metaphysics can be eliminated to Carnap if the meanings of words is defined before the meaning of sentences while Wittgenstein thinks that metaphysics is eliminated if meaning is given to a sentence as a whole.

3.3. THE NATURALISATION OF PHILOSOPHYY

The elimination of metaphysics by logical positivism was a challenge for the reconstruction of philosophy. The reconstruction of philosophy was done by putting it at the service of science. Such philosophy is neither be metaphysics nor philosophy of value but natural philosophy. The naturalisation of philosophy was not only influenced by the rejection of metaphysics but also by the critique of the post-Kantian German idealism. The concept of natural philosophy is not strictly modern, for right from Aristotle, it took the form of the philosophical study of nature. After developing a model of scientific rationality that is based on different approaches of meaning, logical positivism proceeded to the elimination of metaphysics. This implicitly has an impact on the nature of philosophy. If metaphysics by fundamentalist metaphysicians like Descartes is considered as first philosophy, then what becomes of philosophy after the elimination of metaphysics by logical positivism. They answered this question using naturalism. *The Oxford Dictionary of Philosophy* defines naturalism as: "Most generally, a sympathy with the new that nothing resists explanation by the methods characteristic of natural sciences."[427] The naturalisation of philosophy then is an attempt to give a scientific connotation and role to philosophy.[428] The

[426]Ludwig Wittgenstein, *Philosophical Investigation*, Trans. G.E.M. Anscombe, 2nd ed., Oxford, Basil Blackwell Ltd., 1958, p. 24.
[427] Simon Blackburn, *The Oxford Dictionary of Philosophy*, p. 245.
[428]It should be differentiated by the natural philosophy of German idealists like Hegel who gave a speculative approach to philosophy by uniting nature and spirit. This is aptly called romanticism.

naturalisation of philosophy by logical positivism consists in defining philosophy as the logic of science and in rescuing logic and mathematics in the analytic-synthetic distinction.

3.3.1. Philosophy as the Logic of Science

The first step in rendering philosophy as the logic of science by logical positivism consist in illustrating the view that there are no genuine philosophical problems. Philosophical problems to Wittgenstein arises because of the misuse of language. In other words, philosophical problems arise when we allow meaningless expressions to intrude scientific language. The role of philosophy then is not supposed to be a theoretical one but a practical one, which consists in the logical clarification of language. Wittgenstein thus affirms that: "Philosophy aims at the logical clarification of thoughts. Philosophy is not a body of doctrine but an activity. A philosophical work consists essentially of elucidation. Philosophy does not result in philosophical propositions but rather in the clarification of propositions."[429]

The sole objective of scientific philosophy then consists in logical analysis, that is, the clarification of thoughts and expressions used in science. Philosophy as a theory use propositions and claims to give a view of the reality. Such theoretical philosophy is meaningless because the language limits the world and what cannot be expressed in scientific language is not real. Since to him has answered all possible questions while the problems of theoretical philosophy can not be answered because they are not genuine problems. The central pseudo-problem in theoretical philosophy is that of the value and purpose of life. Such question cannot be answered within the world. One must place himself out of the world because everything in the world is accidental while value is necessary. The solution to the problem of the meaning of life thus is considered such problems as pseudo-problems.

Theoretical philosophy to Wittgenstein then is metaphysics and should be rejected as: "the solution of the problem of life is the vanishing of this problem."[430] What every can be clearly thought can be clearly expressed. The role of practical philosophy is to limit thought and language to the meaningful and the expressible. He conceives the role of scientific philosophy by affirming that:

> *The correct method in philosophy would really be the following: To say nothing except what can be said i.e. proposition of natural of natural science – that is something that has*

[429]Ludwig Wittgenstein, *Tractatus*, prop. 4.112., pp. 29-30
[430]*Ibid*., prop. 6.521, p. 88.

nothing to do with philosophy – and then, whenever someone else wanted to say something metaphysical, to demonstrate to him that he had failed to give a meaning to certain signs in his propositions.[431]

Philosophy as an activity then is the logic of science. It does not only clarify the terms and expressions of science but it is pivotal in limiting the frontiers of scientific practice. Philosophy that is useful thus nothing about itself. A practical example of practical philosophy of his text; the Tractatus. The Tractatus is the logic of science because it defines science, prescribes the criterion of meaning of scientific statements and exposes the language world symmetry. The Tractatus to him should be viewed as a collection of elucidatory propositions, which say nothing about themselves and thus are nonsensical. That is why he affirms that: "my propositions serve as elucidations in the following way: anyone who understands and recognises them as nonsensical, when he has used them – as steps-to climb beyond them. He must transcend these propositions, and then he will see the world alright."[432]

The statements of the logic of science thus have no intrinsic content. They have no out-logical status for their function is strictly methodological. Viewing them as methodological devises is an attitude of scientific philosophy and viewing them as have ontological status and intrinsic content is an attitude of pseudo-philosophy. When one goes beyond the ontological status of propositions, he will inevitably see them as sign-posts of an adequate understanding of the world.

The specificity of Wittgenstein's naturalisation of philosophy that is further criticised by Carnap consists in the view that we cannot talk about the syntax of language. Philosophy constitutes the syntax of language but a discourse on philosophy is impossible. Thus, we cannot adequately develop a meta-language or a meta-logic. Wittgenstein at this point instead introduces his notion of mysticism. He thus affirms that: "there are, indeed, things that cannot be put into words. They make themselves manifest. They are what is mystical.[433] This is mysticism in which the expressible shows itself. Consequently, this mysticism is better than all meta-logical and metalinguistic frameworks erected by philosophers of language. That is why the last proposition in the Tractatus is the prescription of silence on meta-logical inclinations: "what we cannot speak about we must pass over in silence."[434]

[431]Ludwig Wittgenstein, *Tractatus*, prop. 6.53, p. 89.
[432]*Ibid*., prop. 6.54, p. 89.
[433]*Ibid*., prop. 6.522, p. 89.
[434]*Ibid*., prop. 7, p. 90.

In the Wittgenstinian way, Moritz Schlick equally conceives philosophy as an activity and not a theory and equally argues that problems in philosophy arise because of mistakes and misunderstanding in language. Using the semantic undertones of the ancient Greek philosophy, Schlick illustrates the view that philosophy from the beginning has always been the science of meaning. He thus asserts that: "in short, Socrates' philosophy consists of what we may call, "the pursuit of meaning." He tried to clarify thought by canalising the meaning of our expressions and the real sense of our propositions."[435]

In each dialogue of Plato, Socrates applies the dialectical method in form of questioning usually end up with clarifications and analysis of words, expressions and propositions. While the philosophical method aims at clarifications and thus the discovery of meaning, the scientific method of Schlick searches for the discovery of the truth. The objectives of these two distinct disciplines are however complementary because to decide on the truth or falsity of a proposition, we must first establish its meaning. Schlock thus affirms that: "it is my opinion that the future of philosophy hinges on this discovery of sense and the discovery of truth."[436] This is also because to understand the meaning of statements we must be able to "indicate exactly the circumstances under which it could be true."[437] Thus, the philosopher must not understand the meaning of his expression by indicating the asserted circumstances, before verifying if it is true or false.

As a science of meaning, philosophy proceeds through analysis. Through analysis, we proceed from sentences till we arrive at an inexpressible level. It is at this inexpressible level that Schlick defines philosophy as an activity because "all of our definitions must end by some demonstration, by some activity."[438] This demonstration is a kind of ostensive definition which consists in painting at some experience or instances that corresponds to the inexpressible level of philosophical analysis. Philosophy then does not contain true propositions as Wittgenstein affirmed. To Schlick, philosophy is, "the activity of finding meaning."[439] He equally notes that: "Philosophy is an activity, not a science but an activity of course is at work in every single science continually, because before the sciences can discover the truth or falsity of a proposition they must get the meaning first."[440] If philosophy is an activity, then philosophical problems do not exist. The only genuine problems are scientific. Thus, any theoretical philosophy that is built on

[435]Moritz Shclick, *"*The Future of Philosophy ", pp. 112-116.
[436]*Idem.*
[437]*Idem.*
[438]*Idem.*
[439]*Idem.*
[440]*Idem.*

formulates problems and theoretical solutions is nonsense. Philosophy to Schlick is thus "the queen of sciences", which itself is not a science because it "is needed by all scientists and pervades all their activities."[441] Schlick thus reduces the future of philosophy into the following words: "the fate of all philosophical problems is this: some of them will disappear by being shown to be mistakes and misunderstandings of our language and the others will be found to ordinary scientific questions in disguise."[442]

Unlike Wittgenstein who argues that ethical propositions are insignificant, Schlick recognises their significance for ethics deals with clarification of terms. Ethics and aesthetics then are philosophy in the narrow sense and Schlick hopes that: "in the future they will, of course, become part of a great system of science."[443] Philosophy then is the logic of science and if philosophy ever wants to have an object of study, then they must become scientists for their discipline to be significant. That is why he concludes that: "on the contrary, in most cases, the future philosophes will have to be scientists because it will be necessary for them to have a certain subject matter on which to work."[444]

In a purely syntactical way, Rudolf Carnap equally conceives philosophy as the logic of science. Carnap agrees with Wittgenstein and Schlick that as a logic of science, philosophy is an activity, but he disagrees on the nature of this logic. To Wittgenstein, a discourse on language is impossible because meaning is language-bound but Carnap holds that as a logic of science, philosophy is the syntax of science that is expressible. Theoretical problems to Carnap are dual; those that concerns the objects found in the discipline and those that concern terms and propositions of the discipline. The former is referred to as object-questions and the latter is referred to as logical questions. For instance: In the domain of zoology, the object-questions are concerned with the properties of animals, the relations of animals to one another and to other objects, etc., the logical questions, on the other hand are concerned with the sentences of zoology and their logical connections between them."[445]

This equally applies to philosophy has two questions. Object-questions are diametrically opposed to science. This question is resolved with objects such as "Things in itself, the absolute, objective idea, the ultimate cause of the world, non-Being, values, absolute norm, the categorical

[441]Moritz Shclick, "The Future of Philosophy", pp. 112-116.
[442]*Idem.*
[443]*Idem.*
[444]*Idem.*
[445]Rudolf Carnap, *The Logical Syntax of Language*, p. 277.

imperative and so on."[446] The object-question thus renders philosophy to be metaphysical and thus a system of nonsense. The logical problems of the foundation of also contain object-questions which are illusory. After eliminating object questions from philosophy, Carnap reduces the latter into the following words: "apart from the questions of the individual sciences, the only questions of logical analysis of science, of its sentences terms, concepts theories, etc., are left as genuine scientific questions. We shall call this complex question, the logic of science."[447]

The logic of science then replaces philosophy. Given that the latter preoccupies itself only with logical problems, then it is illogical to demarcate between scientific and unscientific philosophy. The only philosophy is scientic and its sentences are syntactical. That is why he asserts that: "all philosophical problems which have meaning belong to syntax."[448]

Carnap differentiates his approach from that of Wittgenstein on syntactical grounds. This contrast to Carnap does not betray their construction of a scientific philosophy but instead widen the scope of understanding. That is why he affirmed that: "in what follows my views will sometimes be contrasted with his, but this done only for the sake of greater clarity and over agreement on important fundamental questions must not therefore be overlooked."[449]

To Wittgenstei, the logic of science cannot be expressed but Carnap the investigation of the logic of science contains sentences. The logic of science to Carnap there is a meta-logic or a meta-language.

A. J. Ayer simply isolates philosophy from metaphysics. The role of philosophy is that of analysis of language. Philosophy is neither phenomenology nor psychology nor metaphysics. Ayer affirms that: "in other words the propositions of philosophy are not factual, but linguistic in character. That is, they do not describe the behaviour of physical or mental object. They express definitions, or even the formal consequences of definition."[450] Philosophical propositions then neither have something aprior nor empirical for they are simply logical.

The proponents of philosophy as the logic of science above thus, all have the purifying philosophy from metaphysical nonsense and rendering it at the service of science.

[446]Rudolf Carnap, *The Logical Syntax Of Language*, p. 278.
[447]*Ibid*., p. 279.
[448]*Ibid*., p. 250.
[449]*Ibid.*, p. 282.
[450]Alfred Jules Ayer, *Logic, Language and Truth*, p. 44.

3.3.2. The heuristic Legitimacy of Logic and Mathematics in the Analytic-Synthetic Distinction

The first empiricist to attempt a synthetic-analystic distinction is David Hume in his division of genuine knowledge to matters of facts and truths of reason. While matters of facts refer to empirically observable knowledge, truths of reason defines necessary knowledge of mathematics and logic. However, Kant, in his critical philosophy extended this distinction into analytic and synthetic judgements. Analytic judgement which translates traditional rationalism to him are apriori and synthetic judgment which express empirical knowledge is *a posteriori*. The Kantian revolution that provoked logical positivists to examine this problem is the mathematical prism. To Kant, mathematical knowledge is of the synthetic aprior type.

Kant criticised Hume for not extending his scepticism to mathematics and geometry, since Hume stipulated that their truths were analytic. To Kant, the mathematical proposition "7+5=12", is not analytical for cogitating the union of "7" and "5" does not necessary define "12". Thus, "we must go beyond these conceptions and have recourse to an intuition while corresponds to one of the two. Our five fingers, for example or like Segner in his arithmetic five points, and so by degrees, add the units contained in five given in the intuition to the conception of seven. For I first, take the number 7, and for the conception of 5 calling in the aid of the fingers of my hand as objects of intuition, I add the units, which I before now took together to make up the number 5, gradually now by means of the material image my hand, to the number 7 and by this process, I at length see the number 12 arise.[451] The equation of the sum of 7 and 5 does not imply 12. What the mind is aware of in primarily is the sum of 7 and 5 and not that of 7 and 5 implies 12.

The Kantian treatment of mathematical and geometric proposition nullifies the great principle of logical positivism. That is because, it implies that there are truths in the world that can be known independently of experience while logical positivism views experience as the sole source, of knowledge of the world. It is in this respect that Ayer perceives the necessity to examine mathematical propositions. Empiricism then has two claims in the study of mathematics, notably: "say either that they are not necessary truths, in which case he must account for a universal conviction that they are; or he must say that they have no factual content and then he must explain how a proposition which is empty of all factual content can be true and useful."[452]

[451]Immanuel Kant, *The Critique of Pure Reason (1781) and Other Critiques*, p. 18.
[452]Alfred Jules Ayer, *Logic, Language And Truth*, p. 65.

If the above objectives are not attained, the claimed synthetic apriori knowledge will open the doors for rationalist metaphysics and mysticism. Showing that a priori truth are not necessary or that they bear no empirical underpinning thus is import, for "the admission that there were some facts about the world which could be known independently of experience would be incompatible with our fundamental contention that a sentence says nothing useless it is empirically verifiable."[453]

Wittgenstein's response to this problem consists in viewing logical propositions as tautological. Thus, such statements say nothing about the way the world. Wittgenstein thus holds that: "the propositions of logic are tautological"[454] and concludes that: "Therefore the propositions of logic say nothing."[455] This goes same with mathematical propositions. To Wittgenstein, "mathematics is a logical method. The propositions of mathematics are equations and therefore pseudo-propositions."[456] Equations implies the principle of identity which reveals nothing about the ontological states of relating objects. Logical identity is then semantic for it expresses the identity of meaning of symbols and not ontological for it says nothing about the things-in-themselves. Since every tautology reveals itself, Wittgenstein thinks that logical propositions are important for they exhibit the isomorphism between language and the world.

Hans Hann equally treats logical propositions as tautologies. Logic to him does not deal with objects as traditional logicians claim but: "it only deals with the way we talk about objects.[457] To him, the certainty, universal validity and the irrefutability, of logical propositions arise from the fact that they say nothing about the world. Considering the principle of contradictions: "no object is both red and not red"[458] and the principle of excluded-middle: "every object is either red or not red"[459], we can only be aware of certain relation and not the ontological identities of the objects in the relation. Logical propositions thus are stipulations of designation.

Against Kantian synthetic a priori knowledge, Hans Hann argues that we can not know any observation before actually coming to experience it. He thus affirms that: "there is no material apriori, i.e., no apriori knowledge of facts; for we cannot know of any observation how it must

[453]Alfred Jules Ayer, *Logic, Language and Truth*, p. 66.
[454]Ludwig Wittgenstein, *Tractatus*, prop. 6.1, p.71.
[455]*Idem.*, prop. 6.11.
[456]*Ibid.*, prop. 6.13, p. 78.
[457]Hans Hann, *Logic, Mathematics And Knowledge of The World, In Unified Science*, Hans. Hans Kaal, Vienna Collection, vol. 19, ed. Mc. Guinness, Dordreicht, D. Keidel Publishing Company, 1987, p. 29.
[458]*Idem.*
[459]*Ibid.*, p. 30.

come out before we have actually made it."[460] This applies not only to logical propositions but also to logical inferences. Considering the logical inference; "object "a" is red or blue" and "object "a" is not red", I state object "a" is "blue" along with them. This is the nature of what is called logical inference."[461] This inference deals neither with the beings of the objects nor does it deal with the state of affairs under which its validity can be established. This applies same to mathematics for "the proposition of mathematics are exactly the same kind as the propositions of logic"[462], what Kant refers to as the requirement of intuition, that is addition is referred to as tautological transformation by Hans Hann. When we say "2+3=5, with a podictic certainty and universal validity",[463] calculation here involving 2, 3, 5, + and = is not intuitive and thus synthetic; but they are simply "tautological transformations".

Ayer on the other hand sees a lack of the true definition of analytic in Kant. Using the two examples of synthetic and analytic statements; "7+5=12" which is synthetic and "All bodies are extended", which is analytic. Ayer identifies the confusion between the psychological and logical basis of the definition of synthetic and analytic judgement. In the first example, Ayer identifies a psychological criterion and in the second case, he identifies a logical criterion. That is why he affirms that:

> *This is his ground for holding the proposition '7+5=12' is a synthetic, as we have seen that the subjective intension of '7+5' does not comprise the subjective intension of '12'; where as his grounds for holding that 'all bodies are extended' is an analytic proposition is that it rests in the principle of contradiction alone.*[464]

Ayer thus gives the criterion of the analytic-synthetic distinction which is similar to that of Carnap. According to Ayer thus: "we can say a proposition is analytic when its validity depends solely on the definition of symbols it contains and synthetic when its validity is determined by the facts of experience."[465]

The statement of "other …or…", "not" and expression of the kind, "either "p" is true or "p" is not true" are analytic for they provide no information about the behaviour of "p". Assigning the empirical character to synthetic propositions, Ayer does not consider logical and mathematical propositions as meaningless. Analytical and metaphysical propositions are similar in that they all

[460]Hans Hann, *Logic, Mathematics and Knowledge of The World, In Unified Science*, p. 30.
[461]*Idem*.
[462]*Ibid*., p. 35.
[463]*Idem*.
[464]A. J. Ayer, *Logic, Language and Truth*, p. 72.
[465]*Ibid.*, p. 73.

lack empirical content but while analytical statements are senseful, metaphysical statements are senseless. Mathematics and logic are also useful in empirical science because their statements: "enlighten us by illustrating the way in which we use symbols."[466] For instance, if we say, "all p are q and all q are r' then we can infer that 'all p are r'." This inference says nothing about the state of affair or the external world. The inference instead illustrates the deduction of p/r from p/q and p/r, while metaphysical propositions are useless in empirical science, mathematical and logical statements are indespensation in the linguistic form of science. He thus concludes that: "They call attention to the linguistic usages of which we might otherwise not be conscious and they unsuspected implications in our assertions and beliefs."[467] In a collective article by Cameroonian philosophers; Joseph Teguezem, Roger Mondoué and Betrand Nzogang Nguemeu assert that: *« en encensant la démarche logico-mathématique qui oblige le savant à enraciner sa pensée dans le réel pour en assurer la scientificité et la vérité, ils ont fustigé la métaphysique parce qu'ils n'y voyaient que le foyer des propositions insensées et déconnectées des faits. »*[468]

Rudolf Carnap has the same point of view with Ayer, in his distinction between analytical and metaphysical statements, Carnap conceives the latter as neither analytic nor are they empirical. Thus, metaphysical statements do not have meaning. Carnap thus affirms that: "Since metaphysics does not want to assert analytic propositions, nor to fall within the domain of empirical science, it is compelled to employ application are specified and which are devoid of sense."[469]

Rudolf Carnap differentiates between the analytic and synthetic on grounds of logical validity and empirical references respectively. According to him, "in material interpretation, an analytic sentence is absolutely true whatever the empirical events may be. Hence, it does not state anything about facts."[470] Thus, analytical statements are true by definition and not by empirical inference. On the other hand, he defines synthetic statements as "synthetic sentence is sometimes true – namely when certain facts exist – and sometimes false; hence it says something as to what exist. Synthetic sentences are genuine statements about reality."[471] One of the commentators of Carnap, Pierre Wagner affirms that:

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[466]A. J. Ayer, *Logic, Language and Truth*, p. 74.
[467]*Ibid*., p. 75.
[468] Joseph Teguezem, Roger Mondoué, Betrand Nzogang Nguemeu, « Rudolf Carnap Et La Mise A Mort De La Métaphysique Dans Le Monde », in *American Journal Of Humanities and Social Sciences Research*, vol. 4, no. 10, pp. 149-162, 2020, p. 154. "In incensing the logico-mathematical approach which obiges the knower to ground his thought in the real so as to assure scientificity and the truth, they castigated metaphysics, because they saw it as the host of meaningless propositions that are disconnected from facts;" (my translation).
[469]Rudolf Carnap, *"*Testability And Meaning", p. 430.
[470]Rudolf Carnap, *The Logical Syntax Of Language*, p. 40.
[471]Rudolf Carnap, *The Logical Syntax of Language*, p. 42.

> *In the logical syntax of languages, Carnap tries to make concrete the empiricist picture according to which the whole of science can be divided into two parts. On one side, logic and mathematics. Mathematical and logical truths are analytic on the other hand, empirical science: physical truths are synthetic they are empirical truths which can be confirmed or refuted by experience.*[472]

This implies that logic and mathematics have linguistic function in empirical science. They do not make any concessions to experience neither do they attempt to give a theoretical vision of the reality. Logical rules thus are tautological and permit the symbolisation expressibility and illustration for empirical science. The fact that logical and mathematical rules say nothing about states of affairs distinguishes them from the pseudo-proposition of metaphysics; which do not have empirical content but illicitly claim to assert the reality.

[472]Pierre Wagner, *Carnap's Logical Syntax of Language*, New York, Palgrave MACMILLAN, 2009, p. 148.

PARTIAL CONCLUSION

From the above reflection, it can be deduced that the logical positivist semantic paradigm was not developed exnihilo. It was influenced by classical empiricism and early analytical philosophy. It is evidence that the grounding of knowledge on experience in concepts like empiricism and positivism was influenced by the empiricism of John Locke and the positivism of Auguste Comte. In the same moment, Humean critique of the metaphysical principle of causality and the Kantian trial of metaphysics highly influenced the anti-metaphysical tendencies of logical positivism. Moreover, the analytical orientation of philosophy by logical positivism was motivated by Leibniz's linguistic analysis and Ernst Mach's psycho-physical analysis. In the second moment of our reflection, it can be asserted that the logical positivist semantic criterion is based on three approaches to meaning. In the first approach, meaning is given a correspondence connotation and it can be revealed by the principle of verification. In the second approach, meaning is given a physicalist status and it can be revealed through rational reconstruction and in the third approach, meaning is given a probability approach and can be revealed statistically. On the question of the elimination of metaphysics, the logical positivist considers metaphysics both as an attitude and as the study of the real. To them, metaphysics is an emotive and unscientific attitude of attempting to study the transcendental. In the second place, they view metaphysics as consisting in defending the reality of the external world. Even though the various approaches to meaning leads to an implicit elimination of metaphysics, the effective elimination of the latter realised through two techniques; though the verificationist and logical syntax techniques. With the attempt to reject metaphysics, the logical positivists proceed to the naturalisation of philosophy wherein the latter is reduced to the logic of science. However, mathematics and logic are exempted because of the analytical nature of their statements which situate them above metaphysics because they make no claim about the real. Logic and mathematics are thus tools, that are non-scientific unlike metaphysics which is considered as pseudo-sciencc because of her preference to make a rational discourse on the real.

PART TWO

POPPER'S OPPOSITION TO THE LOGICAL POSITIVISTS' PARADIGME OF SCIENTIFICITY AND THE REVALORISATION OF METAPHYSICS

PARTIAL INTRODUCTION

One major concern in this part is articulated around three subsidiary preoccupations. In the first moment of this part, we will examine Popper's criterion of scientificity. It will be a question of finding out the conceptual origin of his evolutionary epistemology while examining the relationship between falsification and falsifiability as two major concepts of his logic of science. As such, we will find out Popper's deductive method of testing theories and his effective application of the criterion of falsifiability in his demarcation between science and non-science. That will constitute the crux of chapter four. In chapter five, we will examine the major points of Popper's opposition to the logical positivist semantic Paradigm. In fact, Popper's attack on the logic of induction, the subjectivity of the logical positivist semantic paradigm and the revision of the role of language. This will be the main focus of chapter five of this part. Moreover, our greatest interest will be in the way Popper defends the role of metaphysics is the understanding and in the development of science. Using the context of discovery and justification, we will examine the role of metaphysics in the development and justification of science according to Popper. With this, we will find out if a rational discourse on metaphysics is possible with Popper. In questioning the metaphysical bases of scientific realism, our concern will be how Popper defends realism as the better option of instrumentalism. In the third moment of chapter, we will end this part by examining the place metaphysics occupies in Popper's definition of objectivity of knowledge. Thus, our question is, what are the basic pillars of Popper's criterion of falsifiability and how does Popper revalorises metaphysics in his scientific rationality? In answering this question, we will examine the problem of the pertinence of Popper's epistemic rupture from the logical positivists' paradigm of meaning.

CHAPTER FOUR

FALISIFIABILITY AS THE CRITERION OF SCIENTIFICITY

"My problem was different. I wished to distinguish between science and pseudo-science; knowing very well that science often errs, and that pseudo-science may happen to stumble on the truth "[473]

4.1. THE CONCEPTUAL ORIGINS OF POPPER'S EVOLUTIONARY EPISTEMOLOGY

Popper's epistemology is evolutionary in character. This is because knowledge to him has a biological character and thus the major epistemological motivation should be how to ensure the growth of scientific knowledge. There are two main thinkers that influenced the biological nature of knowledge in Popper; notably, Konrad Lorenz and Charles Darwin. From the zoologist Konrad Lawrence, Popper grasp the idea of conjectural knowledge grounded on the innate mechanisms of anticipations and expectations. From Charles Darwin, Popper gives an organic connotation to scientific theories as the growth of the former proceeds by trial and error elimination, a method that is similar to natural selection and survival of the fittest in Harles Darwin. The concern of this sub-chapter then is to examine the tenets of Lorenz and Darwin's influence on the biological character of knowledge in Popper. This will permit to understand the opposition between Popper and logical positivism because Popper proposes conjectural knowledge as the best alternative to inductive knowledge.

4.1.1. Konrad Lorenz's Theory of Imprinting as Grounding of Popper's Conjectural Knowledge

Karl Popper's contention that the mind of organisms is not a tabular rasa for it is disposed with the innate mechanisms of expectation and anticipation which precedes observation was influenced by his reading of Konrad Lorenz's zoology. Thus, his defence of conjectural knowledge as the best alternative to the inductive knowledge of logical positivism was provoked by Konrad Lorenz's theory of imprinting. According to Popper, scientific knowledge is conjectural because hypothesis and problem posing logically precedes observation. The fundamental thesis of Lorenz is that the behaviour of organisms can be interpreted as a product of instincts or innate mechanisms. Imprinting can be defined as a phenomenon in which the early experience of a bird determines their future behaviours.

[473]Karl Poper, *Conjectures and Refutation*, p. 33.

Marga Viceda defines imprinting as, "the process whereby some species of birds follow and become attached to the first moving object they encounter after hatching."[474] This attachment of the young birds to the moving object is instinctive and thus innate because it precedes consciousness. These innate mechanisms can be likened to the Kantian postulations of categories as innate schema. Lorenz's argument is based on his observation after breaking the eggs to hatch one ones of the birds and watch them grow. These young birds became attached to him as their mother. Instincts thus trigger behaviour in animals. These innate mechanisms thus permit organisms to adapt or survive during the process of evolution. The organisms' species must instinctively evolve so as to be able to adopt to the environment and solve problems that arise. This is why Lorenz affirms that:

> *The lower animals, very rarely solves problems as an individual, and whenever it does so, this is only in abysmally simple way. As a rule, a lower organism either has solved problems as a species by evolving instinctive ways of reacting that fits every single one of emergencies that normally occur, or it fails miserably when confronted with the problem for which it does not possess any suitable instinctive response.*[475]

Lorenz's theory of imprinting influenced Popper's innate mechanisms of expectations and anticipations as innate mechanisms of humans. In his critique of induction, in what he qualifies as the bucket theory, he argues forcefully that science does not logically begin with observation. Popper qualifies the view that our knowledge begins with experience and observation as the bucket theory. He thus affirms that:

> *« La théorie que les sens commun se fait de la connaissance est simple. Si vous ou moi voulons connaitre quelque chose d'encore inconnu à propos du monde, nous devons ouvrir l'œil, et regarder. Et nous devons tendre l'oreille, et écouter les bruits, tout particulièrement ceux émis par les autres gens. Nos différent sens sont nos sources de connaissance ; notre esprit est un seau, vide à l'origine – ou plus ou moins vide – et les matériaux entrant dans ce seau par voie de nos sens.»*[476]

The first limitations of the bucket theory of knowledge is the claim of certitude. This theory claims scientific certitude on the grounds of the source of knowledge. Such claim to certitude is

[474]Marga Viceda, "The Father of Ethology and Foster Mother of Ducks, Konrad Lorenz as expert on Motherhood", in *Journal of Science*, vol. 44, no.3, Chicago, University of Chicago Press, 2009, pp. 263-299, p. 270.
[475]Konrad Lorenz, "A Companion in Birds World", in *Journal Of Orthenology*, vol. 83, no. 6, New York, Springer, 1935, pp. 288-413. p. 303.
[476] Karl Poper, *La Connaissance Objective*, trad. Catherine Bastyns, 3e Edition, Bruxelles, Editions Complexes, 1985, p. 71. "The theory which hols that common sense makes knowledge is simple. If you and I want to know something or the unknown about the world we have to open our eyes and look. And we have to stretch our ears and listen to noise, particularly the one produced by other people. Our different senses are the sources of knowledge. (…) our mind is a bucket, that is empty at the beginning or more or less empty and materials cuter this bucket through the means of the senses;" (my translation).

epistemologically weak given the fallibility of man and logically untenable given that it does not permit the growth of knowledge. That is why Karl Popper affirms that:

> *For practical problems arise because something has gone wrong, because of some unexpected event. But this means that the organism, whether man or amoeba, has previously adjusted itself to its environment, by evolving some expectation or some other structure (say, an organ). Yet such an adjustment is the precocious form of developing a theory and since any practical problem arises relative to some adjustment of this kind, practical problems are, essentially imbued with theories.*[477]

There is no pure observation then as posited by logical empiricist thinkers. If one is asked to observe here and now, Popper argues that the person will obviously ask what exactly should he observe. Consequently, "in other to observe, we must have in mind a definite question which ought to be able to decide by observation."[478]

The bucket theory of naïve realists then claim that observation is fundamental while Popper qualifies his view as the search light theory. A commentator of Popper affirms that: "The search light theory replies logically that one or more hypotheses (H) always precedes observation (O), in everyday life and in science, we always start out from a horizon of expectation."[479]

Problems arises from either the modification of previous knowledge or dispositions. Expectations are pre-scientific knowledge and dispositions can either be innate or acquired. For example, the speaking of English or German is an acquired disposition while the disposition to learn language is innate in human species. It is in this light that Popper holds that, *« toute connaissance acquise, tout apprentissage, est la modification (éventuellement le rejet) d'une certaine forme de connaissance, ou de disposition, qui était là auparavant et en dernière instance ; de dispositions innée. »*[480]

In the first instance organisms and humans dogmatically stick to these expectations tell when they will clash with our experience. Popper asserts that:

> *Admittedly, our expectations and thus our theories, may precede historically, even our problems. Yet science starts only with problems. Problems crop up especially when we*

[477]Karl Popper, *Unended Quest, An Intellectual Autobiography*, (1974), 2nd edition, London, Routledge, 1992, p. 153.
[478]Karl Popper, *Our Objective Knowledge: An Evolutionary Approach*, Oxford, Clarendon Press, 1972, p. 259.
[479]Jeremy Shearmur and Geoffrey Stokes, *Cambridge Companion To Popper*, New York, Cambridge University Press, p. 90.
[480] Karl Popper, *La Connaissance Objective*, p. 82. "Every acquired knowledge, every learning, is the modification (eventually the rejection) of a certain form of knowledge or disposition which has there before and innate disposition in the last instance" (My translation).

are disappointed in our expectations or when our theories involve us in difficulties, in contradictions or as the result of the clash between our theories and our observations.[481]

This implies that we become aware of some expectations only when it problems arise. These problems challenge us to adopt a trial and error elimination method, in search for successful conjectures, leading to the growth of knowledge and the development of science.

The advantage Popper's search light theory has over the bucket theory is that it renders into an active construction of knowledge on one hand and it has permits the growth of knowledge. The bucket theory presents the mind as a passive bucket in which knowledge is received via the senses. In the search light theory, observation is not logically purposeless, for it is guided by definite problems.

The influence of Lorenz's theory of imprinting on Popper is not only plausible in the critique of the bucket theory of knowledge but also in Popper's view of the theory of learning. The point of departure of Popper's theory of learning here is the drawing of parallel lines between instruments of experimentations in the scientific practice and the senses used for observation by individuals. Every experimentation is that of a theory and thus every observation is theory-laden. This is why Popper affirms that:

All observations are theories impregnated: they are interpretations in the light of theories, we observe only what our problems, our biological situations, our interests, our expectations and our action programmes, make, just as our observation instruments are based upon theories, so are our very sense organs without which we cannot observe.[482]

Given that every sense-organ is genetically incorporated by theories, Popper asserts that, "theories come before observation and so they cannot be the result of repeated observations."[483] It is also the critique of the theory induction which proceeds by repetition of observations before forming theories. It is in this light that Popper criticises the adaptive theory of learning, defended by Descartes, Locke, Hume and which is presented by Pavlov as behaviourism.

The behaviourism of Pavlov, is a reflex theory of learning, where organisms adapt a particular behavioural pattern due to conditioning. In Popper's terms, the reflex theory of learning claims that:

Animal behaviour consists of muscular responses to stimuli. The stimuli is in the simplest case an irritation or excitation of a sense organ. That is, of a centripetal nerve. The signal

[481]Karl Popper, *Conjectures and Refutations*, p. 222.
[482]Karl Popper and John C. Eccles, *The Self and Its Brain*, Berlin, Springer, 1977, p. 134.
[483]*Ibid.*, p. 135.

> *is carried by the centripetal nerve to the central nervous system. (Spinal cord and brain) and is there reflected. That is to say, it excites (possibly after having been processed in the central nervous system) a centrifugal nerve which in turn is responsible for the excitation and contradiction of a muscle. This causes a physical movement of some part of the body: a behavioural responses.*[484]

Behaviour to the reflex theory then is a product of two reflexes; the innate which is unconditioned and the acquired, which is conditioned. In Pavlov's experiment on dogs, the unconditioned reflex is the flow of saliva while the auditory stimulus, that is the bell, is arranged to follow the visual stimulus, which can be a piece of meat. After repeated conjunction of the bell and the ringing of the bell, the dog will be conditioned to salivate even if the bell is rung without the introduction of the piece of meat.

Popper criticises Pavlov's theory of learning on grounds that it renders animals and humans to be passive in the process of learning. In his interpretation of Pavlov's experiment, Popper sees the dog as disposed of anticipations and expectations other than reflexes. While Pavlov sees the dog's interest as a reflex act, Popper presents it as "general curiosity and activity, something like a Bergsonian elan vital."[485] He equally reinterprets Pavlov as he affirms that:

> *From our point of view, Pavlov's dog is actively interested in the environment, invents a theory (either consciously or unconsciously) and then tries it out. It invents the true and obvious theory, or expectation, that the food will arrive when the bell rings. This expectation makes it saliva flow exactly as the expectation raised by the visual perception or the smell of food.*[486]

Animals just like men are not psychologically passive but dispositionally active for they do not carry their actions mechanically, by responding to stimulus but they carry out "action programme; This active involvement to survive in the world influences the growth and development of their brains. On a strictly epistemological ground, humans do not identify regularities in the world after repeated observations as the inductevists claim but they impose regularities in the world. Popper thus asserts that: "thus we try to discover similarities in our world. Similarities in the light of the laws, the regularities, which we have ourselves tentatively invented without waiting for repetitions, we produce guesses, conjectures without waiting for premises, we jump to conclusions."[487]

[484]Karl Popper and John C. Eccles, *The Self and Its Brain*, p. 135.
[485]*Ibid.*, p. 137.
[486]*Ibid.*, p. 136.
[487]*Ibid.*, p. 137.

Thus, theories and problems precede observation since humans are naturally disposed with expectations and anticipations. When these expectations are betrayed by experience, problems arise and guesses or conjectures are made, which can be further eliminated has groundings in Darwin's theory of evolution.

4.1.2. Darwinian Theory of Evolution as the Corollary of Popper's Method of Trial and Error-Elimination

Darwin's theory of evolution influenced Popper's evolutionary epistemology, given that the latter focuses on the conditions possible for the growth of knowledge while the former provides biological and methodological grounds for the latter. This re-echoed by Popper who affirmed; "The central problem of epistemology has always been and is still that of the growth of knowledge. And the growth of knowledge can be studied best by studying the growth of scientific knowledge.[488] In the same way, Donald T. Campbell, one of the evolutionary epistemologists asserts that: "Popper's first contribution to an evolutionary epistemology is to recognise the process of the succession of theories in science as similar to elimination process.[489]

Darwin's influence on Popper is triadic, notably, on his conceptions of the natural selections of sense organs, the progress of science and on the choice of theory in the context of explanatory competition. In his early writings such as his article, what is dialectics, Popper x-rays the triadic influence of Darwin on him by affirming that:

> *The method by which a solution is approached is usually the same it is the method of trial and error. Fundamentally, it is the same method as that applied by living organisms in the process of adaptation […]. Thus, the method applied in the development of human thought in general and philosophy in particular can well be described as a certain kind of trial and error method. Often, human beings seem inclined to react either in such way that they emphatically assert some suggested theory and hold to it, trying it out for as long as they can or they emphatically fight against such a theory, once they discover its weaknesses.*[490]

In other to create the parallelism between Darwin's theory of evolution and Popper's notion of refutability, it is incumbent to unveil the basis of the former. Darwin's theory of evolution was a biological rupture from the Christian cosmogonic views, which aimed at giving the interpretation of the unwise using natural laws. In fact, the religious version of the origin of life resides in the

[488]Karl Popper, *The Logic of Scientific Discovery*, p. xix.
[489]Paul Arthur Shilpp, *The Philosophy of Karl Popper*, Illinois, Open Court Publishing Co., 1977, p. 415.
[490]Karl Popper, "What is dialectics", in *Mind New Series*, vol. 49, no. 196, London, Oxford University Press, 1940, pp. 403-426., p.421

theory of creation exnihilo. This theory that is recorded in the Bible and defended by creationists such as St. Augustin, St. Thomas Aquinas among others, assume that God created every thing that exist, out of nothing.

Darwinian evolutionism is based on the mechanism of natural selection and the survival of the fittest. Darwin's theory was influenced by these acts; the 1831 earth quake of China, the geographical distribution of species, the variation of species, the colonial process, the struggle of or existence and the Malthusian theory in which population grows at a geometric rate.

Organisms to Darwin evolved from a single-cell and the variation among species is caused by the natural tendency of organisms to adapt dispositions of having food and adapting to changing climatic conditions. Natural selection and the struggle for the survival of the fittest then is caused by the fact that many individual species are produced more than the available food. This environmental pressure provokes the change in the genetic structure to permit the adaptation of organisms. This is the principle of natural selection that Darwin presents as: "tt may be said that natural selection is daily and hourly scrutinising throughout the world every variations, even the slightest; rejecting that which is bad, preserving and adding up all that is good, silently and insensibly working, whenever and wherever there is opportunity."[491]

Darwin gives an example of woodpecker that develops fact, tail, beak and tongues that can enable it catch insects at the barks of trees. Given the commensurability between the large scale of species produced and the scarced resources, organisms will turn to perish. This thus calls for the struggle for survival which Darwin presents in the following words: "a struggle for existence inevitably follows from the high rate at which all organic being, which during its natural life time produces several eggs or seeds, must suffer destruction during some periods of its life and during some seasons or occasional year."[492]

Malthus refers to this unavoidable death as the negative means of population check. Darwin uses climatic conditions also to justify variation of species. He gives the example of the 1854 – 55 winter, which destroyed four-fifth of birds in England. Thus, extreme cold and drought determine the production and growth of organisms. That is why he asserts that: "when we travel from South to North, or from a damp region to a dry, we invariably see some species gradually getting rarer

[491]Charles Darwin, *On The Origin of Species, by Natural Selection*, New York, D. Appleton and Company, 1946, p. 79.
[492]*Ibid*., p. 63.

and rarer and finally disappearing; and the change of climate being conspicuous, are tempted to attribute the whole effect to its direct action."[493]

Natural selection and the struggle of the survival of the fittest are the explanatory of mechanisms of Darwin's theory of evolution. How then did they influence Popper's refutability? The first influence of Darwin on Popper is in his view that sense-organs are products of adaptation to the natural environment. For instance, animals and human in their evolution develop two eyes so as to be able to guard against dangers in their movements. This reinforces his argument that problems come before observation is not possible. Popper thus notes that: "without a problem, no observation. If I asked you: 'please, observe'. Then linguistic usage would require you to answer by asking me: 'yes, but what? What am I supposed to observe.'"[494] The senses as the logical positivist claim are not developed prior to observation as he asserts that: "our senses, from the point of view of evolutionary theory, are tools that have been formed to solve certain biological problems.[495]

Given that the senses are tools for resolving biological problems, Popper's arises, develops his second evolutionary thesis in which organisms and humans do not passively receive knowledge but engages into the method of trial and error elimination, which is similar to natural selection in the Darwinian sense trial.

Popper compares the theory of trial and error-elimination to the testing movements in lower animals. Trial and error elimination just as testing movements in organisms arise as the attempts by organisms to solve problems. Popper in this light affirms that:

> *It is also the procedure that a lower organism, ever a single cell amoeba, uses when trying to solve a problem. In this case, we speak of testing movements through which organisms try to rid itself of a troublesome problem. Higher organisms are able to learn through trial and error how a certain problem should be solved.[496]*

When there is environmental pressure, due to the emergence of a problem, organisms go through a series of testing movements to solve the problem. The sense organs of organisms are; "like theories. They are incorporate adaptive theories and those theories are results of natural selection."[497] When those theories or expectations are betrayed by experience, problems arise

[493]Charles Darwin, *On The Origin of Species, by Natural Selection,* p. 67.
[494]Karl Popper *All Life Is Problem-Solving,* London, Routledge, 1994, p. 6.
[495]*Ibid.*, p. 7.
[496]*Ibid.*, p. 1.
[497]Karl Popper, *The Myth of Framework, In Defence of Science and Rationality*, London, Routledge, 1944, p. 4.

causing organisms to engage into testing movements. The method of trial and error -elimination from tower organisms to man has a triadic phenomenology. Firstly, problems arise and while the second phase consists in trials or attempted solutions, the last stage consists in the elimination of unsuccessful solution. The successful solutions are learnt but not adapted as absolute and definite for they form new expectations.

The mutations in organisms take place in the second stage, where conjectures or attempted solutions are made. There is a kind of pluralism in the second stage, since many attempted solutions on one hand suppose many mutations. At the strictly evolutionary level, Popper argues that a problem situation that demands mutations has two sources; "in the language of our three model, a change in either the environmental conditions or the inner structure of the organism produces a problem. It is a problem of species adaptation: that is, the species can survive only if it solves the problems through a change in the genetic structure."[498]

The transition from the biological to the epistemological ground consist in likening scientific theories to conjectures or attempted solutions. Popper is emphatic on this as he asserts that, "my first thesis here is that science is a biological phenomenon."[499] Science also begins with problems or problem situation and this is followed by attempted solutions, which are theories or conjectures. These tentative theories are trailed and thus, "in science, too, we learn by eliminating our mistakes, by eliminating our false theories"[500] while organisms hate when their expectations are refuted, the refutation of scientific theories on the other hand is positive, because it permits the progress of science. The degree of a theory to ensure the progress of science is evaluated from the profoundness of the problems it resolves. However, while organisms may perish when the betrayal of their expectations is followed by unsuccessful testing movements, the scientist's theory die on his behalf. Thus, Popper compares biological natural selection with epistemological trial and error-elimination as he asserts that:

> *The amoeba shuns falsification: its expectations is part of itself and prescientific bearers of an expectation or the hypothesis are often destroyed by refutation of expectation or the hypothesis. Einstein, however made his hypothesis objective. The hypothesis is something outside him and the scientist can destroy his hypothesis through criticism without perishing with it. In science, we set our hypothesis to die for us.*[501]

[498]Karl Popper, *op.cit.,* p. 5.
[499]*Idem.*
[500]*Ibid.,* p. 7.
[501]*Ibid.,* p. 10.

The methods of trial and error-elimination replaces the inductive method of forming theories from repeated series of observation. Thus, he asserts that: "in fact, I contend that there is no such thing as instruction from without the structure, or the passive reception of a flow of information which impress itself on our sense organs. All observations are theory-impregnates. There is no pure, disinterested, theory-free observations."[502]

Science thus proceeds from problems. In this way, the last influence of Darwin on Popper is on the criterion of the choice of theories in the context of explanatory competition. When two theories compete, the one that is chosen is that which best resolves the problem. He thus asserts that:

> *The preference is certainly not to anything like experiential justification of statements composing the theory; it is not due to a logical reduction of the theory to experience. We choose the theory which best holds its own in competition with other theories; the one which by natural selection proves itself the fittest to which not only has neither stood up to severest tests, but the one which is also testable in the most rigorous way.*[503]

This is what Popper is going to adapt as the criterion of demarcation between science and non-science. Thus, Popper's principle of refutability was influenced by Charles Darwin's evolutionary biology.

4.2. FALSIFIABILITY AS THE CRITERION OF SCIENTIFICITY

Unlike logical positivism that proposed the meaning criterion as the precept of scientificity, Popper presents falsifiability as the criterion of scientificity. The enigma arising from Popper's logic of science is that of first understanding the meaning and the relationship between falsification and falsifiability. We are then going to show how Popper unveils the differences between these two notions and their complementarity. Given that Popper that falsification is a deductive method of testing theory, we will also examine how Popper effectively applies falsification in the testing of theories.

4.2.1. Falsification and Falsifiability: Definitional and Differential Elucidations

The notions of falsification and falsifiability intervene in Popper's scientific rationality. Thus, the clarification of their meaning is important so as to assure clarity and precision in the use

[502]Karl Popper, *All Life Is Problem-Solving*, p. 8.
[503]Karl Popper, *The Logic of Scientific Discovery*, p. 97.

of the two notions. Lexically, the distinctive marks of the two notions are highlighted in *The Oxford Dictionary of philosophy*. According to Simon Blackburn, falsifiability refers to: "The property of a statement or theory that is, it is capable of being refuted by experience. Popper's idea was that it could be a positive virtue in a scientific that it is bold, conjectural and goes beyond the evidence, but that it had to be capable of facing possible refutation."[504]

In *The Oxford Dictionary of Philosophy* then, falsifiability is a property in an empirical theory, which renders it scientific. Any theory that does not portray empirical character of refutation is not falsifiable and not thus scientific. In the same way, Simon Blackburn presents falsification as the actual and practical testing of theories by confronting them with experience. He thus asserts that with Poppe, it is the capacity of a theory to present hypotheses that are capable of being refuted by evidence that constitutes the central virtue of science and not its ability to put forward hypotheses that are confirmed by evidence. Thus, falsification intervenes at the level of the actual testing of theories. It is then the technique of confronting all-ready constructed scientific theories with experience.

It can then be deduced from the above that falsifiability is a character of a scientific theory while falsification is the method of testability of a theory. Karl Popper insists on the specificities of the usage of the two notions as he asserts that:

> *We must clearly distinguish between falsifiability and falsification. We have introduced falsifiability solely as a criterion for empirical character of a system of statements. As for falsification, special rules must be introduced which will determine under which conditions a system is to be regarded as falsified.*[505]

This follows that falsifiability is a principle of a scientificity. It is used for the determination of the scientificity of any theory that claims a scientific status. Falsifiability can thus be applied on infinite possible scientific theories while falsification is applied only on finite and actual scientific theories. To better apprehend the distinction between these two pivotal notions of Popper's scientific rationality, it is important to bring out their specificities so as to determine their complementarity.

To begin with falsifiability, Popper prefers the latter to the logical positivists' criterion of verification. This methodological shift from verifiability to falsifiability is partly because of the crisis of inductive inference. This problem of induction is that of the lack of the principle of

[504]Simon Blackburn, *op.cit*., p. 130.
[505]Karl Popper, *op.cit*., p. 31

justification which culminates in the problem of infinite regress of inductive inferences. By identifying truthfulness to meaning, the logical positivist find themselves entangled in the web of infinite regress. To avoid this, Popper insists that:

> *These considerations suggest that not the verifiability but the falsifiability of a system is to be taken as a criterion of demarcation. In other words, I shall not require of a scientific system that it shall be capable of being singled out, by means of empirical tests, in a negative sense: It must be possible to be refuted by experience.*[506]

The novelty of falsifiability then is the admission of non-verifiable statements into scientific systems given that the meaning of statements cannot be conclusively established as the logical positivists equally agree in their insistence on the relativity of verifiability.[507]

The first character that a theory is supposed to exhibit to be considered falsifiable to Popper is its binary linguistic constitution. That is, a theory is falsifiable if it has two distinct classes of basic statements; those that prohibit the theory and those that defend it. Popper thus affirms that:

> *A theory is to be called "empirical" or "falsifiable" if it divides the class of all possible statements unambiguously into the following two non-empty sub-classes. First, the class of all those basic statements with which it is inconsistent (or which it ruse out or prohibits): we call this, the class of potential falsifiers of the theory, and secondly, the class of those basic statements which it does not contradict (or which it permits).*[508]

The linguistic difference between a falsifiable and the verifiable theory is that the latter has the boldness to propose statements that contradicts it while the former is only based on statements that permit or explain it. Potential falsifiers become actual falsifiers when we transit from falsifiability to falsification by actually confronting definite theories with experience. Falsifiability thus is a character of theories which is effective in the context of recognition of scientificity but not neutral in the context of application, or experimentation. This implies that a theory that has such binary linguistic constitution is not falsified yet but it is considered as being eligible for falsification for it has the possibility of being refuted in the future. For a theory to be falsifiable, we need just one observation statement that contradicts any hypothesis or prediction of the definite theory.

In the second definition of falsifiability by Popper attempts is marked by a transition from occurrences to events. This is because one observation sentence is not enough to rule out a theory. In realist terms, a single observation statement describes just an occurrence, defined as: "a

[506]Karl Popper, *The Logic of Scientific Discovery*, p. 18.
[507]It is worth-mentioning that Neurath talked of verifiability as a matter of logical possibility, Ayer talked of the relativity of verifiability, Carnap talked of the degree of confirmation. Thus, there is no conclusive verification.
[508]Karl Popper, *op.cit*., pp. 65-66.

phenomenon that takes place in a particular spacio-temporal region and can be singular, plural, brief or temporally extended."[509]

In the revised version of falsifiability, potential falsifier prohibit events understood as a class of occurrences and not just an occurrence. That is why Popper holds that:

> *In the "realist" mode of speech, we can say that a single statement describes occurrencs. Instead of speaking of basic statements which are ruled out or prohibited by a theory, we can then say that the theory rules out certain possible occurrences and that it would be falsified if these possible occurrences do in fact occur.*[510]

This is contrary to verificationist who ground theories on basic statements. Basic statements describe individual occurrences. A theory is not falsifiable because it rules out just one occurrence but when it prohibits an event he then adds that, "thus the class of the prohibited basic statements, that is, of potential falsifiers of the theory will always contain, if it is not empty an unlimited number of basic statements: For a theory does not refer to individuals as such."[511]

The possibility of refuting a theory thus is enhanced by potential falsifiers. These potential falsifiers thus constitute the prohibitive strength of the theory. Given that an event is a collection of occurrences described by particular basic statements, the informative content of potential falsifiers determines the prohibitive strength of a scientific theory. This prohibitive strength is directly related to the theory's possibility to be falsified. Carlos E. Garcia in this way asserts that: "if the class of prohibited events of a theory becomes larger and larger, it will relatively be easy to falsify it, since it allows the world of experience only a narrow range of possibilities."[512]

Karl Popper equally gives two definitions of falsification. The first definition presents falsification as a negativist technique of testability. Given that a science is a hypothetico-deductive system of statements, Popper asserts that: "higher level empirical statements have always the character of hypotheses relative to the lower level statements deducible from them: They can be falsified by the falsification of these less universal statements."[513]

In this first definition of falsification by negation, the more universal statements are falsified by refuting statements of less universality, derived from them: statements in the scientific theory are treated by Popper as hypotheses. Even most singular statements are also hypothesis for

[509]Carlos E. Garcia, *Popper's Theory of Science, An Apologia*, London, Continuum, 2006, p. 47.
[510]Karl Popper, *op.cit.*, p. 68.
[511]*Ibid*., p. 70.
[512]Carlos E. Garcia, *op.cit*., p. 49.
[513]Karl Popper, *op.cit.*, p. 55.

conclusions can be drawn from them. In this case, the falsification of the conclusion will imply the falsification of the corresponding singular statements.

Falsification by negation proceeds through the modus tollenus method in traditional logic. Popper illustrates falsification by negation as he affirms that:

> *Let **p** be a conclusion of a system **t** of statements which may consists of theories and initial conditions. We may then symbolise the relation of derivability of p from t by 't→p' which may be read: 'p follows from t'. Assume p to be false which we may write 'ṗ', to be read 'not-p. Given the relation of deducibility t→p and the assumption ṗ, we can then infer ṫ (read 'not t'); that is we regard t as falsified.*[514]

Thus, two things are needed for a theory to be falsified by negation. The theory must have a conclusion or an implication and must also have an initial condition. This is evident if we want to test the statement "all swans are white', we need initial condition '*a* is a swan' in other to derive the prognosis '*a* is white'."[515] This statement has not stated both the initial condition and a conclusion, thus, it cannot be falsified. For, "all swans are white" to be falsified, there must be one initial condition and one conclusion. Every scientific statements then must make bold predictions in form of conclusion. The premises of such conclusions are referred to as the initial condition. If the prediction of the theory in question is false, then at least one of the premises is false.

The second definition of falsification by Popper proceeds by refutation with the help of test statements. These test statements are in no way synonymous to protocol statements of logical positionism. These are statements about objective facts and not statements about the unanalysable elements of the world. Such unanalysable statements lead to subjectivity and psychologism and thus they cannot be intersubjectively tested. That is why he asserts that: "the test statements are not about observed experiences. They must be statements about facts which can be stated intersubjectively."[516] These test statements otherwise called basic statements, have two formal conditions. In the first place, we cannot draw a basic statement from the universal statement without the initial condition and a basic statement can contradict a universal statement. These basic statements are singular existential statements and thus can not be deduced from strictly universal statements that have no space time contextualisation. However, we can derive pure existential statement from singular statements from singular existential statements.

[514]Karl Popper, *The Logic of Scientific Discovery*, pp. 55-56.
[515]Jeremy Sheamur and Geoffrey Stokes, *The Cambridge Companion To Popper*, 1st ed., New York, Cambrigde University Press, 2016, p. 128.
[516]Karl Popper, *Uneded Quest*, pp. 192-193.

Falsification through test statement is in the actual observation of actual falsifiers or these falsifiers must be existential statements of space-time coordinates. For instance, the general hypothesis "All swans are whites" as potential falsifier, "on the 16th of May 1934, a swan which was not white stood between 10 and 11 O'clock in the morning in front of the statue of empress Elizabeth in the Volksgarten in Vienne."[517]

If a swan is actually observed that is not white, then this potential falsifier becomes the actual falsifier to falsify the theory under testing. The problem in the second definition of falsification using test statement is that of the frequency of observation and intersubjective testing. Here, Popper proposes the introduction of conventional rules that will permit scientists to agree. The testing of a theory should be done severally by different scientist, tell they reach on an easily testable statement that everyone can agree on. If such testing leads to no conclusion, then Popper proposes the following: "If this too leads to no result, then we might say that the statements in question were not intersubjectively testable, or that we were not after all dealing with observation."[518]

Such universality is neither arbitrary nor is it a matter of uncritical agreement but it is guaranteed by the universality of scientific language. The exclusion of this conventionalism from science to Popper, will deprive science from a universal language. Experience alone is not sufficient in testing test statements and thus there is need for agreement, without which "it would amount to a new "Babel of Tongues": Scientific discovery would be reduced to absurdity. In this new Babel, the soaring edifice of science would soon be in ruins."[519]

It is firstly at the level of these conventional rules or agreement in testing theories that Karl Popper distinguishes between falsifiability and falsification. He in this way asserts that:

> *We must clearly distinguish between falsifiability and falsification. We have introduced falsifiability solely as a criterion for the empirical character of a system or statement. As for falsification, special rules must be introduced which will determine under which condition a system is to be regarded as falsified.*[520]

Thus, falsifiability is a character of a theory that claims a scientific status. It is a character which makes a theory qualified to be treated as scientific. Falsification on the other hand refers to methodological operations that are carried out in the context of justification of theories. Carlos E.

[517]Jeremy sheamur and Geoffrey Stokes, *op.cit.*, p. 128.
[518]Karl Popper, *The Logic Of Scientific Discovery*, p. 86.
[519]*Idem.*
[520]*Ibid., p*. 66.

Gracia, in the same line of reflection holds that: "falsifiability is simply a property of any theory that belongs to empirical science, but given a general theoretical framework, no empirical research is required to determine whether a system is falsifiable."[521]

This follows that the recognition of a theory as falsifiable depends only on the composition of a theory. Any theory that divides its subclasses of statements into two. Those statements that describe the theory and those that contradict the theory is falsifiable. However, falsification on the other hand needs empirical research as Carlos affirms that: "falsification on the other hand is an epistemo-logical act that involves methodological operations it brings into picture facts from the world of possible experience and therefore presupposes observation and requires informed decisions on the part who performs the evaluation."[522]

Falsifiability then has a universal connotation in science, it is a principle used to define scientific theories as a whole. Falsification on the other hand is contextual and relative orientation. It is the method in which the plurality of theories are constructed and tested from one context to another. Falsifiability has a generalist appeal and falsification is calculable and measured. This is evident in the different degrees of falsification.

Moreover, the difference between the two notions is evident in the types of statement on which they are based. The potential falsifiers in falsifiability are bivalent, that is true or false. Falsification on the other hand intervenes in statements that are already held as scientifically true. Thus, falsifiability is applied on newly developed theories or hypotheses while falsification on the other hand rejects the epistemologically true theories. That is why Michel Bechet Jacques affirms that:

> *« La réfutabilité permet donc de statuer sur le caractère scientifique de tout nouvelle hypothèse ou théorie scientifique, elle s'appuie fondamentalement sur les capacités prédictives de la théorie, c'est-à-dire sa capacité à générer un ou plusieurs énoncés de bases falsificateurs potentiels. »*[523]

This follows that falsifiability is applied to newly formed hypotheses and theories while falsification is applied to already existing theories and hypotheses. The two notions are however

[521]Carlos E. Garcia, *Popper's Theory of Science*, p. 45.
[522]*Ibid.*, p. 46.
[523] Michel-Bechet Jacques, Le Critère de Démarcation et Son Applicabilité, Thèse de Doctorat, Université Paul Valéry – Mont III, Philosophie, dirigés par Mm. Les professeurs Pascal Nouvel et Anatasios Brenner, Soutenue le 13/05/2013. " *Refutability (falsifiability) permits the determination of the scientific character of a new hypothesis or new scientific theory. It is fundamentally based on the predictive character of the theory, that is, its capacity to generate several basic hypotheses, that are potential falsifiers)".(my translation)*

complementary, because falsifiability precedes falsification. That is, if a theory is falsifiable, then it has the necessary scientific character that makes it eligible for falsification or testing. If a theory is not falsifiable, that is, if it does not divide statements to two classes; the initial statements that describe the theory and potential falsifiers that contradict the theory, then it cannot be falsified. Falsifiability is thus a principle and falsification is the methodology of science.

4.2.2. The Deductive Testing of Theories through Falsification

Logical positivist logic of justification was inductivist in approach. Underlying the unjustifiable character of inductive inferences on grounds of the absence of a principle, Popper proposes deduction as the reliable method of testing scientific theories. According to Ivring M. Copi: "a deductive argument is one whose premises are claimed to provide conclusive grounds for the truth of its conclusion."[524] This follows that deductive inferences proceeds from general principles to particular cases. This Aristotelian character of deduction criticised by logical positivists as having a metaphysical status and thus lacks the scientific character.

The most outstanding critique of deductive inference is A. J. Ayer. According to Ayer, the first principles which are claim to be universal and apriori, have no relationship with nature. That is, the first principles from where deductive reasoning is draw say nothing about the world and thus cannot be tested from experience. That is why Ayer asserts that: "for we shall see that the laws of natures' if they are not more definitions are hypotheses which may be confuted by experience."[525]

Despite the critique of deduction by logical positivists, Popper uses the former as the technique of testing theoriesusing falsification. Given the falsifiabilist connotation of Popper's methodology of science, he prefers the *modus Tollens* version of deduction. The *modus Tollens* is the classical technique of logic. According to Layman, "*modus Tollens* means the mode or way of removing. The argument form gets its name from the second premise (minor premise) which denies (remove the truth of) the consequent of the first (major premise)."[526]

Before examining Popper's *modus Tollens* deductive approach to testing theories, it is important to evoke reason for Popper's choice of the deductive method of justification. The major reason why Popper prefers the deductive inference approach to testability is because of the

[524] Ivring M. Cop, *Introduction to Logic*, 5th ed., New York, Macmillan Publishing Co. Inc., 1978, p. 165.
[525] A. J. Ayer, *Language, Truth and Logic*, p. 30.
[526] Stephen Layman, *The Power of Logic*, 3rd ed., New York, McGrew Companies, INC., 2005, p. 23.

necessity involved in the transmission of truth from the premises to the conclusion. He argues that: "If an inference is valid then if all the premises are all true the conclusion must be true, that is, the truth of the premises (if they are all true) is invariably transmitted to the conclusion and the falsity of the conclusion (if it is false) is invariably retransmitted to at least one of the premises."[527]

Thus, when the truth of the premises implies the truth of the conclusion and renders inference to be valid, the transmission of truth thus assures the validity of deductive inference. However, the falsity of the conclusion implies the falsity of at least one premise, rendering inference to be invalid. As such, the retransmission of falsity from the conclusion to the premises leads to the invalidity of inference. Popper thus situates the validity of deductive inference at two levels. Firstly, it is valid "if it invariably transmits truth from the premises to the conclusion"[528] and secondly, he asserts that: "a deductive inference is valid if and only if no counter example exists."[529] In the second case, by counter example is another deductive inference with true premises but with a false conclusion. For instance, the inference "All men are mortal, Socrates is a mortal; therefore Socrates is a man"[530] is true except if there is a counter example where the premises; 'All men are mortal' and 'Socrates is a man' are true but the conclusion, "Socrates is a man is false."

Unlike induction that requires proofs or a principle of justification, deduction does not. This is because "the validity of deduction cannot be validly proven, for this would be proving logic by using logic."[531] Falsification in a deductive way plays two functions "namely, the process of theory testing and selection of theories."[532] Popper in the same way holds that:

> *The method of critical testing theories and selecting them according to the results of test always proceeds in the following lines. From a new idea, put up tentatively, and not yet justified in any way an anticipation, a hypothesis, a theoretical system, or what you will call conclusion are drawn by means of logical deduction.*[533]

This deductive testing has four major articulations. Firstly, we test the internal consistency by comparing the conclusions drawn, we investigate into the logical form, the possibility of the theory to advance knowledge and the empirical applications of the theory. In other words,

[527]Karl Popper, *Unended Quest, An Autobiography*, London, Routledge, 1992, p. 165.
[528] *Idem*.
[529]*Ibid*., p. 166.
[530]*Idem*.
[531]*Ibid.*, p. 168.
[532]Carlos E. Garcia, *op.cit*., p. 39.
[533]Karl Popper, *The Logic of Scientific Discovery*, p. 9

statements are firstly accepted, secondly, predictions, that is, singular statements are drawn and the theory, that is statements that contradict the theory are also sorted out. Popper thus affirms that:

> *If the decision is positive, that is if the singular conclusion turns out to be acceptable, or verified then the theory has for the time being passed it test: we have found no reason to discard it. But if the decision is negatively or in other words if the conclusion have beenfalsified, then their falsification also falsifies the theory from which they were logically deduced.*[534]

Popper captures this deductive testing of theories in his version of Modus Tollens inference. Giving a hypothetico-deductive connotation to scientific theories, Popper holds that theories are falsified through the falsification of conclusions or implications drawn from them. If "*p*" is a conclusion of a system of statement "*t*", we can represent the logical implication as *t→p*, that is, *t* implies *p* or '*p*' follows from '*t'*. The statement *t→p* can be falsified by negating p. This is presented as:

t→p

~p

∴~t

That is, "if *p* is derivable from *t* and if *p* is false, then t also is false."[535]

This deductive testing is also backed by the Popperian view that scientific theories are simply universal statements. He thus emphasises that: "Scientific theories are universal statements. Like all linguistic representation, they are signs or symbols."[536] These theories do not only explain the world as he affirms that, "Theories are nets cast to catch what we called 'the world', to rationalise, to explain", but these theories also make bold predictions. They are these predictions that permit the falsification of theories. Such causal explanation is not inductive but deductive as Popper insists that: "to give a causal explanation of an event means to deduce a statement which describes it, using a premise of the deduction one or more universal laws together with singular statements, the initial conditions."[537]

In causal explanation, the cause is the initial condition and the effect is the prediction. For instance, thread has a tensile strength of 1*ib* that the weight of 2*ibs* was put on it"[538], can be

[534]Karl Popper, *The Logic of Scientific Discovery*, p. 10.
[535]*Ibid.*, p. 56.
[536]*Ibid*., p. 37.
[537]*Ibid.*, p. 38.
[538]*Idem.*

interpreted into two statements. Firstly, the cause which is a weight of 2*ibs* was put on the thread and the prediction which states that the thread will break.

Theories of natural science to Popper thus are natural laws. They have the connotation of strict universal statements, consequently "they can be expressed in form of negation of strictly existential statements or, as we may say, in the form of non-existence statements."[539] This implies that natural laws or theories are prohibitions. They do not assert states of affairs but they insist on the non-existence of states of affairs. Popper illustrates this with two laws in the history of science. The law of the conservation of energy states that: "there is no perpetual motion machine"[540] and the law of electrical elementary charge states that: "there is no electric charge other than multiple electrical charge."[541] Given that natural laws rule out instead of affirming the existence of state of affairs, then they can also be falsified deductively. It suffices to observe singular existential statement that contradicts this universal statement and the latter will be falsified. In this way, Popper affirms that: "If we accept as true one singular statement which as it were, infringes the prohibition by asserting the existence of a thing ruled out by the law, then the law is refuted."[542]

Not only universal statements or natural laws are falsified deductively but the same method applies to singular statements. Unlike the logical positivist who purported the existence of protocol statements but are unanalysable bases of scientific edifice, Popper asserts that singular existential statements can also be falsified given that their hypothetical status give them the logical licence to culminate into conclusions. It suffices then to falsify the conclusion and the statement will also be falsified.

Falsification is thus the deductive method of testing theories because scientific theories which can take the form of hypothesis universal statements or natural laws either prohibit certain states of affairs or produces a class of basic statement that describe them and another class that contradicts them. The class of statements that describes the theory refers to a class initial conditions which are the causes and the class of statements that contradicts the theory are potential falsifiers. If observation confirms potential true statement falsifiers, then the initial conditions are falsified. This is in respect of the principle of the retransmission of falsity from the conclusion to the premises.

[539]Karl Popper, *The Logic of Scientific Discovery*, p. 48.
[540]*Idem.*
[541]*Idem.*
[542]*Idem.*

4.3. THE EFFECTIVE DEMARCATION BETWEEN SCIENCE AND METAPHYSICS

Having examined Popper's criterion of falsification and its deductive application, we will now seek to find out how Popper uses this criterion of scientificity to demarcate between science and non-science. To realise this, it is important to unveil Popper's critique of the logical positivist criterion of meaning. To popper, we cannot delineate the specificity of a scientific theory from its meaningfulness. Such approach is not only parochial but it is also parasitic to the survival of scientific theories. In his reflections on the history of science, Popper how the scientific revolutions proceeded through falsification at the same time rejecting theories that make scientific pretentions but do not open themselves up for testability, such included Marx's theory of history, Freud's theory of psychoanalysis and Afred Adler's individual psychology. These theories to Popper with various theories of historicism are pseudo-scientific. This constitute the nexus of our reflection in this sub-chapter.

4.3.1. Popper's Critique of the Logical Positivists Meaning Criterion of Scientificity

Karl Popper has no problem with the logical positivists' exclusion of mathematics and logic from the domain of science and equally agrees with them that mathematics and logic have meaning which can be established analytically. However, Karl Popper does not agree with the use of the meaning criterion not only to distinguish science from metaphysics but also to eliminate metaphysics as a system of pseudo-statement. Karl Popper here, criticises the logical positivists' bias against metaphysics while highlighting the logical insufficiencies of the meaning criterion of decidability.

The logical positivist focused on the distinction between meaningful and meaningless sentences through the logical method of verification. With this verification method, metaphysics was given a tag of a system of pseudo-statements.

The first critique of Popper against the meaning criterion as developed in his early writing, points at the circularity of such criterion. That is, the criterion adds nothing new to our understanding of the relationship between science and metaphysics because the latter has never claimed an empirical status. That is, if characterising metaphysics as nonsensical is to imply that it does not belong to empirical is begging the question because metaphysics by definition means beyond the empirical and "metaphysics has always been defined as non-empirical."[543] This is what

[543]Karl Popper, *The Logic of Scientific Discovery*, p. 13.

make Popper to control the methodological motivations of logical positivism as biased against metaphysics.

Logical positivism to Popper was not motivated by a genuine intention to establish an objective criterion of demarcation between science and metaphysics but by the desire for "the final overthrow and annihilation of metaphysics."[544] Such annihilation does not only prove destructive to metaphysics but it is suicidal to science because, "scientific laws too cannot be reduced to elementary statements of experience."[545] The so called atomism of logical positivism which guarantees verification to Popper, does not provide grounds for the verification of general statements or scientific laws. In commenting on the asymmetry between the meaning criterion and the inclusion of natural laws in science, Victor Kraft affirms that: "assertions of unlimited generalities cannot be formed by this method. Natural laws cannot be so formulated; they cannot be analysed into conjunction of atomic sentences, because they transcend the observed facts. But the statement of natural laws are meaningless."[546]

Faced with the contradiction between natural laws and meaning criterion, Schlick asserted that natural laws may not be genuine sentences but they are directions which enhance the making of statements for verification. Popper did not have the same view of natural laws. To him, they are general statements or hypothesis that can be contradicted. In other words:

> *A general statement can be refuted if it contradicts a statement about an individual fact; but it cannot be completely verified by ever so many supporting facts because it is supposed to be valid for all those facts which are still unknown. Thus the verification of a general statement by induction, traditional empiricism is logically impossible.*[547]

Popper rejected the inductive method of verifying general statements. We cannot successfully verify general statements from individuals. If we attempt, we will entangle ourselves into an infinite regress. Given that these general statements to Popper are conjectures, guesses or predictions, the problem of infinite regress can be overcome by deducing particular statements from them. Consequently, when there is a contradiction the general statement is false and where there is an agreement, the theory is said to have corroborated.

Given the limitation of using the meaning criterion to eliminate metaphysics, Popper proposes that the best methodological approach instead consists in giving distinctive definitions

[544]Karl Popper, *The Logic of Scientific Discovery, p. 13.*
[545]*Idem.*
[546]Paul Arthur Schlipp, *The Philosophy of Karl Popper*, p. 189.
[547]*Ibid.,* p. 190.

and specificities of science and metaphysics. Insisting on the inductive method of verification, instead leads to the intrusion of metaphysics into science given the inclusion of the non-verifiable natural laws or general statements into science. That is why Popper affirms that:

> *This shows how the inductivist criterion of demarcation fails to draw a dividing line between scientific and metaphysical systems and why it must accord them equal status, for the verdict of the positivist dogma of meaning is that both are systems of meaningless pseudo-statements. Thus, instead of eradicating metaphysics from the empirical science, positionism leads to the invasion of metaphysics into the scientific realm.*[548]

The second critique Popper evies against empiricism is that of the impossibility of complete verification of statements. According to a commentator of Popper: "there is no complete verification at all of general statements about reality only an ambiguous falsification for it possible."[549] It was this critique that made Carnap to abandon verification and adopt testability through confirmation of synthetic statements.

The third area of disaccord between Popper and logical positionism on the meaning criterion is on the status of test sentences. Influenced by sensualistic empiricism of March and Russel which purports that knowledge is grounded on sese-data Carnap argued that elementary experience or "individual psychie" is the base of knowledge. In their physicalist language, Carnap attempted the transformation of statement expressing such elementary experience to one another on the basis of similarities. Carnap and Otto Neurath refer to statements bearing such elementary experience as protocol statements while Schlick refers to them as reports. Statements in science to the logical positionists have meaning if they are verified from these basic statements. Popper did not only criticise the subjectivity of test statements but also their exclusion from testability. Popper overcomes this psychologism in two ways; notably, by insisting that test statements should be of space-time coordinates and by arguing that such statements can only translate objectivity, if they can be intersubjectively tested. In other words, "the test sentences are not statements about observed experiences, they must be statements about facts which can be stated intersubjectively."[550] The claim of indubitable test statements is more metaphysical than scientific. This implies that the absolutism of the foundation of knowledge and verification do not have logical justification.

[548]Paul Arthur Schlipp, *The Philosophy of Karl Popper,* p. 14.
[549]*Ibid.,* p. 190.
[550]*Ibid.,* p. 193.

The critique of logical positivist meaning criterion influenced them to revise their theories. The relationship Popper had with them was a critical one. That is why Victor Kraft asserts that:

> *But the Vienna Circle did come to agree with Popper that hypotheses must be corroborated by test sentences, and the corroboration must be possible intersubjectively. Both also agreed that statements about experiences, about psychical data, cannot directly proved intersubjectively because these are inaccessible to other persons and that only statements concerning body processes are intersubjectively confirmed.*[551]

The logical positivist's revision of some of the tenets of the meaning criterion was also due to Popper's critique of Carnap's naturalistic view of logically narrow because it reduces meaning to science only, with the intension to destroy metaphysics. Popper defines such narrow orientation of meaning as he asserts that:

> *By the naturalistic theory of meaningfulness, I mean the doctrine that every linguistic expression purporting to be an assertion is either meaningful or meaningless not by convention, or as a result of rules which have been laid down by verification, but as a matter of facts.*[552]

Such naturalism to Popper claims that statements are meaningful if and only if they can be reduced to atomic statements that are expressing observation or perceptions. The problem Popper finds in such an approach is the impossibility of the reducibility of general scientific statements or natural laws. Popper thus qualifies such criterion as a wrong method of demarcation:

> *This criterion excludes from the realm of meaning of all scientific theories (or laws of nature); for these are no more reducible to observations reports than so-called metaphysical pseudo-propositions. Thus, the criterion of meaning leads to the wrong demarcation of science and metaphysics.*[553]

Moreover, Popper attacks the nominalism that constitutes the logical positivist meaning-criterion. Nominalism in the context of logical positivism holds that only words have meaning when they are empirically defined. Thus, the meaning of statements is derived from the meaning of the various words that constitute it. In his own words, Popper affirms that; "it is a doctrine that all non-logical or I prefer to say, non-formative words are names – either such as 'Fido' of a single physical object, or as 'dog' shared by several objects."[554] This is what we qualified in the first part of this work as the syntax approach to meaning. Carnap's nominalism is rooted on the exclusion of universals from scientific language. Thus, when the thing is denominated by the same term,

[551] Paul Arthur Schlipp, *The Philosophy of Karl Popper*, p. 194.
[552]Karl Popper, *Conjectures and Refutations*, p. 259.
[553]*Ibid*., p. 261.
[554]*Ibid.*, p. 262.

there is no ontological similitude between them. What they have in common is just the name. Everything that exists is strictly a particular individual and there are no such things as universals.

Nominalism of logical positivism to Popper is limited because it excludes synthetic statements from science. Given that the meaning of a sentence is gotten through enumerative definition of constitutive words, we are confronted with a scientific system in which meaning is analytical when the word is found in the enumerative list or contradictory when it is not. It is in this regard that Popper holds that: "similarly, if I give the meaning of 'white' by listing (1) the paper on which I am writing; (2) my handkerchief; (3) the clouds over there and (4) our snow morning then the statement 'I have white hair' will be false whatever colour of my hair may be."[555] Thus, synthetic propositions have no place in such nominalist approach to meaning. To Popper, this approach to science is methodically destructive because it cannot favour the formation of hypotheses. He thus disqualifies it as he insists that: "It is clear that in such a language, hypotheses cannot be formed. It cannot be a language of science. And conversely, every language adequate for science must contain words whose meaning is not given in the enumerative way."[556]

If the words given are already defined enumeratively then such statements cannot constitute hypotheses since they are already extensionally determined. It will not be possible to carry out scientific predictions on one hand and even confront such predictions with critical experiment. Scientific language to Popper thus needs "genuine universals" with indeterminate extension that can create a methodological avenue for formation of hypotheses, making of bold predictions and confronting such predictions with crucial experience.

As Popper pointed out, the logical insufficiencies of the naturalistic and nominalistic conceptions of meaning, logical positivists and Rudolf Carnap in particular abandoned such theory and engaged into physicalism and the attempt to construct an artificial language of science. Rudolf Carnap's first episode in the project was his methodological solipsism. It claims that one's experience is the bases of knowledge. Popper severally rejected this methodological solipsism because of its psychologism and subjectivism. Even the critique of metaphysics because it does not fit within universal language of science is erroneous because also exist out of it but its rule in science is recognised by logical positivists. If the logic of universal language of science exists out of it and it is recognised as scientifically important then the refusal to recognise the metaphysics

[555]Paul Arthur Schlipp, *The Philosophy of Karl Popper*, p. 262.
[556]*Idem.*

of science to Popper, is pure bias. That is why, after Taski's meta-logical influence, Popper asserts that:

> *For no doubt, the strong philosophical belief which inspired the forceful and lovable person was by his own standards, purely metaphysical. A unified science in a universal language is really nonsense, I am sorry to say, and demonstrably so, since, it has been proved by Taski, that no consistent language of this kind can exist. Its logic is outside it, why should its metaphysics be out of it?*[557]

It can then be deduced from above that the logical positivist criterion of meaning is logically limited when confronted with Popper's critical tribunal. The limitations range from the impossibility to verify natural laws, to realise conclusive verification of statements and the semantic inconsistencies involved in the logical positivists nominal and naturalist conceptions of meaning. These make Popper to suspect the logical positivists of an unjustified bias against metaphysics.

4.3.2. The Application of Demarcation through Falsification

Karl Popper conceptually traces the problem of demarcation to the critical philosophy of Immanuel Kant as he notes that: "This problem was known to Hume who attempted to solve it. With Kant, it became the central problem of the theory of knowledge. If, following Kant, we call the problem of induction 'Hume's' problem; we might call the problem of demarcation 'Kant's problem."[558]

While Hume treated this problem in the form of induction and causality, Kant questioned the epistemological status of metaphysics as a whole. This was realised in his critical examination of the powers of cognition, to delineate what reason can, from what reason cannot know. It is in this light that Popper defines it as "the problem of finding a criterion which would enable us to distinguish between empirical science on the one hand and mathematics and logic as well as 'metaphysical' systems on the other hand, I call the problem of demarcation."[559]

The positivist view of the problem of demarcation is naturalistic. It is a complete bias against metaphysic making such criterion to be deprived from objectivity. Metaphysics is not empirical science and thus the problem of demarcation should not consist in classifying theories on empirical bases. Moreover, Popper rejects inductivist logic of justification, thereby celebrating the death of

[557]Karl Popper, *Conjectures and Refutations, p. 262.*
[558]Karl Popper, *The Logic of Scientific Discovery*, p. 11.
[559]*Idem.*

logical positivism as he affirms that: "everybody knows nowadays that logical positivism is dead. But nobody seems to suspect that there may be a question to be answered here-question 'who is responsible?' or rather the question 'who has done it?' I fear that I must admit responsibility."[560]

Despite the Kantian origin of the problem of demarcation and Popper's quest to revise the logical positivist criterion, Popper was highly motivated by the dominant theories of his time. These theories claimed scientificity, provoking Popper to investigate into the basis of their scientific status. He classified those theories into unfalsifiable and falsifiable theories. While the unfalsifiable theories that claimed scientificity included Marx's theory of history, Freud's theory of psychoanalysis and Afred Adler's individual psychology, the falsifiable theory was Einstein's theory of relativity.

Investigating into the scientific status of the unfalsifiable theories above Popper notices that they are empirical but they are not different from mythical representation like astrology. He thus asserts that: "it was rather that I felt that these other three theories though posing as sciences, had in fact more in common with primitive myths than with science; that they resembled astrology rather than astronomy."[561] The illusory scientific tag of the three theories was grounded on their power of confirmability. Popper is not against the attempt by a theory to predict a theory but he rather criticises the fact that these theories were not capable to make bold predictions and falsify them. That is why he states that:

> *I found that those of my friends, who were admirers of Marx, Freud, and Ader, were impressed by a number of points common to those theories and especially by their apparent explanatory power. These theories appeared to be able to explain practically everything that happened within the fields to which they referred.*[562]

Confirmability is only scientifically tenable if they are products of bold predictions. A good scientific theory is a bold prohibition for, "it forbids certain things to happen. The more a theory forbids, the better it is."[563] A theory which does not prohibit or predict is simply metaphysical.

Moreover, Popper criticise these theories; Marx's theory of history, Adler's individual psychology and Freud's psychoanalysis because they are victims of conventionalist stratagem. This is the attitude which consists in interpreting the theory and evidence when a theory is proven false, instead of falsifying it. This was common with Marxism and that is why Popper notes with

[560]Karl Popper, *Uneded Quest, An Intellectual Autobiography*, p. 99.
[561]Karl Poppe, *Conjectures and Refutations*, p. 31.
[562]*Ibid.*, p. 34.
[563]*Ibid*., p. 36.

dissatisfaction that: "some genuinely testable theories were found to be false are still upheld by their admirers – for example by introducing ad hoc some auxiliary assumption, or by re-interpreting the theory ad hock in such a way that it escapes refutation."[564]

Such attitude destroys the scientific character of a theory. William A. Gorton, a commentator makes the same remark as he observes with Popper that:

> *Marx made a number of predictions that never materialised. He predicted declining rather than rising wages for working class and declining rate of profit for capitalists. Hepredicted that attempts by capitalists' nations to mollify the vicissitudes of the business cycles would be unaffectual. And of course, he predicted socialists revolutions on the most advanced capitalists nations.*[565]

Among the three theories, Popper admired the prediction abilities of Marx but however acknowledged its failure. Marx's fault consisted in avoiding falsification. Why William A. Gorton gives reason to Popper as:

> *He notes, for example that revolution would take place in the most advanced industrial country, England, for Marx – but of course, the first socialist revolution occurred in economically backward Russia. This was no minor deviation from the Marxist theory of historical materialism. It was a complete inversion of it. Instead of the forces of production dictating politics, the opposite happened.*[566]

Marx predicted an economic revolution to precede a social revolution but this was not the case. The revolution was first of all political and it took place in an economically backward nation; Russia, instead of an economically viable nation, that is England as predicted by Marx. Marx's fault is not in the falsity of his theory but in the fact that he did not boldly affirmed that the Russian revolution was a falsification of his theory.

The second elements in these theories that Popper criticises is their claim to predict the future. Marxism and other theories like Plato's law of decay and Hegel's dialectics attempt to imitate empirical science in predicting the future by imposing patterns, laws and treads at the basis of the evolution of history. Historicism thus is infested with the germs of methodological errors. Popper's argument against the predictive connotations of historicist theory is triadic. Firstly, our knowledge to him is constantly growing, secondly the future life of man is influenced by his knowledge and thirdly, since we cannot predict what our knowledge of the future will look like, then we cannot predict the future. That is why in the preface to the poverty of Historicism, Popper

[564]Paul Arthur Schlipp, *The Philosophy of Karl Popper*, p. 37.
[565]William A. Gorton, *Karl Popper and Social Sciences*, New York, Albany State University Press, 2006, p. 84.
[566]*Ibid*., p. 84.

asserts that: "(1) The human history is strongly influenced by the growth of human knowledge (2). We cannot predict, by rational or scientific method the future of the growth of our scientific knowledge (3) we cannot therefore, predict the future course of human history."[567]

Theoretical history is thus metaphysical and cannot be given the scientific status. The proponents of theoretical history mistake patterns for laws. Laws have universal characters while Trends or patterns are particular statements observed in particular cases. He quotes an example of the theory of evolution which is also a historicist theory. In evolutionism:

> *Hypotheses is an explanation of a host of biological and paleontological observations – for instance, of certain similarities between various species and genera by the assumption of a common ancestry of related Forms. This hypothesis is not a universal law, even though certain universal laws of nature such as heredity, segregation and mutation enter with it into the explanation.*[568]

All laws of nature are thus hypotheses but not all hypotheses are laws of nature. Evolutionism just like other theories of historicism do not have genuine laws to claim the prediction of the future. Popper to this effect affirms that:

> *It is important to point out that laws and treads are radically different things. There is little doubt that the habits of confusing trends with laws, together with the intuitive observation of trends, inspired the central doctrine of evolutionism and historicism. The doctrine of the exorable laws of biological evolution and of the irreversible laws of motion of the society.*[569]

This confusion is equally evident in August Comte's triadic circumscription of the evolution of the human mind. No society can thus successfully predict the evolution of its own knowledge. The result of such prediction can only be achieved at the end of the event this becomes a retroduction and no more a prediction. Any social science or any other theory that assumes scientificity because of its claim to predict is faulty given that attending results after the event is useless for either confirmation r falsification. We cannot falsify the results of the prediction of an event that has already come to an end. In this line of reflection, Popper insists that:

> *My proof consists in showing that no scientific predictor-whether a human scientists or a calculating machine – can possibly predict by scientific methods, its own future results. Attempts to do so can attain results after an event when it is too late for prediction; they can attain their results only after the prediction has turned into a retroduction.*[570]

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[567]Karl Popper, *The Poverty of Historicism*, Boston, Beacon Press, 1957, pp. ix – x.
[568]*Ibid*., pp. 106 – 107.
[569]*Ibid*., pp. 155 – 156.
[570]*Ibid.*, pp. x – xi.

Popper pejoratively refers to psychoanalysis of Freud, Adler's individual psychology, Marx's theory of history, and other historicist theories like Plato's law of decay, Hegel's dialectics, Auguste Comte's law of the evolution of the human mind and Charles Darwin's theory of evolution, as scientistic theories. That is, these theories cannot be classified under empirical science, "since they represent misguided effort to copy those methods, they may be described as scientistic."[571]

Social sciences thus cannot be conferred the status of empirical sciences for their historistic claim is "to lay bare the law of evolution of society in order to foretell its future."[572] It is thus clear that these social sciences should not be ranged as empirical sciences given their historical refusal to aptly apply falsification, universal laws, and predictions in their methodologies.

After classifying the historicist theories above as non-scientific, Popper was attracted by the corroboration of Einstein's theory of relativity in 1919. Einstein's theory of relativity is grounded on two principles. Firstly that one cannot detect uniform motion except relative to objects. This first postulate was a critique of Newton's theory of absolute motion and rest. To Newton, space is absolute, implying that absolute space is that: "without regard to anything external, homogenous and immovable, its parts are the 'absolute spaces', which 'all keep positions in relation to one another from infinity to infinity', and 'absolute motion' is translation from one absolute space to another."[573]

At the 17th century scientist, Newton's theory of absolute space was based on the view that the space is static, not expanding or contradicting, flat and consequently, objects have the natural inclination to move on straight lines at constant speed. Newton equally postulated the existence of a gravitational force, while gravitation depends on the gravitational mass, acceleration depends on the initial mass. Mass and energy to Newton are different things but to Einstein, energy and mass are interchangeable. In the presence of gravity, space is curved and not flat. Mass and energy in Einstein is general relativity affects space and time to curve space – time affects mass and energy to move. This constitutes Einstein's prediction of the gravitational lensing where the curvature of space by mass-energy causes an observed bending of light.

[571]Karl Popper, *The Poverty of Historicism,* p. 105.
[572]*Ibid*., pp. 105 – 106.
[573]Isaac Newton, quoted by Rodert Disalein, U*nderstanding Space – Time: The Philosophical Developments of Physics from Newton to Einstein*, New York, Cambridge University Press, 2006, p. 255.

The above is Einstein's second postulate of relativity. It holds that unlike the velocity of massive objects, the speed of light is constant and is the same for all observers independently of their constant velocity towards or away from the source of light. It is due to this, that Einstein predicted that the path of light will be bent by the gravitational field, when it attempts to pass a massive object such as the sun. Einstein did not only predict this about light but he also proposed falsification of his theory, by asserting that: "if the redshift of spectral lines due to the gravitational potential should not exist then the general theory of relativity will be untenable."[574]

Einstein's theory of relativity did not only took the risk of making bold predictions but its hypothesis was confirmed in 1919 by Arthur Eddington during the so eclipse. That is why Popper expresses his admiration for Einstein's theory of relativity as he asserts that:

> *The small circle of students to which I belonged – were thrilled with the results of Eddington's eclipse observation which in 1919 brought the first important confirmation of Einstein's theory of gravitation. It was a great experience for us and one which had the lasting influence on my intellectual development.*[575]

Einstein's attitude was scientific par excellence. That is, the attitude of the critical testing of theories. In the experiment of Eddington, the light from a distant fixed star whose apparent position was close to the sun, reached the earth as if they have been shifted from the sun and from one another. Unlike Marx's theory, Freud's theory of psychoanalysis and Adler's individual psychology which resist refutability, the confirmation of the predictive result of Einstein make Popper to assert that:

> *Here was an attitude utterly different from the dogmatic attitude of Marx, Freud, Adler and even more so that of their followers. Einstein was looking for crucial experiments whose agreement with his predictions would by no means establish his theory; while a disagreement, as he was the first to stress, would show his theory to be untenable.*[576]

Popper in this way recalls that: " I arrived, by the end of 1919, at the conclusion that the scientific attitude was critical attitude, which could refute the theory tested, thought they could never establish it."[577]A theory is scientific when it offers itself for refutations when counter-examples are confirmed. Metaphysical and other non-scientific theories are not subjected to crucial experience. The criterion of demarcation thus has two moments, the predictive instance, where a

[574]Abbert Einstein, quoted by Popper in, *Unended Quest*, p. 39.
[575]Karl Popper, *Conjectures and Refutations*, p. 34.
[576]*Karl Popper, op.cit.*, p. 39.
[577]*Idem.*

theory must prohibit certain events to occur and the falisifiabilist instance where the predictions of a theory are subjected to a number of tests. He thus affirms that:

> *Now the impressive thing about this case is the risk involved in the prediction of this kind. If observation shows that predicted effect is definitely absent, then the theory is simply refuted. The theory is incompatible with certain possible results of observation in fact with results which everybody before Einstein would have expected! This is different from the situation I have previously described, when it turned out that the theories in question were compatible with the most divergent human behaviour, so that it was practically impossible to describe any human behaviour that might not be claimed to be a verification of these theories.*[578]

This implies that the falsifiability is not only the criterion of scientificity but the criterion of demarcation between science and metaphysics. If the criterion of meaning of logical positivist was accepted by all scientists, then Einstein's theory would have been eliminated because it was not confirmed at that time it was conceived. However, in the absence of observation instances, he opened up his theory for any future testing. In the same way:

> *Newton's theory for example, predicted deviations from Kepler's laws (due to interaction of planets) which has not been observed at the time. It exposed itself thereby to attempted empirical refutations whose failure meant the success of the theory. Einstein's theory was tested in a similar way.*[579]

Testability is not confirmability but refutation. This testability is in degrees because theories do not expose themselves to crucial experience in the same way. Some have high degree of testability on grounds of their empirical content and precision. For instance:

> *A theory from which we can deduce numerical predictions about the splitting up of spectral lines of light emitted by atoms in magnetic fields of varying strengths will be more exposed to experimental refutation than one which merely predicts that a magnetic field influences the emission of light.*[580]

There are three degrees of such theories. The well-tested theories, the hardly tested and the non-tested. While the well-tested and hardly-tested falls under empirical science "those which are non-testable are of no interest to empirical scientist. They may be described as metaphysical.[581]

Falsification from the above is not absolute, it does not translate relativism. It is a matter of degree only at the level of the classification and distinction between theories. It is not only the

[578]Karl Popper, "Conjectures and Refutations", in *Philosophy Of Science*, vol. 1, no. 1, New York, - London, Norton Company, 1957, pp. 1-10, p.7.
[579]Karl Popper, *Conjectures and Refutations*, p. 256.
[580]*Ibid.*, p. 256.
[581]*Ibid*., p. 257.

variations of theories' exposure to falsification that render it to be a matter of degree but also the symbiosis between metaphysics and science. This is because most scientific theories originated from myths. Popper notes this as he asserts that: "I have indicated one of the reasons for this by saying that we must not try to draw the line too sharply. This becomes clear, if we remember that most of our scientific theories originate in myth."[582] The most plausible example is the scientific system of Copernicus which originated from the "neo-platonic worship of the light of the sun who had to occupy the "centre" because of his nobility."[583]

The theories we consider non-scientific today because they are meaningless could become scientific in the future. The meaning-criterion is not thus the best criterion for "it would hardly contribute to clarity if we were to say that these theories are non-sensical gibberish in one stage of their development and then suddenly become good sense in another."[584] Some metaphysical theories of today are scientific theories of tomorrow. The criterion of demarcation is not then meaningfulness but refutability. The theory must not only be empirical to be termed metaphysical but it should also be able to make bold predictions and offer itself for falsification.

CHAPTER FIVE

POPPER AGAINST LOGICAL POSITIVISM ON THE LOGIC AND LANGAUGE OF SCIENCE

The problem of how to construct a language of science which includes all we wish to say in science but excludes those sentences which have been considered metaphysical is a hopeless one. It is a typical pseudo-problem.[585]

5.1. POPPER'S REVOLUTION ON THE LANGUAGE OF SCIENCE

According to popper, logical positivism reduced science only into linguistic frameworks. Such reduction to him is illicit. The problems of science cannot be reduced to the problems of language. To him, the limitation of the function of language by the logical positivist only to the descriptive function alienates scientific theories from their critical connotation. Popper thus proposes the argumentative function as the best option to the authoritarian method of justificationism, developed by logical positivists. Thus, in other to appreciate popper's revolution on language, we will proceed by examining his critique of linguistic reductionism of science and

[582]Karl Popper, *Conjectures and Refutations,* p. 257.
[583]*Idem.*
[584]*Idem.*
[585] Karl Popper, *Conjectures and Refutations,* pp. 276-277.

his defence of the argumentative function of language. This argumentative function will set the pace for Popper to develop his thesis of critical rationalism.

5.1.1. The Critique of the Linguistic Reduction of Epistemology and the Defence of the Argumentative Function of Language

It is primafacie enigmatic to talk of Popper's theory of language given his critique of the logical positivists linguistically monolithic conception of philosophy of science. This attitude is qualified by Emmanuel Malolo Dissaké as Popper's aversion for language. He captures this aversion as he notes that:

> *« D'une part, il tient que les limites du sens et du non-sens ne coïncident pas avec celles de la science et de la métaphysique ; d'autre part, il soutient qu'il ne faut pas faire du langage la seule activité philosophique valable et en faut certainement pas la faire dans le modèle de Wittgenstein ou, comme à suite, le cercle de vienne. »*[586]

Wittgenstein and some members of the Vienna Circle asserted that there are no genuine philosophical problems and that the only problem philosophy has is the problem of the misuse of language. This made them to affirm that philosophy has just one function, which is, the clarification of language. Popper does not only reject the meaning criterion of demarcation as Malolo affirms above, but he rejects the claim that philosophy only has a linguistic function. This aversion for language is emphasised in his preface to the 1959 edition of the *Logic of scientific Discovery*. Popper here, affirms that:

> *Language analysts believe that there are no genuine philosophical problems, or that the problems of philosophy, if any, are problems of linguistic usage, or of the meaning of words. I, however, believe that there is at least one philosophical problem in which all thinking men are interested. It is the problem of cosmology: The problem of understanding the world including our knowledge, as part of the world. All science is cosmology. I believe, and for me, the interest of philosophy, no less than of science, lies solely in contributions which has made to it.*[587]

Popper's point can well be understood if we look at the relationship between philosophy and science in their histories and if we are ascertained of the fact that the greatest scientific revolutions in history which influenced every aspects of knowledge including language is further clarified by the fact that most astronomical. For instance, the views of Descartes, Leibniz and Kant influenced

[586] Emmanuel Malolo Disaké, *Langage, Falsificationnisme et Science Objective*, Paris, PUF., 2004, P. 6. "On one hand he holds that the limits of sense and non-sense do not coincide with those of science and metaphysics; on the other hand he supports the idea that language should not be made the only apt philosophical activity and it should not be certainly done following the model of Wittgenstein or like that of the Vienna Circle;" (my translation).
[587] Karl Popper, *The Logic of Scientific Discovery*, p. xviii.

theoretical physicists like Faraday, Marxwell, Einstein, DeBroglie and Shrodinger. Popper thus gives an illustration as he affirms that: "so much for the doctrine of point-atomism (or of monads) which grew out of Leibniz's criticism of the Cartesian theory of matter of his doctrine is clearly metaphysical and it gives rise to metaphysical research programmes, that of explaining bodies with the help of forces."[588]

Against the accordance of a strictly analytical function to philosophy of science, Popper in his realist motivation insists that the aim of constructing knowledge, whether in science or philosophy is the search for the truth. This truth can be attained using any means. This is a kind of cautious methodological pluralism which should be interpreted solely from its realist undertones; that is, the affirmation of the search of the truth. Popper x-rays this as he affirms that "philosophers are as free as others to use any method in searching for the truth. There is no method peculiar to philosophy."[589]

Besides the cosmological commitment of philosophy, Popper in an evolutionary tone posits that the second problem of philosophy of science which is that of thinking of conditions possible for the growth of knowledge. This has nothing to do with the study of language as he affirms that: "a second thesis which I should like to propound here is this. The central problem of epistemology has always been and still is the problem of the growth of knowledge. And the growth of knowledge can be studied by studying the growth of scientific knowledge."[590]

The exemplary method of philosophy to Popper resolves the problem of the extensional limitation of the method of analysis. This is the method of 'rational discussion'. It is not only proper to philosophy but also preponderant in science and in every form of rational discussion. This method consist in "stating one's problem clearly and examining its various proposed solutions critically."[591] What determines which method to use there have and each time solutions are proposed to these problems, critical discussion will require the attempt to over through rather than maintain the solution as absolute.

Popper equally criticise the physicalist attempt to construct a universal language of science. Such language to us is simply, "a working model in miniature of vast systems of minute gadgets."[592] Such approach is limited because it cannot permit the understanding of knowledge

[588]Karl Popper, *The Myth of Framework*, p. 37.
[589] Popper, *op.cit*., p. xix.
[590]Karl Popper, *The Logic of Scientific Discovery*, p. xviii.
[591]*Idem*.
[592]*Ibid*., p. xxiv.

and its progress. The in exactitude of the symbolisation involved in such attempts makes Popper to affirm that:

> *Thus the method of constructing artificial model language is incapable of tackling the problem of the growth of our knowledge; and it is even less able to do so than the method of analysing ordinary languages. It is a result of their poverty that they yield only the most crude and the most misleading model of the growth of knowledge – the model of an accumulating heap of observation statements.*[593]

The linguistic orientation of philosophy of science then does not permit the promotion of the growth of knowledge, they cannot permit the understanding of the history of scientific thought and it is the source of subjectivism viz psychologism in science.

It is due to Popper's critique of the linguistic limitation of philosophy of science of logical positivism that Malolo questions whether it is still important to talk of the importance of language. The former shows such importance by arguing that refutability gains objectivity only when it is grounded on intersubjectivity and the latter is only possible through the mediation of language. He thus asserts that*: «sans énoncés, les conjectures, les argumentations visant à la réfutation des essais proposés, l'exposé de la conception de l'expérience et de son object, il n'y aurait pas de science du tout. »*[594]

It is indisputable that Popper's conception of language was influenced by Karl Bühler's tri-functional theory of language. The problematic of language that grounds Bühler's theory of the three functions of language is conceived by Malolo Dissaké as that of the distinction and the specification of the humanity and the animality of language. Karl Bühler in this line of reflection sets the basis of the schism between animality and humanity on linguistic ground. He offers an empirico-teleological account of language given that the latter evolves from the simplest to the complex linguistic signs. Language is thus biological before being a social phenomenon. There is an anthropo-zoologic linguistic symmetry in the first two function of language.

The first inferior function of language is the expressive or the symptomatic while the second is the signalling or the releasing function. There is no expression which does not stimulate signalling. The sender of the information is the nerve-centre of the expressive or symptomic function. Communication through expression involves the linguistic exteriorisation of the feelings

[593]*Idem.*

[594] Emmanuel Malolo Dissaké, *op. cit*., p. 110. "Without statement, conjectures, argumentations aiming at refutation of propose triars, the exposition of the conception of experience and its object – they will not be science at all;" (my translation).

and mind of the speaker. Animals and man coincide here because they all involve in the enunciation of vital and mental states of the instinctive speaker to another. The second function is based on the receiver of the information expressed in the linguistic situation. The transmission of information by the speaker through expression thus produces an effect on the receiver through signalling. Through signalling or appealing thus, there is a change in the behaviour of the interlocutor. An example to illustrate Popper's adoption of Bühler's view of the primitive functions of language is that of a hen making a sound when the hawk in the presence of a predator to the chicks. With the expression of this sound of warning, it provokes a reaction in the chicks who ran and hide for safety. Karl Bühler shows the interconnectivity between these two basic functions as he affirms that:

> *It is not true that the term "thing" or the more conceptual pairs, "objects" and state of affairs captures everything for which the sound is mediating phenomenon, a mediator between the speaker and the hearer. Rather, each of the two participants has his own position in the make-up of the speech – situation, namely the sender as the agent, as the subject of the speech action on the other hand. They were not simply a part of what the message is about rather they are the partners in an exchange and ultimately this is the reason why it is possible that the sound as a medical product has a specific significative relationship to each to one and to the other severally.*[595]

Besides the mutual interaction between the speaker and the listener thus, there is a formal dimension which is properly human. The mutual guidance is strictly material – based because animals such as bees cannot inform their "peers" without making reference to matter. Man in this sense is not only linguistic but he is also symbolic. Buhler asserts that while signs refer to material objects and gestures and are used by both animals and man in their primitive linguistic acts, symbols are formal and play the representative role. While signs have immediate reference and are stimuli in linguistic acts, symbols are complex and are products of the intentional production of man and are therefore rational. This is why the representative, descriptive or symbolic function is lacking in animals but present in humans.

Human language is more perfect than animal language because it is distinguished from the latter by its higher functions of representations and argumentations. The descriptive function of language is fundamental in science. It helps to determine the object of science that becomes the centre of critical discussion. Popper thus affirms: *« sans le développement d'un langage extra-somatique descriptif - langage qui comme un outil se développe à l'extérieur du corps, il ne peut*

[595]Karl Bühler, quoted by Marx Halaw, "Karl Bühler's and Ernst Cassirer's conception of man", in *Verbum*, vol. xxxi, no. 2, Berlin, Freil University, pp. 60-84, p. 73.

y avoir objet pour notre discussion critique. »[596] The evolution of human language from stage to another is in tandem with the evolution of the human brain. The most evolved and highest function is the argumentative. It is at this stage that humanity attains linguistic perfection. Popper thus affirms that*: « c'est à ce développement des fonctions supérieures du langage que nous devons notre humanité, notre raison. Car nos facultés de raisonnement ne sont rien d'autre que des facultés de discussion critique.* »[597]

The argumentative function of language is the instrument of critical discussion. The descriptive and the argumentative are distinct from each other because one can describe without necessarily arguing. Argumentations are thus carried out on descriptions. This follows that argumentation is superior to description. While description is unilateral for it provides proofs for a point of view, argumentation intervenes with the provision of reasons for and against a particular description. Animals on the other hand can neither describe a reality nor argue to justify their preference for one thing or the other. Jean Baudouin thus affirms that: *« il ne manque pas seulement au langage animal la capacité de décrire la réalité, il lui mangue également la capacité d'argumenter. C'est-à-dire de justifier la préférence donnée à un énoncé au détriment d'un autre. »*[598]

The four functions to Popper should be viewed as a hierarchicalisation for "each of the higher one can not be present without all those which are lower, while the lower ones may be present without the higher."[599] That is, there is no signalling function without the expressive one, there is no descriptive function without expressive and signalling function and there is no argumentation without the expression signalling and description. Popper captures the thesis of interconnect and eh hierarchicalisation of the four functions of language as he affirms that:

> *An argument for example serves as an expression in so far as it is an outward symptom of some internal state of the organism. It is also a signal, since it may provoke a reply, or agreement. In so far as it is about something, and supports a new view of some situation or states of affairs, it is descriptive. And lastly, it is an argumentative function, it gives*

[596] Karl Popper, *La Connaissance Objective*, p. 134; "Without the development of a descriptive extra-somatic language which as a tool develops out of the body - there will not be an object for our rational discussion"; (my translation).
[597] *Idem*. "It is to this development of superior functions of language that we owe our humanity, our reason. For our faculties of reasoning are non-other than the faculties of critical discussion"; (my translation).
[598] Jean Baudouin, *Karl Popper*, Paris, PU.F., 1989, p. 13. "Animal language does not only lack the capacity to describe the reality, it also lacks the capacity to argue, that is, to justify the given preference of a statement at the detriment of the other"; (my translation).
[599] Karl Popper, *Conjectures and Refutations*, p. 295.

reasons four holding this views, e.g., by pointing our difficulties or even inconsistencies in an alternative view.[600]

Given that the specificity of Popper's view is on his argumentative function, it is incumbent to examine the role of the latter on scientific rationality. Firstly, the argumentative function of language is used to evaluate the correspondence theory of truth. Through the descriptive function, the idea of truth as correspondence to facts is established. The evaluation of the degree of this correspondence is the role of the argumentative function of language. Popper thus affirms that*: « Les discussion portent fondamentalement sur des descriptions, elles critiquent des descriptions du point de vue des idées régulatrices de vérité de contenu et de vraisemblance. »*[601]

Secondly, the argumentative function of language permits the transition from world two to world three. That is, the wired of objective knowledge, where there is rational discussion. The third advantage of the argumentative function is that it permits the growth of knowledge. Language here is considered by Popper as the 'organon of criticism'. This criticism or intersubjective criticism mediated by the argumentative function of language has the following merits, highlighted by Emmanuel Malolo Dissaké:

« L'argumentation appelle au dialogues, à l'échange, à passage du privé au public, de ce qui vaut parce qu'il dépend de moi à ce qui ne vaudra que parce qu'il reçoit, en serait-ce que momentanément, une justification acceptable, l'acceptabilité de celle-ci étant susceptible d'être diversement évaluée pas les uns et les autres. »[602]

In Popper's view of language thus he criticises the logical positivist thesis that language is the main concern of philosophy of scienc. Arguing that there are genuine philosophical problems, cognisant of the fact that the critical method of science requires language, engages into the question of linguistic pragmatism. He adopts Karl Bühler's tri-functional theory of language while coining the argumentative function as that which translates rational discussion, the evolutionary character of knowledge and also assures the objectivity of knowledge.

[600]*Idem.*

[601]Karl Popper, *op.cit.*, p. 134. "Discussions are fundamentally carried on descriptions: They criticise descriptions from the point of view of regulatory ideas of the truth, content and verisimilitude "; (my translation).

[602]Emmanuel Malolo Dissaké, *op.cit.*, p. 39. "Argumentation implies dialogue, exchange, confrontation, it is the passage from the private to the public, from what is worthy because it depends on me to what will be worthy because it momentarily receives a momentary acceptable justification, the acceptability of the latter is susceptible to be diversly evaluated by one and another"; (my translation).

5.1.2. Pancritical Rationalism as the Better Alternative to the Logical Positivist Justificationism

While justificationism is the product of the descriptive function of language and verification, critical rationalism is the product of fallibilism and falsification. Justification explains and describes the bases of true knowledge that is void of errors and epistemological imperfections while critical rationalism searches for errors with the hope of promoting the growth of knowledge. Popper differentiates between the two attitudes as he affirms that:

> *The question about the sources of our knowledge can be replace in a similar way. It has always been asked in the spirit of: "what are the best sources of knowledge – the most reliable ones, those which will not lead us into error, and those to which we can and must learn, in case of doubt as the last court appeal of appeal?" I propose to assume, instead, that no such ideal sources exist – no more than ideal rulers – and that all "sources" are liable to lead us into error at times. And I propose to replace therefore, the question of the sources of our knowledge by the entirely different question: "How can we hope to detect and eliminate error."*[603]

From the above, it is evident that we will not only question the meaning of critical rationalism but we will also examine the fallibilism as the source of the former. This will lead us to the integration of critical rationalism to natural sciences and social sciences and as the paradigmatic philosophical position as opposed to verificationism and justificationism. This holistic application of criticism will constitute what Bartleg refers to as, 'Popper's Pancritical Rationalism'.

Critical discussion originates from fallibilism. Popper, in this way describes it as "fundamentally an attitude of admitting that 'I may be wrong and you may be right, and by effort, we may get closer to the truth."[604] The central problem on the status of fallibilism and how it influences our epistemological attitude, is Popper's defence of knowledge without the knowing subject. If scientific knowledge is object on grounds that it is void of our subjectivities then how can fallibilism influence the growth of knowledge. This question is pertinent only if fallibilism is more psychological than epistemological. In Parsusniková's and Cohen's edition of Rethinking Popper, the two types of fallbilism are illustrated. Firstly, fallibilism in Popper can be situated psychologically because: "Humans are fallible. It is part of human condition that are err, that we make mistakes and there are short of being perfect. We may fail while perceiving but also while

[603]Karl Popper, *Conjectures and Refutations*, p. 25.
[604]Karl Popper, *The Open Society and Its Enemies, The High Tide of Proplosy: Hegel, Marx and the After Math*, vol. III, London, Routledge, 1966, p. 213.

communicating, arguing, reasoning, criticising."[605] Thus, primafacie, fallibilism appears to be psychological for making mistakes in the state of human minds and such mistakes are externalised in language and communication and it is identifiable in the various communicational forms like argumentation and criticism. This is presented by Popper in his thesis of trial and error elimination disposition of organisms in his evolutionary view of knowing. Secondly, fallibilism is equally epistemological because "knowledge is fallible, especially when Popper talks of conjectural, hypothetical or tentative nature of scientific theories."[606]

It should be noted that in the context of critical discussion, error does not originate from the individuals. Given that every observation is problem-laden and those problems arise when anticipations and expectations are disappointed by observation, leading to the formation of theories in form of conjectures and hypotheses, it can thus be admitted that fallibilism is essentially epistemological. This coupled with the fact that observation is not fundamental in theory formation, implies that fallibility should be attributed to theories, propositions which are fallible entities of the third world; the world of objective knowledge. These fallible entities of the third world are defended by Popper as he insists that rational discussion does not involve the criticism of people but of the critique of their arguments. That is why he asserts that: "It leads to the view that we must recognise everyone with whom we communicate as a potential source of argument and of reasonable information. It thus establishes what we may call the rational unity of mankind."[607] Thus, 'rational unity of mankind' is not equivalent to Hegel's rationalism where individuals are absorbed by the absolutism of the societal incarnation of reason. It does not also imply collectivism as Popper holds that: "in speaking of a social theory of reason, I mean more precisely that the theory is an interpersonal one and never that it is a collectivist theory."[608] Thus, reason is not also a faculty that disproportionately dispose men as Plato claims. That is, there are no humans that are more rational than others for, "clever men may be very unreasonable"[609] especially when they are entangled in prejudices. The claim of the degrees of reasoning thus is a form of authoritarianism and cannot be reconcile with rationalism whose critical status is only determined by the production and listening of arguments. After examining the link between fallibilism and critical rationalism, Popper, defines the latter as he affirms that:

> *« Quand je parle de rationalisme, je n'ai pas en vue une théorie philosophique, comme celle de Descartes par exemple, pas plus d'ailleurs que la croyance, si peu raisonnable,*

[605]Zusanna Parusnikovná and Robert S. Cohen, *Rethinking Popper*, London, Springer, 2009, p. 72.
[606]*Idem.*
[607]Karl Popper, *op. cit*., p. 213.
[608]*Ibid*., p. 214.
[609]*Idem.*

selon la qu'elle l'homme n'est qu'un par être de raison. Ce que j'entends, lorsque je parle de la raison ou de rationalisme, ce n'est rien d'autre que la conviction que nous pouvons apprendre par la critique de nos faits et de nos erreurs, et, en particulier, par la critique des autres aussi bien que par l'autocritique.» [610]

This implies that the aim of criticism is the desire to promote the growth of knowledge. This is not the case with justificationism which is characterised by the hatred of error. Justification is not only manifest in logical positivism but it is characteristics of optimistic epistemologists.[611] In Aristotle's philosophy, the causes are used to justify the reality and the reason is guided by rigorous rules that he in the avoidance of fallacies. In Francis Bacon's theory of logic, induction is the attitude par excellence of scientists and it consists in presenting the world as it is and in the avoidance of idols, in Cartesianism, the scientific mind constitutes in the capacity of the four rules of the method to guard the powers of the mind; that is intuition and deduction against error. In logical positivism, epistemology is given the role of infitesimal analysis of language, to purify it from errors.

A critical rationalist should adopt the Socratic attitude of, 'the only thing I know is that I know nothing'. This has heuristic and pedagogic advantages. Heuristically, it is the best way to evaluate our theories and pedagogically, it is the method par excellence of learning from others.

Given the openness of critical discussion, the problem now is, how do we judge who is more pertinent than the other? And how is such discussion possible without initial common grounds? Poppe resolves this question by projecting disagreement and not agreement as the tool of the growth of knowledge. He thus condemns orthodoxy because "orthodoxy is the death of knowledge, since the growth of knowledge depends entirely on the existence of disagreement."[612] It is true that disagreement leads to strife and violence, which is condemnable, it also leads to discussions, arguments, mutual criticisms on the other hand, which is a positive element. Thus, the condemnable should be avoided for the promotion of the positive element. This is possible in the transition from the war of arms to the war of words. It is in this that Popper holds that: "i suggest

[610] Karl Popper, *Tout Vie Est Résolution de Problèmes*, tome 2, Trad. de Claude Duverney, Paris, éditions Actes Sud, 1994, p. 20. "When I talk of rationalism, I do not have a philosophical theory in view, like that of Descartes and not a less reasonable belief that man is a pure being of reasoning. What I imply when I talk of reason or rationalism, is nothing other than the conviction that we can learn through the critique of facts and our error, in particular, through the critique of others and also through autocritique"; (my translation).
[611]Optimistic epistemologists claim the possibility of attaining the truth through the avoidance of errors.
[612]Karl Popper, *The Myth of Framework*, p. 34.

that the greatest step towards a better and more peaceful world was taken when the war of swords was first supported and later sometimes replaced by the war of words."[613]

Popper condemns the view that people should agree on common points before critical discussion. Such assumption is counterproductive to the growth of knowledge and Popper qualifies it as the 'myth of framework'. Such myth assumes that: "A rational and fruitful discussion is impossible unless the participants share a common framework of basic assumption or, at first, unless they have agreed on such a framework for the purpose of the discussions."[614] The pertinence of our arguments in critical discussion is not in the cogency of our points but in our ability to expand the scope of learning. Popper reiterates on this as he states that:

> *I think that we may say of a discussion that it was the more fruitful, the more the participants were able to learn from it. And this means the more interesting questions and difficulties question they are asked, the more new answers they were induced to think of, the more they were shaken in their opinions and the more they could see things differently after the discussion.*[615]

Thus, fruitful discussions do not arise from common element in individual views but in the gap that exist between them. Since the aim is to promote knowledge through disagreement for, "the greater the gap, the more fruitful the discussion can be."[616] The pertinence of an argument then is not in the provision of new information but in the posing of more complex questions and problems and the more the ceaseless attempt to resolve these problems evolve, the more one becomes cognitively elastic. Critical discussion thus necessarily end up with inconclusive arguments. The most important is the clash of opinions which produces more complex and interesting arguments. It is this clash of different cultures and frameworks that is the engine of civilisations.

Critical discussion does not provide absolute and final solutions to problems given the tentative nature of the truth. It is thus in this light that Popper holds that: "we must not expect any critical discussion of a serious issue, any 'confrontation', to yield quick and final results. Truth is hard to come by it needs both ingenuity in criticizing old theories and ingenuity in the imaginative invention of new theories. This is not only in science, but in all fields."[617] Thus, we do not win at the end of critical discussion, but we advance or knowledge of the problem at hand. While a

[613]*Idem*.
[614]*Ibid*., pp. 34-35.
[615]*Ibid*., pp. 35-36.
[616]*Ibid*., p. 36.
[617]Karl Popper, *The Myth of Framework,* p. 44.

dogmatic approach seeks for justification and victory, critical discussion seeks for the implication of the growth of knowledge. He thus affirms that: "a discussion which you win but which fails to help you to change or clarify your mind at least a little should be regarded as sheer loss."[618]

Popper's critical rationalism does not apply only to natural sciences but to philosophy and social sciences. Popper gives a Kantian connotation to philosophy wherein we do not teach any philosophy as the latter is simply a method. He thus holds that: *« toute rationaliste se doit de dire avec Kant : on n'enseigne pas la philosophie mais en mieux sa pratique, à savoir l'attitude critique. »*[619] Philosophy consists not in the accumulation of knowledge, in the justification of our claims on erecting authorities of justification but in the inter-personal criticism.

Critical rationalism equally has ramifications in political science as well as political philosophy. This is because the kind of social institutions we erect determines our freedom and our exercise of critical rationalism. Thus, "reason like science grows by way of 'mutual criticisms'; the only reasonable way of planning its growth is to develop institutions that safeguard the freedom of criticism, that is, to say freedom of thought."[620] Popper thus differentiates between rational and professional political scientists while rational politicians accept their weakness and are open to criticism, professional politicians practice amateurism and always claim to be on the right. Popper thus asserts that: "for the piecemeal technologists or engineer, these views mean that if the wishes to introduce scientific method into the study of society and into politics, what is needed is the adoption of a critical, and a realisation that trial and error are necessary."[621]

Scientific politicians must be ready to subject their views for criticism and analysis. This goes same with every form of social analysis. It is in this light that Popper criticises democracy by proposing the adoption of "democratic control" which constantly review democracy from regenerating to tyranny. Thus, criticism should not be limited only to social scientists but also to sovereignty. Stefano Gattee in this way affirms that: "we must come to grip with our fallible nature, both in the natural and social sciences. And in both fields we have to face the problem of the limits either of our critical ability or sovereignty. We have to avoid strategies in practice democratic vigilance."[622]

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[618]*Idem.*
[619]Karl Popper, *Toute Vie Est Résolution de Problèmes*, p. 26. "Every rationalist must say with Kant : we do not teach Philosophy but its practice', that is, the critical attitude." (my Translation)
[620]Karl Popper, *The Myth Of Framework*, p. 214.
[621]Karl Popper, *The Myth of Framework*, p. 315.
[622]Stefano Gattei, *op.cit.*, p. 79.

Justification in natural and social sciences appeal to authoritarianism. It is grounded on question such as how do we know? How can our knowledge be adequately justified? Some of the authoritarian answers include the "Bible", "Leader", "intelled", "sense-experience" among others. To political scientific questions like who should rule?, we also have concession to authoritarianism. This is exemplified in answers like "the best", "the wisest", "the people", "the master", among others. Popper however changes the question to "How can we arrange our institutions to get rid of bad rulers or restrict the amount of harm they can do."[623]

The applicability of rational criticism to natural sciences, social sciences and philosophy renders the former to the universal method of all sciences. It is in this light that William Warren Bartleg III, refers to Popper's rationalism as pancritical rationalism. He affirms that pancritical rationalism, "differs from the theories of rationality just rehearsed in that it provides a non-justificational account of rationality. In this account, rationality is unlimited with regards to criticism."[624]

To Bartley, Popper may be interpreted as a fideist for his claim to the unjustifiable faith in reason. However, such fideist attitude is later replaced by falsification. He thus affirms that: "Popper continues to call 'critical rationalism' and which I prefer to call 'comprehensively critical' or 'pancritical rationality', is an attempt to overcome the problem of the limits of rationality by generalising and correcting Popper's original position."[625]

Description goes with justification and criticism leads to non-justification. Rationalism can only be situated in criticism then and he who claims to be a rationalist, must "hold all his positions, criteria, authorities and especially his way of life – open to criticism."[626] Therefore, there is infinity in criticism for it is an endless process. This infinity cannot be linked to the infinite regress in justificationism. This is because "no infinite regress arises since there is no question of justification of anything at all."[627]

[623]Karl Popper, *The Open Society and Its Enemies*, pp. 120-221.
[624]William Warren Bartley, *Evolutionary Epistemology, Rationality and Sociology of Knowledge*, Illinois, open Court, 1987, pp. 220-221.
[625]William Warren Bartley, *Evolutionary Epistemology, Rationality and Sociology of Knowledge* p. 211.
[626]*Ibid*., p. 212.
[627]*Ibid*., p. 213.

5.2. POPPER'S CRITIQUE OF THE INDUCTIVE METHOD OF JUSTIFICATION

As a rationalist, one of the areas where Popper disagreed with classical as well as logical positivists is on the solutions to the problem of induction. Popper appreciates Hume's examination of the problem of induction but does not agree with his solution. After the examination of Hume's view of the problem, Popper offers three solutions to the problem. The first is the defence of conjectural knowledge, the second is the defence of the objective basis of science and the third is a logical solution in which Popper proceeds in the reformulation of the problem. With this, Popper also engages into the critique of the logical positivist views on probability. Infact, popper in a falsifiabilist logic prefers improbability to probability and presents corroboration as the best alternative to probability.

5.2.1. The Trilogy of Popper's Solution to the Problem of Induction

The problem of induction is the first concern of Popper in his early text, *The Logic of Scientific Discovery*. Popper's treatment of this problem is a logical consequence of examination of the problem. This problem is referred to as the Humean problem by him. He thus asserts elsewhere that Hume is to induction, what Taski is to the notion of truth and what Kant is to the problem of demarcation. We are thus going to examine Popper's view of the origin of the problem of induction, his definition of the problem, his appreciation of Humean solution and his triadic response to the problem of induction.

The problem of induction to Popper arises from the conflict between three main theses that undercut Hume's examination of inductive reasoning. In these three theses include:

> *(a) Hume's discovery that it is impossible to justify a law by observation or experiment since it 'transcends experience'. (b) The fact that science proposes and uses laws everywhere and all the time. To this we have to add (c) the principle of empiricism which asserts that in science only observation and experiment may decide upon the acceptance or rejection of scientific statements, including laws.*[628]

To solve the problem of induction, then is to show that there is no conflict between these three theses arising from Hume's treatment of inductive reasoning. That is, if we only accept statements legitimaised by experience (c), but laws exist beyond experience (a) while science needs those laws (b) then we will involve into self-contradictions. That is why the traditional problem of induction as posed by Hume is that of our logical aptitude to justify the future or the

[628]Karl Popper, *Conjectures and Refutations*, p. 54.

unkown, using the past or the known. Popper thus puts the problem in the Humean way as: *« Comment justifier la conviction que le future sera (en grande partie) tel que le passé? Ou, peut être : Quelle justification donner aux inférences inductives. »*[629] In other words, are the number of observational instances sufficient to guarantee our claim of knowledge of the future ?

To appreciate Hume's response to the problem of induction, Popper gives a dualist connotation to the former. Hume's examination of the problem to him is at the same time logical and psychological. That is why he affirms that? *« Le problème logique de Hume est le suivant : Sommes-nous justifiés a raisonner à partir de cas (répétés) autres cas (conclusion) dont nous n'avons pas l'expérience ? »*[630]

Hume's answer to the logical problem of induction is negative, that is, no matter the plethora of observational cases, we can never be rationally justified to draw conclusion on cases we have no experience of. Hume asserts that there is no logical necessity between the observed and the unobserved. Popper agrees with Hume's treatment of the logical aspect of the problem, with his famous illustration of the impossibility of asserting that all swans are white on the basis of observational instances of swans.

Secondly, Hume's view of the problem to Popper, is also psychological. The latter can be posed as, how do individuals arrive at the correction that what we do not yet have experience of, will be like what we have had experience of? It is in other words, the problem of the justification of our predictions and the problem of the origin of regularity in our perception of the world. To Popper, the Humean theses of the problem of induction, that is, the source of our regularity in perceiving the world is: *« à cause de l'usage ou l'habitude, i.e, parce que nous somme conditionés par les répétitions et par le mécarnisme de l'association des idées. »*[631] Popper does not agree with Hume psychological account of regularity. Such psychological account is the product of the bucket theory of the mind. According to the later, widely defended by the empiricist, there is nothing which did not get to the mind through observation. Popper thus is going to discard this empirical psychology, to propose an alternative way of learning, that is, through conjectures and refutations.

[629]Karl Popper, *La Connaissance Objective*, p. 12. "How can justify the conviction that the future (in great part) will be like the past? Or maybe; what justification can we give to inductive inference? (my translation).
[630]*Ibid*., p. 14. "The logical problem of Hume is as follows: Are we justified to reason from cases (repeated) that we have experience to other cases (conclusion) which we do not have experience?"; (my translation).
[631]Karl Popper, *La Connaissance Objective*, p. 14. "due to the custom and habit, i.e., because we are conditioned by repetitions and by the mechanism of the association of ideas"; (my translation).

The logical positivists avoided Hume's critique by asserting that laws are not genuine scientific statements. To Reidienbach and Schlick, they are directives of successful predictions, claiming such, the logical positivists oriented induction into verification, probability and predictions. Popper finds every inductive instance of reasoning as faulty on grounds that "no matter how many instances white swans we may have observed, this does not justify the conclusion that all swans are white"[632] whether it is about inferring the truth of universal statements from experience, or reduction of the truth of the universal statements to the truth of singular statements established from experience by logical positivism, Popper argues that they are all logically untenable. The necessary condition of establishing the truth of inductive inferences is to conceive the principle of induction. That is, "if we want to find a way of justifying inductive inferences we must first of all try to establish a principle of induction. A principle of induction would be a statement with the help of which we could put inductive inferences into logically acceptable form."[633]

If we have to establish the principle of induction, it cannot be a tautological statement given that inductive inference is strictly bound to experience. However, using a synthetic statement as the principle of induction will instead culminate to an infinite regress, since to justify one synthetic statement, we need another of the higher empirical degree to justify the later we need another statement that is higher and we will continue ceaselessly in such empirical cycle. To resolve this problm, Popper will propose the deductive method of testing theories.

Examining the responses of Hume and logical positivism to the traditional problem of induction. Popper resolves the latter in a triadic way. From Hume's inductive psychology, he proposes the conjectural view of learning and knowing, from the psychologism of logical positivism, he will propose the objective empirical bases of science and from the infinite regress of the inductive inferences of logical positivism, Popper illustrates the deductive solution to the problem of induction.

The first response Popper offers to the problem of induction is in his proposal of conjectural knowledge.[634] It is worth recalling that Hume's account of the origin of regularities is psychological. Through the customs and habit of observing one event come before the other, we engage into causal explanation of phenomena. Thus natural laws or regularities between events is

[632]Karl Popper, *op.cit*., p. 4.
[633]*Idem*.
[634]Chapter one of « La Connaissance Objective » (objective knowledge) is « Connaissance Conjecturale: Ma solution au problème de l'induction ». "Conjectural knowledge my solution to the problem of induction"; (my translation).

found in nature and we can only discover them, through repeated instances of observation. The inductive psychology of Hume makes the individual to be passive as he faithly account for the regularities and learning and behaviour here is influenced solely by the external stimuli. Popper changes the paradigm of the human psychology as he asserts that:

> *I was led by purely logical considerations to replace the psychological theory of induction by the following view. Without waiting passively for repetition to impress or impose regularities upon us, we actively try to interpret it in terms of laws invented by us. Without waiting for premises, we jump to conclusions. These may be discarded later should our observation show that they are wrong.*[635]

Natural theories are therefore not found in the world but are conjectures, invented by man in his interaction with the world. That is, "scientific theories were not digest of observations, but that they were inventions boldly put forward for trials to be eliminated if they clash with observations."[636] The reason behind this paradigm is due to the impossibility of pure observation. Every observation to Popper is problem-laden. He illustrates this with an example he used with his students:

> *Take pencil and paper; carefully observe and write down what you have observed. They asked, what I wanted them to observe. Clearly the instruction, observed is absurd. Observation is always selective. It needs an object; a definite task, an interest, a point of view, a problem.*[637]

Problems logically precede observation because the latter uses the descriptive function of language. Every description makes use of property worlds which show the possible similarity and the classification that exists between things. The attempt to classify things in nature on the other hand is motivated by an interest, a point of view or a definite problem. For instance, when an animal is hungry, it classifies the world mainly into eatable and non-eatable things. Hunger and the need to eat thus precede such observation. In animals such needs determine observation but in scientist, his observation is influenced by his: "theoretical interest, the especial problem under investigation, his conjectures and anticipation, and the theories which he accepts as kind of background: his frame of reference, his horizon of expectation."[638]

These problems arise when our expectations are betrayed by experience. The first expectations are thus apriori to experience. They are unconscious expectations and we only become conscious when they are found to be mistaken. Popper gives the following example to

[635]Karl Popper, *op.cit*., p. 46.
[636]*Idem*.
[637]*Idem.*
[638]Karl Popper, *Conjectures and Refutations,* p. 46.

show how our experience betray our unconscious expectations, leading to problems: "I had several times in my long career: in going down stairs and reading the last step, almost fell, and become aware of the fact that I had unconsciously step, or one last step, than actually existed."[639]

Expectations are thus hypothesis and renders knowledge to be conjectural. As asserted elsewhere in this work, the thesis of conjectural knowledge is grounded on the genetic disposition of animals and humans in form of expectations, which manifest themselves in the quest for proper adaptation to the environment. Learning does not consist in the accumulation of repetition of observation but in eliminating unsuccessful expectations and solution, "more to the level of passing preferences, so that eventually, the successful attempts at the solution appears to be almost the one left."[640] We engage into the elimination of these solution in other to better adapt to the environment. Applying this trial and error elimination to science, Popper deduces four processes which constitutes his psychology. They include: "(1) The old problem (2) the formation of tentative theories (3) attempts at elimination through critical discussion; including experimental testing (4) the new problems that arise from the critical discussion of our theories."[641]

The first problems are pre-scientific and arise from unconscious expectations that are revealed to us only by problems and experience. The second problems are those that arise from scientific theories, when they involve into difficulties during testing. While the old problems are psychological, the new problems are epistemological. The inborn expectations do not translate the thesis of valid apriori Knowledge. Expectations cannot be certified as valid inborn knowledge because given their conjectival nature, they are potential victims of falsification. Popper thus distinguishes the epistemological apriori from the psychological apriori. This is a difference that was not noticed by Kant; that is, the difference between apriori knowledge and apriori way of thinking. It is in this light, that he asserts that: "we are born with expectations; with knowledge which although not valid or a priori, is psychologically or genetically apriori that is, prior to all observational experience. One of the most important expectation is the expectation of regularity."[642] Two implications arise here; the transition from inductive to deductive psychology and the conception of natural laws as product of the human mind. This is why Geoffrey Stokes affirms that:

> *Popper outlined a deductivist psychology as possible alternative to inductivism. In his presentation he started out with an idea from Ernest Mach, who had explained the origin*

[639]Karl Popper, *A World of Propensities*, Bristol, Thoemmes Press, 1999, pp. 31-32.
[640]Karl Popper, *All Life Is Problem Solving*, *op.cit*., p. 3.
[641]*Ibid*., p. 14.
[642]Karl Popper, *Conjectures and Refutations*, p. 47.

of concepts on biological basis, more precisely as a result of the interactive relationship between perception and reaction.[643]

The external stimuli may provoke the organism's behaviour or but purposeful behaviour like the search for regularities depends entirely on the organism or the reacting agent. The expectation of regularities may be considered not only psychological but also logical because they ground the knowledge of the environment. However, the logicality of the innatism of the expectations of regularity is thwarted by the fact that "we can easily construct an environment) it will be a lethal one) which compared with our ordinary environment is so chaotic that we completely fail to find regularities."[644]

Laws of nature are thus conjectures. With this conjectural account of thinking and knowledge acquisition, Popper declares that the problem of induction has no impact in the psychology of scientific knowledge: he thus asserts that: "induction, that is, inference based on mere observations, is a myth. It is neither a psychological fact, nor a fact of ordinary life, nor a scientific procedure."[645]

The second response of Popper to the problem of induction is in this conception of the conjectural and objective nature of the empirical bases of science. Popper rejects the logical positivists view that science is based on unequivocally certain statements. Carnap and Neurath claim that protocol statement are irrefutable basis of science. Popper agrees that empirical statements are fundamental but that they are objective and not subjective for they describe objective facts and they are also conjectural in nature. It is in this light that Popper dismisses the question of the basis of science from scientific rationality, replacing it with the question of the testability of statements. That is, the question of scientific methodology should not be that of the base (protocol statement) but that of questioning, "how do we test statements by their deductive consequences."[646] This follows that the deductive testing of theories examine above is an alternative to the inductive method of scientific rationality.

The third moment of Popper's solution to the problem of induction is logical. He proceeds in a deductive way, after a reformulation of the problem to solve it. This reformulation is aimed at

[643]Jeremy Shearmur, *op.cit*., p. 70.
[644]Karl Popper, *op.cit*., p. 48.
[645]*Ibid*., p. 53.
[646]Karl Popper, *The Logic of Scientific Discovery*, pp. 79-80.

moving from the subjectivist to the objective examination of the problem. Popper realises this as he affirms that :

> *« Au lieu de parler d'une 'conviction' je dis 'affirmation' ou encore 'théorie explicative', et au lieu d'une 'impression', je parle de 'compte rendu d'une observation' ou 'énoncé expérimental', et en place de 'justification d'une conviction', je dirai 'justification' de la prétention qu'une théorie est vraie. »*[647]

With this objective interpretation, the problem of induction becomes the quest to know , "can the claim that an explanatory theory is true be justified by assuming the truth of certain test statements?"[648] Popper's response to this question is negative just like Hume's. No matter the number of test statements we construe, they can never establish the truth of a theory. In this new formulation, theories simply replace situation we do not yet have experience of while phenomena we have experience become test statements. The truth of theories or universal statements then cannot be deduced from the truth test statements.

In the second reformulation of the problem, Popper changes "a theory is" to a "theory is true or false. He thus reformulates the problem in the following words:

> *« le peut-on justifier la prétention qu'une théorie explicative universelle est exacte ou qu'elle est fausse par des 'raison, empiriques' i.e, le fait d'accepter l'exactitude d'énoncés expérimentaux nous permet-il de dire qu'une théorie explicative universelle est exacte ou qu'elle est fausse ? »*[649]

Popper's response to the second formulation of the problem of induction is positive. This is when test statements are true, the theory is false and when test statements are false, the theory is tentatively accepted.

The third reformulation of the problem arises from the need to choose between competing theories. The third formulation, Popper affirms that: *« L3 ne préférence pour certaines théories universelles concurrentes plutôt que d'autres d'après le critère d'exactitude ou de fausseté, peut-elle jamais être justifier pas de telles 'raisons empiriques. »*[650] Popper's answer here is also

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[647] Karl Popper, *La Connaissance Objective*, p. 16. "Instead of talking of a 'conviction', I say 'affirmation' or again 'explanatory theory' and instead of impression, I talk of 'the account of observation' or 'test statement' and in the place of 'justification of a conviction' I will talk of 'justification of the claim that a theory is true"; (my translation).
[648] Michel Ter Hark, Popper, Otto Selz, and the rise of evolutionary epistemology, Cambridge, Cambridge University Press, 2004, p. 7.
[649] Karl Popper, *Connaissance Objective*, p. 17. "Can we justify the claim that a universal explanatory theory is true or false using 'empirical reasons', i.e., the acceptance of the truthfulness of test statement, permit us to say whether a universal explanatory theory is true or false"; (my translation).
[650] *Ibid*., p. 17. "L3 can a preference of certain competing universal theories instead of others be justified by 'empirical reasons', following the criterion of truth and falsity"; (my translation).

affirmative. This is not always because just few test statements may reject few theories. However, preference should be given the best theories that resist testing.

From the three reformulations, Popper implies that the problem of induction is that of the validity, truth and falsity of universal statements on the using test statements. This is a deductive solution to the problem of induction because theories are tested using the modus tollens techniques. When a theory divides itself to two classes of basic statements; those that describe the theory and those that falsify the theory (test statement). When the test statements are true, we deduce the falsity of the theory. Thus, the problem of induction is akin to that of demarcation. Popper insists on this deductive resolution of the problem as he affirms that: *« mes formulations de L1, L2, L3, et les solutions que j'y apporte, entrent entièrement dans le champ de la logique déductive. »*[651]

The originality of Popper's solution to the problem of induction resides in the following. It breaks away from the subjectivity of Hume and logical positivism, giving an objective treatment of the problem. It presents laws of nature as conjectures and hypothesis. It remains within the scope of empiricism for theories are tested using statement; observational statements. It is also grounded on the critical method of testing theories. This is why Popper thus prides himself to have resolved the problem of induction. He thus opens his discussion on objective knowledge with the affirmation: *« je pense avoir résolu en problème philosophique majeur : le problème de l'induction. »*[652] We thus speak of the trilogy of Popper's solutions because he proceeds in three stages and offers three responses to his reformations of the problems.

5.2.2. The Measure of Testability; Corroboration as the Best Alternative to Probability

Popper's introduction of the notion of corroboration in *The Logic of scientific Discovery*, which his later discussed in *Objective knowledge*, has two objectives in the two texts. Primo, the notion of corroboration in the *Logic of Scientific Discovery*, was to avoid the usage of the notion of truth, which was controversial in his fallibilist methodology. That is why is affirms that: "in the logic of science here outlined it is possible to avoid using the concepts of 'true' and 'false'."[653] It was until Taski's influence that Popper conveniently integrated the notion of truth in his epistemology. Faced with the difficulties of establishing the truth of universal statements, from

[651]*Ibid*., p. 23. "My formulations L1, L2, L3 and the solutions that I give fall within the field of deductive logic." (my translation).
[652]Karl Popper, *Connaissance Objective*, p. 11. "I think I have solved the major philoaophical problem, the problem of induction." (My translation).
[653]Karl Popper, *The Logic of Scientific Discovery, op.cit*., 273.

particular statements, the logical positivists did not only adopt the inductive method of justification, but they also use the probability method of prediction. Popper's second reason for coning the notion of corroboration is to illustrate the absurdity of probability logic. That is why he affirms that: *« J'ai originellement introduit l'idée de corroboration, ou 'degré de corroboration', dans le but de montrer clairement que toute théorie probabiliste de la préférence (et donc toute théorie probabiliste l'induction) est absurde. »*[654] To the logical positivists, the epistemological strength of a theory is determined by the number of confirmative empirical evidences from which it can be justified. Given the lack of certainty in inductive inferences, the logical positivist introduce the notion of probability; as a measure of certitude which proves the magnitude of the empirical evidence of a theory.

Corroboration is not a truth value but the measure of theory's resistance to testability. He thus defines it by affirming that, "a theory is 'corroborated' so long as it stands up to these tests."[655] It thus evaluates the fitness of a theory to survive testability. The appraisal of a theory's degree of corroboration is determined by the notion comparability and incompatibility. In fact, "we regard incompatibility as falsification of a theory. But compatibility alone must not make us attribute the theory a positive degree of corroboration. The mere fact that a theory has not yet been falsified can obviously not be regarded as sufficient."[656]

Two implications arise here; the procedure of the mechanisms of compatibility and incompatibility on one hand, and its limitation on the other hand. When basic statements are incompatible with the theory, the latter is falsified and when there is compatibility, the theory is tentatively accepted. However, this condition is not sufficient because one can construct even metaphysical theories in a way to make them compatible with basic statements. Thus defining the procedure of corroboration using the mechanisms of compatibility and incompatibility is not enough. It is in this regard that Popper defines corroboration by making concessions to falsification. He thus affirms that: "a theory is to be accorded a positive degree of corroboration if it is compatible with accepted statements and if in addition, a non-empty sub-class of these basic statements is derivable from the theory in conjunction with the other accepted basic statements."[657]

[654] Karl Popper, *op.cit.*, p. 28. "I originally introduce the idea of corroboration, where the 'degree of corroboration', with the aim of clearly showing that all probabilist theory of preference (and thus every probabilist theory of induction) is absurd"; (my translation).
[655]Karl Popper, *Logic of Scientific Discovery*, p. 82.
[656]Karl Popper, *Logic of Scientific Discovery*, p. 264.
[657]*Ibid*., p. 265.

This introduces falsification into corroboration. The theory should not only be compatible but it must have two class of basic statements; those that discourse the theory and those that contradict the theory. A non-falsifiable theory then can not be accorded a positive degree of corroboration. In other to proceed in the non-probabilist evaluation of the degree of the fitness of the theory, Popper proposes beyond the numerical calculation of the instances of corroboration. It is not just the number of corroboration instances but the severity of the test that determines the degree of corroboration. This severity is determined by the universality of the hypothesis under testing. That is ,"the degree of corroboration of a theory which has the higher degree of universality can thus be greater than that of a theory which has the lower degree of universality."[658]

When a theory has a high degree of universality it, asserts more facts and thus has high propensity to be tested. It is also favoured to less universal ones because it can be applied and evaluated into as many fields as possible. High degree of corroboration, is also influenced by the simplicity and degree of precision of a theory. The more precised a theory is, the more resistant it will in the context of testing. As such "one of the reasons why we do not accord positive degree of corroboration to the typical prophecies of palmists and soothsayers is that their predictions are so cautious and imprecise that their logical probability of being correct is extremely high."[659]

Theories do not have fixed values of corroboration. The corroboration of yesterday is not the same like that of today and the latter does not determine the corroboration of the future. Corroboration is thus" a critical report on the quality of past performance: it could not be used to predict future performance."[660] A highly corroborated theory thus shows but a momentary highly power of explanation and a momentary symmetry with experience. That is why Stefano Gattei affirms that: "corroboration only shows how well a theory has stood up to the tests up to a certain moment of time, it does not indicate how well they will face in the future, since it might fail the very next test."[661]

This relativisation of corroboration does not betray the objective appraisal of theories. The first corroboration is the most decisive one because further corroboration only increase the degree just slightly. The sharp increase in the degree of corroborations is however possible only if the new instances of testability are new. That is, if "these new instances are very different from the

[658]*Ibid*., p. 268.
[659]*Idem*.
[660]Karl Popper, *Unended Quest,* p. 117.
[661]Arthur Schlick, *Philosophy Of Karl Popper,* p. 84.

earlier ones, that is, if they corroborate the theory in a new field of application."[662] Popper proposes some principles of corroboratability. For instance, we should not continue to accord positive degree of corroboration to theories that have been intersubjectively tested. Intersubjective testing is the objective way of proving theories through rational discussion. When a theory is refuted objectively, it looses its corroborative strength. In the second rules can be expressed as: "The addition of new statements to set of accepted basic statements and the performance of new tests might change a corroborative appraisal, replacing a positive degree of corroboration by a degree by a negative one."[663]

Corroboration has the merit of rendering the growth of knowledge possible. Given that, "the degree of corroboration of a theory is a rational grounds to practice"[664], it helps in the evaluation theories. In other words, "we can sometimes justify one preference for another, for example, if it degree of corroboration is greater."[665] The secondly, it is not only the superseding of a theory by another but also through the highly corroborated theory's embodiment of the explanatory content and power of the less corroborated theory. That is:

> *By demanding that the superseding theory 'contain' the older (superseded) theory, Popper secures deductive relationship between the latter and the former while describing the advancement of science as a progressive movement from theories of lesser degree of universality to the theories of higher degree of universality.*[666]

Corroboration is thus an essential feature of Popper's methodology of science. It translates falsification in the sense that if the theory b, (Tb) has a high degree of corroboration than theory a (Ta) either Ta has resisted more tests that Ta in the same field of application or the explanatory of power of Tb contains that of Ta. Thus, Ta is falsified on the basis of the tests it has failed. However, even if Ta and Tb have resisted the same number of test, the universality of Tb makes it preferable to Ta since Tb has the largest field of application. In either of these two cases, the less corroborated theory is falsified.

Another merit of corroboration is that it is a source of in the falsifibilist rationality that is taxed by others as a sceptical approach to the understanding of science. That is why Stefano Gattei affirms that: "corroboration thus is neither truth nor a truth value. It simply evaluates the relationship between theories and basic statements. A statement can have as many 'true', 'false'

[662]Karl Popper, *The Logic of Scientific Discovery*, p. 268.
[663]Athur Schlick, *op.cit*., p. 89.
[664]Karl Popper, *Unended Quest*, p. 118.
[665]*Idem*.
[666]Athur Schlick, *op.cit*., p. 90.

or 'correct' values in as many corroborative instances as possible. That is why Popper asserts that: "Corroboration is therefore not a 'truth value', that is, it cannot be placed on a par with the concept 'true' and 'false' for to one and the same statement there may be many number of different corroboration values of which indeed all can be 'correct' or 'true' at the same time."[667]

The most critical moment of our examination of Popper's notion of corroboration is his critique of probability and the projection of corroboration as the best alternative. The basic of this critique is the consideration of the informative content of the informative content as the determination. This is because the more a theory says, the more the number of test are and the more it is corroborated. Thus, corroboration is closer to improbability then probability because the former has a higher informative content and thus can be evaluated in testability. Popper in this light affirms:

> *« Ma théorie de la préférence n'a rien à voir avec une préférence accordée à l'hypothèse 'la plus probable'. Au contraire j'ai montré que la possibilité de tester une théorie croît et décroît avec son contenu informatif, et donc son improbabilité (au sens ou calcul des probabilités l'entendent). Donc, hypothèse 'meilleure' ou 'préférable' sera, le plus souvent, la plus improbable. »*[668]

Logical probability focuses on the search for the truth with no emphasis on the content. Probability is based on greater extension. They are statements of singular observational instances but corroboration deals with theories and their relationships with their sub-class basic statements: Popper thus affirms that: "logical probability represents the idea of approaching logical certainty, or tautological certainty, or tautological truth through gradual diminution of information content."[669]

The second critique of probability by Popper is on its justificationism tendencies. Probability searches for certainty. It preserves observational statement in other to carry out predictions. To Popper, such approach cannot lead to the progress of knowledge and thus the negativist side of corroboration makes it a sound technique to assure the growth of knowledge. Popper thus asserts that:

> *« La différence fondamentale entre mon approche et celle que j'ai qualifié voici déjà longtemps inductiviste est que je mets l'accent sur des arguments négatifs ou contre*

[667]Karl Popper, *The Logic of Scientific Discovery*, p. 275.
[668] Karl Popper, *La Connaissance Objective*, p. 28. "My theory of preference has nothing to do with preference accorded to the most probable hypothesis. On the contrary, I showed that the possibility of testing a theory increases and decreases with its informative content and thus its improbability. (In the sense of the calculation of probability). Thus, the best or the must preferable hypotheses will be the most improbable"; (my translation).
[669]Karl Popper, *Conjectures and Refutations*, p. 237.

exemples, réfutations et tentatives de réfutation – bref, sur la critique – alors que l'inductiviste insiste sur des 'cas positifs'. »[670]

Corroboration evaluates the power of the theory to resist negative instances of refutation or testability. A theory that cannot be refuted has no corroborative value. Induction and probability on the other hand attempts to measure the degree of verification, using confirmative and positive instances. Corroboration thus assures vensimitude. That is, the more the theory resist testing, the more approximate the truth.

Finally, Popper's notion of corroboration is a better alternative to probability because while the former creates hop to researchers, probability leads to scepticism and to infinite regress is we try to establish the principle of probabilistic predictions. It is in this light that Stefano Gattei affirms that: "Corroboration he now says is essential to science, since it provides an encouragement to our researchers, should be not only capable of being refuted but it should not be refuted too soon. We want to be assured that knowledge grows."[671]

This is a sound defence of Popper's methodology from those who assert that it is sceptical in the context of application. Scientific rationality is no more based on conjectures and refutation only but on conjectures, corroboration and refutations.

5.3. POPPER'S OBJECTIVE AND EVOLUTIONARY CONCEPTIONS OF SCIENTIFIC TRUTH

Popper develops the objective theory of scientific truth as opposed to the subjective theories of classical epistemologists and logical positivists. In the first place, we will unveil Popper's critique of subjective theories of knowledge such as the evident theories of Descartes and Bacon, the coherency theory of Otto Neurath and the theory of pragmatism. Poppers objective theory of knowledge arises from his revalorisation of the correspondence theory of the truth by Taski. Infact, it is in the invention of the notion of meta-language that popper finds himself licenced to talk of truth as correspondence. Given that absolute correspondence is impossible, Popper develops the idea of verisimilitude which measure the degree of correspondence and the closeness of the theory

[670]Karl Popper, *op.cit*., p. 31. "The fundamental difference between my approach and that which I have qualified as inductivist is that I lay emphasis on negative examples such as negative examples or counter examples, refutations and attempts of refutations, briefly, on critique – while the inductivist insist on the 'positive cases"; (my translation).
[671]Stefano Gattei, *op.cit*., p. 42.

to the truth. These tenets of popper's theories of objective and evolutionary truths constitute the vector of our reflections in this sub-chapter.

5.3.1. The Critique of the Subjective Theories of Truth and the Defence of the Objectivity of Tarski's Correspondence Theory

In Karl Popper's early writings like *The Logic of scientific Discovery*, he does not pay attention to the notion of truth. This is partly because truth as conceived before him contradicts his fallibilist approach to scientific rationality and also because the basic motivation of his scientific methodology has always been that of reflecting on the possibility of the growth of knowledge. This aversion for truth was changed by Taski's correspondence theory of truth, ordered possible by his development of the notion of metalanguage. This is why Popper asserts that:

> *All this was changed by Tarski's theory of truth and of the correspondence of the statements with the facts. Taski's greatest achievement, and the real significance of his theory for the philosophy of empirical sciences is that he rehabilitated the correspondence theory of absolute or objective truth which had become suspect. He vindicated the free use of the intuitive idea of truth as correspondence to facts.*[672]

Before examining the merits of Tarskian correspondence theory of truth and how it influenced Popper, it is necessary to give a synoptic presentation of the subjective theories of truth and Popper's theories of truth to Popper include:

> *The coherence theory which mistakes consistency for truth, the evidence theory which mistakes "known to be true" for true, and the pragmatic or instrumentalist theory which mistakes usefulness for truth. These are all subjective theories of truth in contradiction to Tarski's objective theory.*[673]

The evident theory of scientific truth is associated to Francis Bacon and Rene Descartes. They both claim that the truth is hidden from the knowing subject and once it is revealed, every human can have the power to discern it and distinguish it from what is false. The Cartesian approach is grounded on the four infallible rules; evidence, analysis, synthesis and enumeration. These rules guide the intuitive and the deductive powers of the mind to attain certainty. Descartes also purports clarity and distinctness as the criteria of the truth as he affirms that:

> *But do I not therefore also know what is required in order for me to be certain of something? For in this first act of knowledge there is nothing other than clear and distinct perception of what I affirm to be the case; and this certainty would be insufficient to make me certain of the truth of the matter, it could ever come to pass that something I perceived*

[672]Karl Popper, *Conjectures and Refutations*, p. 223.
[673]Karl Popper, *Conjectures and Refutations*, p. 225.

so clearly and distinctly was false. And therefore, I seem already to be able to lay down as a general rule, that everything I clearly and distinctly perceived is true.[674]

Intuitively, Descartes establishes the evidence of the cogito and the clarity and distinctness of the latter give Descartes, the licence to establish clarity and distinctness as the criteria of certitude.

Francis Bacon equally develops the evidence theory of truth which consists in ridding ourselves off idols or prejudices, so as to make an objective interpretation of nature. Through induction and the purification of the mind from prejudices it is possible to attain the truth. Bacon thus asserts that: "Man, being nature's servant and interpreter, is limited in what he do and understand by what he has observed of the course of nature – directly observing it or inferring things from what he observed. Beyond that, he doesn't know anything and can't do anything."[675]

Through passive interpretation of nature then, the truth manifests itself. Descartes does not only point at the identification of what is known to be true now as truth, but he equally criticises the infallible methodology of the truth manifest theories. That is why he affirms that:

By the doctrine that the truth is manifest I mean, you will recall, the optimistic view that truth, if put before us naked, is always recognisable as truth. Thus truth, if it does not reveal itself, has only to be unveiled, or discovered. Once this is done, there is no need for further argument. We have been given eyes to see the truth, and the "natural light" of reason to see it by. This doctrine is at the heart of the teaching of both Descartes and Bacon. Descartes on the important theory of the veracitas dú what could be clearly and distinctively seen to be true must indeed by true. For otherwise God would be deceiving us. Thus, the truthfulness of God must make truth manifest.[676]

Descartes reason for adopting the criteria of clarity and distinctness is grounded on the perfection of God. God then is the guarantor of truth. Bacon's version resides in nature for scientificity to him consists in the passive reading of nature. Popper rejects the evident truth theory because of its authoritarianism which breeds dogmatism that is resistant to criticism. That is why he affirms that:

Yet the theory that the truth is manifest not only breeds fanatics possessed by the conviction that all those who do not see the manifest truth must be possessed by the devil but it may also lead though perhaps less directly than does a pessimistic epistemology of authoritarianism.[677]

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[674]Rene Descartes, *Meditations on First Philosophy* (1641), trans. Michaeil Moriarty, New York, Oxford University Press, 2008, p. 25.
[675]Francis Bacon, *Novus Organum*, (1620) trans. Jonathan Bennett, Cambridge, Cambridge University Press, 2002, p. 4.
[676]Karl Popper, "On the Sources of Knowledge and Ignorance", in *International Studies In Philosophy Of Science*, vol. 20, no. 2, London, Oxford University Press, 1966, pp. 185-213, p. 187.
[677]*Ibid*., p. 190.

The authoritarian character of the Cartesian logic is evident in the dictatorial nature of the rules. Projecting God as the guarantor of truths since the knowing subject is victimised by doubting, Descartes engages into the ontological installation of God as a perfect Being and the source of the indubitable truth. In the same line of reflection, Bacon uses the authority of the senses or observation as the perfect instrument of interpreting nature. The truth evident method thus is dictatorial and is mutilating to objectivity, which is guaranteed by intersubjective criticism. Popper thus criticises the authoritative, dogmatic and subjective nature of the truth-evident theory as he insists that "if we respect truth, we must search for it by persistently searching for our errors, by infatigable rational criticism and self-criticism."[678]

The second subjective theory of truth that Popper criticises is pragmatism. Pragmatism is the philosophical theory that attempts to link thinking and action. In his theory of meaning, Charles Sanders Pierre affirms that the meaning and truthfulness of theory is deduced from its relationship with action. William James also asserts that the veracity of a theory depends on it "cash value". Thus, the central question in pragmatism is; "what concrete difference will it being truth make in any one's life?"[679] Modern pragmatists like Rorty and Pietmam, have simply expounded on the status of belief and its relationship with human attitudes, emotion and needs. Thus, pragmatism " is the idea that belief in truth on one hand must have a close connection with success in action on the other hand."[680] Popper criticises the pragmatist approach because usefulness as not synonymous to truth. As for the coherency theory of truth developed in the first part of the work, Popper argues that it mistakes consistency for truth and for the verificationists criterion of truth, Popper ignores it because of the problem of infinite regress that characterises the inductive method. The above theories are subjective thus because they consider personal beliefs, convictions or circumstantial instances of truth as truth. In this way, Popper affirms that:

> *They are subjective in the sense that they all stem from fundamental subjectivist positions which a special kind of knowledge only as a special kind of mental state, or as a disposition or as a special kind of belief, characterised, for example by its history or its relations to other beliefs.*[681]

The correspondence theory of truth that Karl Popper revives following Tarski's influence can be reduced to the following question and answer "when is an assertion, or a proposition, or a statement on a theory or a belief true? The answer is; an assertion is true if it corresponds or agrees

[678] *Idem*.
[679] Samuel Stumpf and James Frieser, *Socrates to Sartre, Beyond The History of Philosophy*, 8th ed., New York, MCgraw Inc., 2003, p. 399.
[680] Simon Blackburn, *op.cit*., p. 286.
[681] Karl Popper, *Conjectures and Refutations*, p. 225.

with the facts."[682] The logical problem posed by this theory of truth is, how are we certain of such correspondence. It is Tarski who came up with the logical revolution that made Popper to adopt the correspondence theory.

To Emmanuel Malolo Dissaké, the Tarskian revolution is contained in his introduction of the notion of metalanguage. The aim of Tarski, was to avoid the paradoxes of ordinary languages and to resolve the crisis that characterised mathematics in the 20th century. Thus Tarski wanted a theory of truth that is void of inconsistencies. To Tarski, different conceptions of truth have failed because they cannot differentiate between the definition on one hand and the criterion of the truth on the other hand. Malolo Dissaké asserts thus that:

> *« La subtilité qui sous-tend la solution qu'il proposera est la séparation préalable à l'intérieur du problème général, de deux questions particulières, d'une part celle de la définissabilité de vérité, d'autre part celle des procédures de décision ou d'énumération pour la vérité. »*[683]

To Tarski, a definition of truth cannot then contain the criterion of the identification. The criterion of the identification of truth is meta-definitional. Malolo identifies two aspects of this Tarskian revolution; positively it purports for the possibility of truth, thanks to the introduction of the notion of metalanguage. That is why he asserts that: *« Ce qu'on nomme alors le métalangage sémantique est précisément ce qui offre la possibilité d'avoir dans la même énonciation et l'énoncé et sa qualification 'vraie'. »*[684] This negative aspect to Malolo is in the indefinibility of the truth predicate.

The central problem now is, how Popper appropriated Tarski's theory of truth. The problem remains important because the attainment of the truth will seemingly contradict the methodology of falsification. That is why Jean Baudoin affirms that:

> *« La sémantique tarskienne permet aussi à Popper de restaurer le problème de la vérité dans ses droits sans disqualifier pour autant le principe 'faillibiliste' puisqu'il ne s'agit nullement ici de proclamer un critère générale de la vérité mais seulement d'établir les*

[682] Carlos E. Garcia, *op.cit*., p. 174.
[683] Emmanuel Malolo Dissadé, *op.cit.*, p. 115. "The subtlety that undercuts the solution that he will propose will be the previous separation at the heart of the general problem, of the two particular question, on one hand that of the definitionability of truth and on the other hand, that of the procedures of the decision or the enumeration for the truth"; (my translation).
[684] *Idem.* "What is named the semantic metalangugae is precisely what offers the possibility of having the qualification 'truth' in the same pronouncement and statement"; (my translation).

conditions auxquelles une proposition verbalisée peut correspondre à un fait ou à un ensemble faits. »[685]

Thus, the correspondence theory of truth in Popper applies to statements and into to general theories of science. In the Popperian words, truth is synonymous to correspondence. For instance, "(1) The statement or the assertion, 'snow is white' corresponds to the fact if and only if snow is indeed whit. (2) The statement or the assertion 'grass is red' corresponds to facts if and only if grass is indeed red."[686] This correspondence theory is only possible if we make use of a language in which we can speak about statements and facts to which they refer. This is semantic meta-language. On the other hand, there is syntactical meta-language which describes statements without referring to facts. The form of such a semantic meta-language is made up of facts in the object language by either translating them into meta-language or making the object language part of the meta-language and terms denoting the predicates of the first two fundamental expressions.

5.3.2. Verisimilutude: The Logical Pre-eminence of Truth-likeness over Truth in the Tentative Theory of Truth

While the correspondence theory of Popper applies to empirical statements like "snow is white", it is difficult to establish the conclusive correspondence of theories. Consequently, we can ascertain ourselves of the correspondence of statements using the meta-language, "by contrast, theories (i.e. a set of universal statements), in general cannot be true, but can have different degrees of verisimilitude, which means that they are closer or further from the truth."[687]

The critique of the possibility of attaining absolute certitude in science influenced Popper to introduce the notion of verisimilitude in his historical note Popper cites the pre-Socrates as having introduced the notion of verisimilitude.

The notion of verisimilitude is a produce of negativist methodology of falsification and the basic of the tentative theory of truth. Fallibilist scientific rationality supposes the ceaseless construction of conjectures and perpetual attempts to overthrow them. Even when theories resist crucial experiments, they are simply held as tentative truths. That is why Popper asserts that:

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[685] Jean Baudoin, *op.cit*., p. 10. "The Tarskinian semantic also permits Popper to restore the problem of truth in its rights without disqualifying the fallibilist 'principle', since it is not a question of proclaiming a general criterion of truth but to establish the conditions according to which a verbal proposition can correspond to a fact or to an assembly of facts"; (my translation).
[686] Karl Popper, *Conjectures and Refutations*, p. 224.
[687] Carlos E. Garcia, *op.cit*., p. 122.

> *The falsificationists or fallibilists, say roughly speaking that what cannot (at present) in principle be overthrown by criticism is (at present) unworthy of being seriously considered; while what can in principle be so overthrown and yet resists all our critical efforts to do so may quite possibly be false, but is at any rate not unworthy of being seriously considered and perhaps even if being believed – though tentatively.*[688]

This is not the case with positivism given their logic of confirmability. The fallibist, to Popper accept the irrationalist claim that we can not positively provide evidence for the justification of a theory or a belief, but unlike the irrationalists, the fallibilist rationalist goes beyond induction to accept the view that: "The rationality of science lies not in its habit of appealing to empirical evidence in support of dogmas – astrologers do so too – but solely in critical approach: in an attitude which of course involves the critical use."[689]

In the tentative theory of truth, science does not engage in the search for certainty. The strength of a theory is deduced only in the context of the resolution of problems. Thus, the more the theory involves in the resolution of problems, the more it expresses itself to refutation and the more we learn from our mistakes. It is in this light that Popper affirms that:

> *Science, has nothing to do with the quest for certainty or probability or reliability. We are not interested in establishing scientific theories as secure or certain or probable conscious of our fallibility we are only interested in criticising them and testing them, hoping to find out where we are mistaken; of learning from our mistakes and, if we are lucky, of preceeding to better theories.*[690]

After accepting with Tarski that it is logically difficult to establish the criterion of the truth, the truth in the tentative theory becomes a regulatory idea or a standard that theories become better than others when they approximate it. The aim of science is thus truth but not truth that can be attained with absolute certitude. Truth is not even probable but it is improbable and hard to achieve. Expressing the impossibility of absolute certitude Popper insists that:

> *Yet we stress that truth is not the only aim of science. We want more than mere truth: what we look for is interesting truth – truth which is hard to come by. And Natural sciences (as distinct from mathematics) what we look for is truth which has a high degree of explanatory power in the sense which implies that is logically improbable truth.*[691]

It is not then the attainability of the truth that is of great importance to natural science but the relevance of the truth especially in the problem-situation. The central question to evaluate the critical note of the truth then are, does it answer a difficult question? Does it resolve a fertile

[688]Karl Popper, *Conjectures and Refutations,* p. 228.
[689]*Ibid*., p. 229.
[690] Karl Popper, *Conjectures and Refutations,* p. 229.
[691]*Idem.*

problem? It is in responding to these critical question that the conjectures on truth gain their epistemological relevance. This negativist scientific rationality does not culminate to hopeless scepticism because: "finding that our conjecture was false, we shall have learnt much about the truth and shall have got nearer to the truth."[692]

What determines the evaluation of the approximation of a theory to the truth is its content; which can be logical or empirical. Popper differentiates the two by affirming that: "Logical content of a statement or a theory, is the class of all statements which follow logically from a while I have defined empirical content of a as the class of all basic statements which contradicts a."[693]

Thus, there is a fusion of the idea of truth and content. These two give rise to "the idea of a degree of better (or worse) correspondence to truth of greater (or less) Likeness or similarity to the truth; or to use a term already mentioned above (in contradistinction to probability) the idea of (degrees of) verisimilitude."[694]

The logical values true and false are not so relevant but what is important is the degree of the verisimilitude of a theory. Popper cautions that this does not open the doors for multivalent logic because verisimilitude is neither the criterion of truth nor is it to truth value.

Talking of verisimilitude implies content of statement. Given the law of the transmissibility of truth from the premises to the conclusion in deductive reasoning, which is apt for the testing of theories, Popper holds that if, the content of a statement a, let us say a is true, the conclusions will inevitably be true and if it is false then certainty the conclusion is made up of false and true statements. An example of a false premise is, "it always rain on Sundays and the example of a true conclusion can be, 'it rained last Sunday'."

Truth content refers to the true logical consequences deduced from a theory while a falsity content refers to the false logical consequents derived from a theory. The two contents are important in determining the degree of verisimilitude because the latter is drawn from the subtraction of the falsity content from the truth content. Considering theory one t1 and theory two t2, t2 can be considered as being similar to the truth than t1 under two conditions. They is, if; "(a) the truth-content but not the falsity-content of t2 exceeds that of t1 (b) if the falsity content of t1,

[692]*Ibid*., p. 231.
[693]*Ibid*., p. 232.
[694]Karl Popper, *Conjectures and Refutations,* p. 233.

but not its truth-content, exceeds that of t2."[695] It is in this light that Popper formulates the formula for the measure of the degree of verisimitude of theory a, that is, VS (a), as:

$$VS(a) = Ct_T(a) – ctf(a)".$$

The difference between the truth content and the falsity content thus gives the degree of the verisimilitude of a theory. The degree of verisimilitude increases when the truth-content increases and does not when the truth-content decreases. Thus verisimilitude is an approximation to truth and it reasons an objective view given that the truth is simply a standard or a regulatory idea. Thus, Popper asserts that: "our idea of approximation to truth or of verisimilitude has the same objective character and the same ideal or regulatory character as the idea of objective or absolute truth."[696]

The notion of verisimilitude is in tandem with scientific progress because it permits the comparison and selection between competing theories. Theories that approximate better than others are favoured tentatively and those that fail to past crucial tests are replaced. That is why Carlos E. Garcia affirms that: "Popper's notion of verisimilitude would complete the picture because now we can say that science grows by making successively better approximation to the truth."[697] It is thus the measure of the closeness of a conjecture to the truth and therefore, "roughly speaking, the degree of verisimilitude expresses the relative distance to the truth of a (false) statement or a partially false theory."[698] When theories of lower degree of verisimilitude are replaced by those with higher degree, there is scientific progress.

With the notions of truth-content and falsity content, it is easy to compare competing theories, but how do we know that a theory has a higher degree of verisimilitude? Popper responds: "verisimilitude is defined that maximum verisimilitude would be achieved only by a theory which is not only true, but completely comprehensively true: if it corresponds to all facts, as it were and of course to real facts."[699]

But is is such perfect correspondence of a theory to facts to assure maximum verisimilitude possible? Popper responds that it is simply an ideal that is not attainable as he affirms that, "this is of course much more remote and unattainable ideal than a mere correspondence with some facts."[700] Thus, the difference between Tarski's version of correspondence and Popper's view of

[695]*Idem.*
[696]*Idem.*
[697]Carlos E. Garcia, *op.cit.*, p. 122.
[698]*Ibid*., p. 121.
[699]Karl Popper, *op.cit*., p. 234.
[700]*Idem.*

verisimilitude comes out clearly. While theories in verisimilitude are on continuous approximation to the ideal truth, never attaining with certainty, statements in the Tarskian correspondent theory of truth can actually describe facts tentatively, thanks to the meta-language. Scientific rationality applies the notion of higher and lower degree of verisimilitude more than the notion of truth. This is essentially because there is no criterion of truth and:

> *Thus we are not as a rule, able to decide of a statement or a theory whether it is true. Ascertaining truth may be a very difficult business and often a practically impossible one. But the meaningfulness of the term "truth" is affected by this no more than the meaningfulness of the term "father", is affected by any difficulty in ascertaining fatherhood.*[701]

It is thus logically apt not to talk of true theories but of theories which have the higher or lower degree of verisimilitude. Another element of verisimilitude that Popper clarifies is that of the choice between false and refuted theories. If we are faced with the option of dealing only with theories that are already refuted, what logical posture should we adopt? Popper asserts that the fact that theory two t2 passed tests more than theory one t1 in the previous context of experimentation, makes t2 to be preferable to t1. That is:

> *Even after t2 has been refuted its turn, we can still say that it is better that t1, for although both have been shown to be false, the fact that t2 has withstood tests which t1 did not pass maybe a good indication that the falsity content of t1 exceeds that of t2 while its truth content does not.*[702]

Therefore, the difference in falsity content of refuted theories can play a role in their selection and also determine the possible difference in their truth content. This is because the truth-content and falsity-content are inversely related, when one increase, the other decreases and the converse is true. A good illustration of science are those of Newton and Kepler. Popper notes that:

> *Thus Newton's theory allowed us to predict some deviations from Kepler's laws. Its success in the field established that it did not fail in cases which refuted Kepler's: Atleast the now known falsity content of Kepler's theory was not part of Newton's while it was pretty clear the – truth content could not have shrunk since Kepler's theory followed Newton's as a first approximation.*[703]

Newton's dynamics, thought refuted today, is preferential to Kepler's and Galileo. It withstood the tests and crucial experiments that the first two could not. This this implies that Newton's dynamics has a higher truth-content, a lower falsity-content and thus a higher

[701]Karl Popper, *The Myth of Framework*, p. 173.
[702] Karl Popper, *op.cit*., p. 235.
[703]*Idem.*

explanatory power than Galileo and Kepler. In Newton's work, we can peruse a greater extension of Galileo in his definition of the relationship that exists between energy and motion. While Galileo could only determine the laws of gravity and motion on earth, Newton explained further that the force which causes the stone to fall is the same that acts and determines the motion of planets and the moons.

Moreover, the comparison of the degree of verismilutude also permits the overthrow of theories. Verisimitude thus fits into the fallibilist methodology of falsification. It equally permits the tentative acceptance of theories. It is the disparity between the degrees of verisimilitudes, what renders the theory of Einstein to be preferable to that of Newton. Popper in this light affirms that:

> *« La comparabilité intuitive des contenus de la théorie de Newton (N) et de la théorie d'Einstein (F) peut s'établir de manière suivante : (a) à toute questions à laquelle la théorie de Newton donne une réponse au moins aussi précisé, ceci donne le contenu (la mésure du contenue) de N, dans un sens un peu plus large que celui de Tarski : Il est plus petit ou égal à celui de E, (b) il existe des questions auxquelles la théorie d'Einstein E peut donner une réponse, alors que la théorie de Newton N ne peut le faire : Ce ci rend le contenu de N définitivement plus petit que celui de E. »*[704]

This is the critical role of verisimitdue, for it evaluates the strength of competing theories in responding to specific questions and problems. Popper however, differentiates between verisimilitude and probability. The theory or hypotheses with a high degree of verisimilitude is not the most certain, or probable or the true one but the better one or the closest to the truth. Popper differentiates between verisimilitude and probability as he affirms that:

> *Logical probability represents the idea of approaching certainty or tautological truth through a gradual diminution of informative content. Verisimilitude, on the other hand represents the idea of approaching comprehensive truth. It thus combines truth and content while probability combines truth and lack of content.*[705]

Verisimitude connotes relativity which does not make concession to subjectism but which is justified by the view that theories cannot attain absolute truth on one hand and by the view that truth-likeness vary from one theory to another depending on the variations of truth and falsity content.

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[704] Karl Popper, *La Connaissance Objective*, p. 63. "Intuitive comparibility of the contents of the theory of Newton (N) and of the theory of Einstein (E) can be established in the following manner: (a) The theory of Einstein gives a precise answer at least to every question that is answered by the theory of Newton; this gives the content (measure of content) of N, in a larger sense more than that of Tarski; it is smaller or equal to that of E; (b) There are questions to which the theory of Einstein can give answers while the theory of Newton con not: This renders the content of N to be definitely smaller than that of E"; (my translation).

[705]Karl Popper, *op.cit*., p. 237.

CHAPTER SIX

THE METAPHYSICAL BASES OF SCIENCE

In every sphere of the development of science, we are under the sway of metaphysics – that is, untestable-ideas; ideas which not only determine what problems of explanations we shall choose to attack but also of answers we shall consider.[706]

6.1. METAPHYSICAL FOUNDATION OF SCIENTIFIC REALISM

Unlike logical positivists that develop the instrumentalist approach to science, Popper argues that science attains her full nature and functions well within the realist realms. The best interpretation and understanding we can make of science to him should be realist in nature. Popper as developed below will proceed with the critique of instrumentalism and the concomitant defence of scientific realism. Scientific realism as shall be presented is based on metaphysical realism. In the second moment of this reflection will be consecrated on Popper's propensity interpretation of quantum physics. He rejects the subjectivist and instrumentalist interpretation of the Copenhagen interpretation and presents quantum states as propensities or the power to actualise. This is developed below.

6.1.1. The Critique of Instrumentalism and the Defence of Realism

The question of the aim of scientific theories is the centre of conflict between instrumentalism and realism. Positivism is a version of instrumentalism because it argues that scientific theories are simply tools used for predictions. While Russell, Carna, Neurath, do not accept the reality of the external world, Wittgenstein and Schick argue that natural laws are not genuine statements in science but instruments or directives used for the derivation of individual statements. In *Routledge Handbook of scientific Realism,* instrumentalism is thus defined as the view which holds that: "Science is valuable primarily in so far as it is an instrument for making predictions about the observables and scientific discourse about the unobservable is merely an instrument for making predictions concerning the observable."[707]

To instrumentalism, natural laws and theoretical terms are not real. They do not have the semantic scientific status because they have no corresponding states of affair. To positivism, any

[706]Karl Popper, *Unended Quest*, p. 61.
[707] Jamin Asay, Freraz Azhar, Alexander Burd, at el; *The Routledge Handbook of Scientific Realism*, London-New York, Routledge, 2018, p. 84.

attempt to accord meaning to such statements is not scientific on one hand and the assertion of the reality of the external world including the claim that science can provide theories that can give of this mind-independent reality is viewed by logical positivists as making concessions to metaphysics, at the detriment of science. Thus, the logical positivist instrumentalist position is intandem with the anti-metaphysical motivation of their version of scientific rationality.

Before examining Popper's critique of instrumentalism, it is important to restate his definition of the latter. Popper sees instrumentalism as a form of pragmatism which evaluates the theory on the bass of its use. Popper in this way affirms that: "for it is their creed that we should not or cannot aim at 'pure' knowledge or at truth – with our scientific theories. That theories are nothing but instruments – instruments, that is, for prediction and practical application."[708] Scientific theories thus tell us nothing about how the world is. This is because they cannot give us correct and adequate descriptions of the world. To begin his critique of instrumentalism, Popper portrays the inherent confusion between pure science on one hand and applied science within the theory of instrumentalism. He restates the definition of the notion as he asserts that: "instrumentalism can be formulated as the thesis that scientific theories of the so-called 'pure' sciences are nothing but computation rules (or inference rules, of the same character, fundamentally, as the computation rules of the so-called applied sciences."[709]

In this definition, Popper criticises the reduction of pure science to applied science in the instrumentalist orientation of science. There is a great divide between pure theories and technological applications. The manner in which rules of computations are applied is not the same way in which scientific theories are tested. That is why Popper holds that: "the logical relations which may hold between theories and computation rules are not symmetrical."[710] The aim of listing is dual; to refute them and to learn from them. The testing of theories is selective in which they are put into critical experiment. The result of this testing is either the falsification or the corroboration of theories. Instruments on the other hand are designed to be applied and even if the instrument is rejected, it is because it is outdated or has broken. Popper thus affirms that: "An instrument may break down to be sure or it may become outdated. But it hardly makes sense to say that we submit instruments to severest tests, or we can design in order to reject it if it does not stand up to them."[711]

[708]Karl Popper, *The Myth of Framework*, p. 173.
[709]Karl Popper, *Conjectures and Refutations*, p. 110.
[710]*Idem*.
[711]*Ibid*., p. 113.

The asymmetry between pure science and applied science, implicit in instrumentalism, leads to the second moment of Popper's critique of instrumentalism. Instrumentalism kills the scientific methodology of falsification by assigning the instrumental role to theories. Popper holds that: "by neglecting falsification and stressing application, instrumentalism proves to be an obscurantist philosophy."[712] It is only in the search for the refutation of theories that science advances cognitively and practically. Cognitively because we learn from the errors of our theories under experimentation and practically because the superseding of theories by others on the basis of their degrees of corroboration leads to new fields of application.

The third critique of instrumentalism is in its inability to justify the interest of scientists in the search for the truth. In the absence of this justification, instrumentalism engages into sceptical logic of induction and probability with their intrinsic logical insufficiencies. We test theories, by submitting them into crucial experiment, to approximate the truth. Popper critises instrumentalist from their aversion to the truth as he holds that: "instrumentalism is unable to account for the importance to pure science of testing implications of its theories, since it is unable to account for the pure scientist's interest in truth and falsity."[713] When the theories of instrumentalist seem to clash with experience, instead of refuting them, they use ad hoc hypotheses of reinterpret and adopt them. The fourth critique of instrumentalism is that, it does not favour scientific discoveries and inventions. Discoveries are purely conjectural and thus the product of realism and not instrumentalism. Instrumentalism emphasises only on prediction as the aim of science but the orientation given to prediction is epistemologically narrow, according to Popper. Popper identifies two types of predictions that are not distinctly treated by instrumentalism. They include:

> *The productions of events of a kind which is known, such as eclipse or thunder storms on the one hand and on the other hand, the prediction of new kinds of events ("which the physicist calls new effects"), such as the production which led to the discovery of wireless waves or zero point of energy.*[714]

Scientific prediction in instrumentalism concerns only events which are already known. That is, from the known, they predict the unknown. However, such prediction cannot lead to new discoveries because it is based on what is already know. To be able to realise the prediction of new events, science has to approach the world using bold conjectures, which stand the risk of either being falsified or corroborating. Such theories thus, can either be true or false and thus supposes the existence of the mind-independent reality. Instrumentalism makes concessions neither to the

[712]*Karl Popper, Conjectures and Refutations*, p. 113.
[713]*Idem.*
[714]*Ibid.*, p. 117.

mind-independent reality nor to claim of the truth. Thus, instrumentalism cannot guarantee and account for scientific discoveries.

The second phase of our reflection here is consecrated to Popper's defence of realism. It is thus important to review the general meaning of realism, Popper's view of the notion and his arguments in favour of it. According to Steve Clarke and Timothy D. Lyons: "scientific realism involves two key claims. First, science aims primarily at truth. Second, we can justifiably believe that our successful scientific theories achieve or at least approximate this aim."[715]

The above assertion implies that our descriptions can be true and that the truthfulness of these descriptions depends on the extra-linguistic reality. Thus, there is an external world and that truth implies correspondence to this external reality. It is in this light that Steve Clarke and Timothy D. Lyons differentiates between the axiological and the epistemic pillars of scientific realism. The axiological connotation of scientific realism asserts that: "science aims primarily to express true statements about the world."[716] It is thus axiological because scientific inquiry and rationality posit the truth as its value. The epistemic aspect of scientific realism on the other hand holds that "we can be justified in believing that successful scientific theories are (approximately) true."[717] It is epistemic because it has to do with the justification of knowledge, on the basis of the truth. Status Psillos on the other hand goes beyond the axiological and the epistemic pillars by proposing three indicators of scientific realism. The first to him is the metaphysical as he holds that; "(1) The metaphysical stance asserts that the world has a definite and mind-independent natural – kind structure."[718] He lays emphasis on the mind-independent world but insists on the naturality of this world. Thus, the independent world of science is not a transcental or a world of pure ontology but that which can be objectively studied by science through entical rationality and experiment. The second pillar of scientific realism to Psillos is the semantic connotation as he affirms that: "(2) The semantic stance takes scientific theories at face-value, seeing them as truth conditioned descriptions of their intended domain, both observable and the unobservable. Hence, they are capable of being true or false."[719]

The role of scientific theories is to describe and the aim of these descriptions is to attain the truth. The third pillar of scientific realism to him is the epistemic stance which "regards mature

[715]Steve Clarke and Timothy D. Lyons, *Recent Themes In The Philosophy of Science*, Dordreidit, Springer, 2002, p. ix.
[716]*Ibid*., p. x.
[717]*Idem*.
[718]Stattus Psillos, *Scientific Realism, How Science Tracks the Truth*, London, New York, Routledge, 1999, p. xvii.
[719]*Idem*.

and predictively, that is, successful theories as well – confirmed and approximately true of the world. So, the entities posited by them, or at any rate, entities very similar to those posited do inhabit the world."[720] Beside the logical positivists who claim that the unobservable. That is the laws of nature are not genuine statements but directives of pre-direction, the instrumentalism in quantum physics also claim that the unobservables or theoretical files and genes do not exist but are simply instrumental aids to our understanding of the observables. Realism however asserts that if the observables exist, then the unobservable posited by them should exist.

To Karl Popper, realism does not reject the predictive role of theories but he asserts that it also recognises the search for the truth as the aim of science. Popper's methodological superseding of the instrumentalist monolithic claim to prediction and his thesis of scientific realism is captured in the following assertion:

> *We admit, of course that a scientific theory may be applied to all sorts of practical problems. […] and we have no objection to the assertion that all scientific theories are instruments – either actual or potential instruments. But we assert that they are not merely instruments for we assert that we may learn from science something about the structure of our world that scientific theories can offer genuinely satisfying explanations that can be understood and so add our understanding of the world."*[721]

The metaphysical thesis of the mind-independent natural world highlighted by Psillos above is implicit in this assertion by Popper. Our world of science is an objective one whose description is the role of our language. Our knowledge thus is tenable on the basis of quest to know this world, using our language. Popper insists that, "science aims at truth, or at getting nearer to the truth, however, difficult it may be, to approach the truth, even very moderate success."[722]

The first argument in favour of realism is grounded on the universal acceptability of common sense. That is, "Popper appeals to common sense to distinguish between reality and appearance, between surface reality and underlying reality, between kinds of real things."[723] Science to Popper deals with the real world as totality of natural things. They include the concrete, even theoretical objects of physics are real. By common sense, proof thus Popper imply the assertion of realism from the immediate knowledge and awareness of the fact that the various objects of the world such as stones, trees, valleys among others, exist independently of us. This follows that the world continues to exist even when our own existence will come to an end. This is credible because

[720]*Stattus Psillos, Scientific Realism, How Science Tracks the Truth, p. xvii.*
[721]Karl Popper, *The Myth of Framework*, pp. 173 – 174.
[722]*Ibid*., p. 174.
[723] Roberta Corvi, *op.cit.,* p. 80.

people and pass away but they do not die with the world. Therefore, the world, commonsensesically exists independently of us. Any attempt to criticise this view is untenable because it will still be based on another dimension of common sense which to Popper lacks the critical and rational strength as he affirms that all alleged arguments against commonsensical proof are not only philosophical in the derogatory sense of the term but are at the same time, the uncritical acceptance of common sense. That is why he affirms that: *« (a) que le réalisme fait partie du sens commun, et (b) que tous les arguments avances contre lui sont non seulement philosophique au sens le plus péjoratif de ce terme mais encore basée sur une partie du sen commun acceptée de manière non-critique. »*[724] Popper's thesis above is commonly referred to as naive realism. In the view of Steve Clarke and Timothy D. Lyons, the argument or realism on the basis of common sense is the most appealing as: "first, it involves a strident form of naïve realism. If we see and feel a wooden table infront of us, then, it is plain common sense that to believe that a wooden table exists, which we are feeling."[725]

Realism as the appeal to common sense however, does not imply that it can be tested like empirical theories. It is philosophical just like idealism and given the inability to test it, Popper refers to scientific realism as metaphysical realism. That is, why he holds that: *« en raison de son manque (apparent) de testabilité, je préfère quant à moi qualifier le réalisme de 'métaphysique' que de scientifique. »*[726]

The second argument of Karl Popper in favour of realism, is a logical consequence of Taski's influence on his theory of truth. This is based on the claim that theories are descriptions and conjectures. They permit us to approximate the truth. This argument on truth is in tandem with the descriptive and argumentative functions of language. Every discussion and description in science is of facts or the reality. Thus, to criticise realism using language is to imply the descriptive and argumentative function of language. Popper differentiates between real and imaginary descriptions. If the things described happen, then the description is true and if they do not happen, then the description is false. Thus, all genuine description implies realism. He thus asserts that : *« la réfutabilité, le langage, la description, l'argumentation, s'appliquent tous à une certaine réalité ; et s'adressent à un auditoire. Tout ce à présuppose le réalisme. »*[727]

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[724] Karl Popper, *La Connaissance Objective*, p. 50. "(a) That realism is part of common sense and (b) That all arguments advanced against it are not only of this word but also based on the part of commons sense accepted in a non-critical manner"; (my translation).
[725]Steve Clarke and Timothy D. Lyons, *op.cit.*, p. xvi.
[726]Karl Popper, *op.cit.*, p. 50.
[727]*Ibid*., p. 51.

The third argument of Popper's defence for realism states that all physical theories imply realism. Even the most subjective theories of knowledge will be pure dreams and imagination[728] if the knowledge consist in dispositions of adaptation to an objective reality. Popper asserts that: *« La raison en est que notre connaissance subjective même notre connaissance perceptuelle, consiste en dispositions à agir et est donc sorte d'adaptation à l'essai (tentative) à la réalité. »*[729] If there is no reality, then every thing will be dreams. Thus for our language, descriptions, truth and theories to be epistemologically tenable, then they must suppose the existence of the reality.

In the fourth argument in favour of realism, we can convocate the objective method of testability. This method consists in critical discussion of theories and statements. Popper argues that even the basic statements that are used to test theories are not subjective as the logical positivists' claims. Not only are basic statements description of facts but natural laws are also conjectures that can be refuted. The merit of this is that it promotes the growth of knowledge and also account for the success of science. This is somewhat related to the "no miracle" argument of Hilary Putman. This argument is restated by a commentator of Putman as: "the no –miracle-argument notes that if the success of our current scientific theories is not due to the fact that they are true or at least approximately true with respect to what they say about the unobservable, then the success of these theories is a miracle."[730]

Popper does not access the success of theories in terms of the theoretical heritage that is preserved like the actuality of plate tectonics justification of earth quakes and mountainous eruption and the theory of DNA that is envogue since 1970. These positive instances motivates Putman to construct the; "No-miracle-argument". Popper thinks that the success of science can be judged from our ability to learn from our theories, when we falsify them. His proof for the existence of the unobservable can be deduced from his propensity interpretation of quantum physics as seen below.

[728]The Dream argument in Meditation one of Rene Descartes' Meditation on first philosophy. Descartes in this analogy argues that he could be perceiving physical things when in fact they are figments of his imagination and dreams.
[729]Karl Popper, *La Connaissance Objective*, p. 52. "The Reason is that our subjective knowledge, even our perceptual knowledge consist in dispositions to act is and is thus a sort of trial adaptation (tentative) to the reality"; (my translation).
[730]Jamin Asay, Frerez Azhar, Alexander Bird, and others, *op.cit.*, p. 37.

6.1.2. The Propensity Interpretation as an Objective and Realist View of Quantum Mechanics

The greatest revolution in the history of physics was recorded in the 20th century with the advent of quantum physics. This revolution was influenced by Max Plank and Maxwell identification of the difficulties in the macro physical interpretation of the radiation of heat from surfaces. These two physicists noted that bodes release heat in quanta. This did not only lead to the discovery of the microphysical state of an atom but it introduced the notions of uncertainty and reinforced the probabilistic nature of physics. Physics and mathematics that were considered as exact sciences were invaded by uncertainty and imprecision. Marx Jammer describes this revolution in the following words: "Never in history of science has there been a theory which had such profound impact on human thinking as quantum mechanics: nor has there been a theory which scored such specular successes in prediction of such an enormous variety of phenomena."[731]

The first attempt to interpret quantum mechanics was made by the proponents of the Copenhagen school, spearheaded by Niels Bohr and Heisenberg. Popper qualifies their interpretation of quantum physics as subjectivist and instrumentalist. Heisenberg is pivotal in the Copenhagen interpretation of quantum physics because of his principle of uncertainty. That is, "according to Heisenberg's uncertainty relations, every measurement of the position interferes with the measurement of the corresponding component of the momentum."[732] Thus, it is difficult to carry out predictions in quantum states because the measurement of one state like, position alters the status of other states like momentum. The principle of uncertainty implies that of complementarity which holds that to have knowledge of a microphysical state we have to exclude knowledge of the other. Heisenberg in this way holds that: *« l'état est modifié par l'observation d'une propriété déterminée du système de telle sorte qu'une connaissance acquise, par exemple au cours de l'observation antérieures au sujet de la valeur ou de la valeur probable d'une autre propriété est par là même définitivement perdue. »*[733]

This implies that uncertainty and probability of quantum states does not arise from the structure of the atom but from our lack of knowledge of the microphysical states. Louise De Broglie asserts that certainty would have been established in the quantum states if we had full

[731]Marx Jammer, *The Philosophy of Quantum Mechanics*, The Interpretation of Quantum Mechanics in Historical Perspectives, London, John Wiley and Sons INC., 1974, p. v.
[732]Karl Popper, *The Logic Of Scientific Discovery*, p. 213.
[733] Werner Heisenberg, *Philosophie, le manuscrit de 1942*, Paris, Editions du Seuil, trad., de Catherine Chevalley, 1998, p. 302. "The state is modified by the observation of a determined property of a system such that acquired knowledge, for instance during previous observation on the subject of value or of the probable value of a property is by that definitely lost"; (my translation).

knowledge of it. Thus, it is impossible to introduce a law of prediction that can help in the attainment of complete knowledge of quantum states. This is why he asserts that:

> « *On considérait tout naturellement l'apparition des probabilité en physique théorique comme résultat d'une ignorance partielle de l'état, supposé toujours bien déterminé, du monde physique. Je dis 'ignorance partielle', car, si notre ignorance était totale, nous ne pourrions introduire aucune loi utilisable de probabilité et, si notre ignorance était nulle il y aurait certitude et non probabilité. L'introduction d'une loi de probabilité entraîne des incertitudes et ces incertitudes sont d'autant plus grandes que notre ignorance et plus étendue. »*[734]

The Copenhagen interpretation of quantum physics is thus antirealistic, it deprives the observable of their ontological status. With the principle of complementarity, we cannot establish the ontological status of theoretical terms like electrons, protons, waves, etc. the unobservable thus are not real entities but they are tools for the manipulation of the macrophysical realities. To Heisenberg, only classical physics could be understood and quantum physics to him is grounded on uncertainties and probability. Quantum mechanics to them is not than a definite description of the reality. This leads to the notion of the wave and particle duality. Waves do not have any real and independent existence but they can only be conceived as part of atoms. With this useful interpretation, the Copenhagen school thought they had developed a final theory. That is why Von Neuman introduced the notion of hidden variables and proved that such variable could not exist and that quantum physics as interpreted by them was the final theory of physics. This end-of-road assumption of the Copenhagen interpretation was short-lived with the discovery of Neutrino and position the same year. This thus implied that there was still more to be explored in quantum physics than the Copenhagen interpretation was school stipulated.

Popper's critique of the Copenhagen interpretation was influenced by Einstein, Podolsky and Rosen argument. This argument defends the possibility of obtaining the sharp position and the momentum at the same time. Thus, with this argument, we can measure the momentum and the position of the particle without making concessions to the principle of complementarity, defended by Heisenberg and Niels Bohr. Popper restates the Einstein, Podolsky and Rosen argument that:

> *Suppose one has a composite system described by a shrödinger equation, containing say, two particles, A and B, prior to any collision between them. Then they collide and afterwards are of these particles is measured, which we can call A, we may choose to*

[734] Louise De Broglie, *Certitudes et Incertitudes de la Science*, Paris, éditions Albin Michel, 1966, p. 24. "The appantion of Probability in physics was simply considered as a result of partial ignorance of the supposed state of the physical world that is always determined. I say "partial ignorance, for if our ignorance was total, we could have introduced a law of empty we would have had but certitude and not probability. The introduction of the law of probability leads to uncertainties which are greater and more extended than our ignorance"; (my translation).

measure various aspects; for example; or we may measure momentum. If the position of A is measured, this, together with the Ψ-function of the composite system, will allow us to find the position of B. if the momentum of A is measured one can similarly obtain the momentum of B.[735]

We can thus deduce the position of B without intervening in its momentum from the difference between the Ψ-function of the composite and the position of A. there is thus no action at a distance given that we can study one particle without influencing the other. It is not thus our disturbing of B that causes uncertainty but the incomplete information arising from the quantum theory. Popper thus asserts that:

According to the locality principle, separated and non-interacting, objects are independent. Thus, B must have an objective reality apart from any 'act of observation' and must have a sharp position and a sharp momentum at the same time, even though we can not know both at the same time.[736]

This thus motivated Popper to refute the subjectivity of the Copenhagen interpretation and propose an objective and realist interpretation. Popper's aim thus is "to exorcise the ghost called 'consciousness' or 'the observer' from quantum mechanics and to show that quantum mechanics as objective' a theory as; say classical statistical mechanics."[737] The observer in quantum mechanics is supposed to play the role of the observer in classical physics. That is, the role of testing it. This is not the case with the Copenhagen interpretation which "does not represent particles, but rather our knowledge; our observations or our consciousness of particles."[738]

Another limitations of the Copenhagen interpretation evoked by Popper is the confusion between the notions of theory and concepts. Science to him is the search for true theories as its fundamental aim. These theories or statement describe the world and the structural properties of this world. To Popper, "these theories or systems of statements may have their instrumental use: yet what we are seeking in science is not so much usefully as truth: explain approximation to truth; explanatory power and the power of solving problems."[739]

The Copenhagen claimed that the quantum theory can not be understood but that understanding is possible but with classical pictures which can be 'particle pictures' or 'wave pictures'. Popper is against the equation of theories to pictures or conceptual frameworks.

[735]Karl Popper, *Quantum Theory and The Schism in Physics*, *The Proscipt To The Logic of Scientific Discovery*, London, Rowman and Littlefiled, 1982, p. 18.
[736]*Ibid.*, p. 19.
[737]*Ibid.*, p. 35.
[738]*Idem.*
[739]*Ibid.*, p. 42.

Wittgenstein and Heinrich Hertz spoke of science as formation of pictures. This is the same view of Mach and Bohr who spoke of 'particle picture'. Theories are not identical to concepts or pictures. We can replace the conceptual frame work of a theory without changing the theory in question. In the same way, it is possible for two incompatible theories to have the same conceptual framework. Conceptual frameworks are instruments to construct theories but the latter are not instrument. A theory to Popper cannot be understood from the point of view of a picture but from the point of view which the problem for which it is constructed. Thus, "a theory is not a picture. It needs to be 'understood' by way of 'visual images': we understand a theory if we understand the problem which it is designed to solve, and the way in which it solves it better or worse than its competitors."[740]

The problem situation of a theory is thus important and identifying a theory as a picture renders the understanding of the problem it is out to solve to be futile. It is also from this angle that Popper criticises the subjectivist solution to the problem of quantum physics. To Popper, the subjectivist interpretation of quantum physics does not understand that the problem of quantum physics as posed by them was a statistical problem and thus requires a statistical answer or solution. Whether it is Planck's problem of radiation, Einstein's photon hypothesis, Bohr's theory of spectal emissions, "the central problem which leads to the new quantum mechanics was to improve on this by obtaining exact statistical results."[741] Instead of understanding that the statistical character of the quantum theory was influenced by the statistical status of the problem, Heisenberg and his followers instead appealed to human ignorance. This is another cause of the intrusion of subjectivity into the quantum theory as Popper asserts that:

> *This mistaken belief that was have to explain the probabilistic character of quantum theory by our (allegedly necessary) lack of knowledge, rather than the statistical character of our problems, which has led to the intrusion of the observer or the subject, into quantum theory.*[742]

The second articulation of this reflection, is consecrated to Popper's propensity interpretation of quantum physics which at the same time translates objectivity and realism. The propensity interpretation is the development of the classical theory. The classical interpretation, "explains P(a,b) – that is the probability of a given b – is the proportion of those equally possible cases satisfying b which are favourable to a."[743] Popper's innovation here is that of changing the

[740]Karl Popper, *Quantum Theory and The Schism in Physics,* p. 451.
[741]*Ibid.,* p. 47.
[742]*Ibid.,* p. 50.
[743]*Ibid.,* p. 69.

word "equally" with thus instead of speaking of "equally possible cases", Popper talks of "the sum of the weights of the cases". In the second formulation, Popper changes the 'sum of the weights of the cases' to "the measure of propensity which is the, "tendency of a possibility to realise itself upon repetition."[744] Probability statements are not considered her is statements of relative frequencies but statements that are of finite virtual frequencies while statistical statements on the other hand are those of finite sequence in experimental situations. The notion of 'weight' are thus measures of virtual possibilities and they can be tested b actual statistical frequencies. For example:

> *If we have a large dice containing a piece of lead whose position is adjustable, we may conjecture (for reasons of symmetry) that the weights (that is, the propensities) of the six-possibilities are equal as long as the centre of gravity is kept equidistant from six sides and that they become unequal if we shift the centre of gravity from the position. For example, we may increase, the weight of the possibility of six (06) turning up moving by the centre of gravity away from the side showing six*.[745]

Weight thus is the measure of the propensity or the tendency of a side in a dice, to turn up after repetition of a series of experience. In the propensity interpretation, probability strictly refers to the measure of property. They are virtual frequencies and become actual frequency after repetition of experience. We do not talk of possibilities any longer but of propensities or tendency of producing a relative frequency. This has two implications. Firstly, "probability distribution is taken to be a property of a single experiment"[746] and secondly, "we can look upon probability as a real physical property of any concrete unique physical situation."[747] The propensity interpretation thus deals with the probability of single statements in their unique physical experiments. The frequency interpretation cannot resolve the problem of single-case probabilities. A single case to Popper may happen once but it must be seen as having the tendency, dispositions and propensities to produce sequences of equal frequencies. That is why Stefano Gattei affirms that:

> *The introduction of hidden propensities underlying frequencies allows Popper, on the one hand to highlight the objective feature of probability as opposed to those who interpret it subjectively, as a measure of the imperfection of our knowledge – and on the one hand to account for single case probability.*[748]

Given that the possible cases are simply propensities, there is no particle – wave duality as cognised by the Copenhagen interpretation. Waves are not simple parts of particles but dispositions or propensities of the particle structure. The wave packet is nothing other than determining

[744]Karl Popper, *Quantum Theory and the Schism In Physics*, p. 70.
[745]*Idem*.
[746]*Ibid.*, p. 71.
[747]*Ibid.*, p. 72.
[748]Stephano Gattei, *op.cit*., p. 48.

propensities. They determine the "propensity of the particle's being in a certain place or possessing a certain momentum."[749] Waves do not then constitute the particles. Popper thus asserts that: "exactly as do the waves do in the soldier's random walk. The waves do not constitute the particles, any more than the random walk example constitute the soldiers."[750] Waves are just determinants of the object or particle and are situational for they are relative to experimental set-up or situation.

The world of physics is thus a world of propensations, in which the totality of dispositions or propensities relative to an observation or an experimental situation determine every physical system. The world is thus in a continuous series of actualisations. This world to Popper is at the same time dualistic and monistic. The dualistic connotation resides in the fact that, potentialities exists because of their possible actualisations or realisation and it is monistic because actualisations or realisations are somewhat potentials taking the form of actual realities.

Popper equality attributes values to propensities. Unlike the value 1 which implies certainty, 0 which implies impossibility in statistical and frequency interpretations the propensity 1 implies actualisation and 0 implies the absence of propensity. Thus, he affirms that:

> *The propensity 1 is the special cause of a classical force in action: a cause when it produces an effect. If a propensity is less than 1, then this can be envisaged as the existence of competing forces pulling in various opposed directions but not yet producing or controlling a real process.*[751]

When the propensity value is less than 1, it does not imply the likelihood not to happen but it is instead explained by the fact that to every particle, as well as experimental situation, there are many propensities. However, "zero propensities are, simply no propensities at all, just as the number zero means 'no number, for example, the propensity of getting the number 14on the next throw with two ordinary dice is zero for, there exists no such possibility and therefore no propensity."[752]

Popper insists on the objectivity of the propensity interpretation, given that propensities are not inherent in objects. They are instead "inherent in situation (of which the object was part of)."[753] Propensities are thus determined by the situations. Popper saves his interpretation of quantum physics from determinism. This is because situations are relative to experimental set up and thus

[749]Karl Popper, *op.cit.*, p. 141.
[750]*Idem.*
[751]Karl Popper, *A World of Propensities*, p. 13.
[752]*Idem.*
[753]*Ibid*., p. 14.

cannot determine future situations. That is: "the past situations, whether physics or psychological or mixed do not determine future situations."[754] This indeterminism is intandem with objectivity. Popper thus affirms that:

> *Quite apart from the fact that we do not know the future, the future is not objectively fixed. The future is open: it is objectively open. Only the past is fixed; it has been actualised and so it has gone. The present can be descried as the continuing process of the actualisation of propensities: or more metaphorically, of the freezing or the crystallization of propensities.*[755]

Propensities are thus the power to actualise. They are in a continues process are real processes themselves. They can only stop being real when they actualise themselves. The world is thus not a fixed machine that is product of determinism but it is simply, "[…] an unfolding process of realising possibilities."[756] In this world, new elements are produced from the actualisation of propensities, and the production of new elements creates new propensities of combining and synthesising to form other new elements. This is: "especially in the evolution of biochemistry, it is widely appreciated that every new compound creates possibilities for further compounds to synthesise: possibilities which previously did not exist."[757] The world of propensities is thus a creative one because the life from the biological point of view thus it offers new forms of life that are better than the previous ones. This is a realist and an objective interpretation because propensities are the reality in the making.

6.2. THE METAPHYSICAL BASES OF THE PSYCHOLOGY AND LOGIC OF SCIENCE AND THE CRISIS OF THE DEMARCATION PROBLEM

In this sub-chapter, we will question the role metaphysics in the manner in which scientific theories are invented and tested. To popper we cannot adequately answer the question, what is the origin of scientific hypothesis? And how are theories tested?, without making recourse to metaphysics. Making allusion to the history of science, Popper will attempt to show how myths and metaphysical research programs have inspired testable scientific theories. Moreover, unlike the logical positivist who asserts that there is no possibility of a rational discourse on pure metaphysics, given that the later is abstract and meaningless, Popper asserts that it is possible to make a rational discourse on metaphysics. This is realised in what he calls critisizable metaphysics.

[754]Karl Popper, *A World Of Propensities* p. 17.
[755]*Ibid*., p. 18.
[756]*Ibid.*, p. 19.
[757]*Idem.*

6.2.1. The Heuristic Role of myths and research programs in science and the possibility of a rational discourse on metaphysics

The indispensable role of metaphysics in the development of scientific theories is evident at the level of the origin of scientific hypotheses. Popper rejects the logical positivists' rationality of science, which claims that the latter can only be tenable if it is wholly separated from all forms of metaphysics at all levels. This is impossible on grounds that there cannot be any scientific account of how we come about having a hypothesis. At the psychological level, that is, the level of the invention of scientific hypotheses, science does not differ from other non-scientific disciplines like arts. They are all unjustified invention of the human minds at the primary level. It is in this light that Popper asserts that:

> *The initial stage, the act of conceiving or inventing a theory seems to be neither to call for logical analysis nor to be susceptible of it. The question how it happens that a new idea occurs to a man whether it is a musical theme, a dramatic conflict or a scientific theory may be of great importance to psychology.*[758]

To claim that all our ideas and hypotheses originate from observation is to make a point for the inductive source of knowledge and the theory of the Passive mind. The human mind is creative and thus invents hypotheses to anticipate experience and to better adapt to his environment. However, there is no demarcation between metaphysical ideas and scientific hypotheses in the context of the discovery of ideas. Some of these untested ideas at the level of discovery, obstruct the development of science. This is not an all-compassing reason to eliminate metaphysics because a bulk of other untested ideas that have metaphysical tags equally lead to the development of science. In this light, Popper insists that; "for it can not be denied that only with metaphysical ideas which have obstructed the advance of science there have been others such as speculative atomism which have acted it."[759]

If we go by the logical positivist paradigm, then it will be impossible to talk of the creativity of the human mind. In this way, the metaphysical undertones of the context of discovery is not only grounded on the non-empiricality of these invented ideas but also in the scientific mind at this state. Understood as the disposition that the human mind must have in other to objectively do science, the scientific mind in the context of discovery is strictly fideist. This psychological fideism is based on the argument that the only justification of over possession and acceptance of the

[758]Karl Popper, *The Logic of Scientific Discovery*, p. 7.
[759]*Ibid.*, p. 16.

invented ideas is simply our faith in our conjectures, we will have nothing to confront with experience in our context of justification. That is why Popper affirms that:

> *And looking at this mater from the psychological angle, I am inclined to think that scientific discovery is impossible without faith in ideas which are of a purely speculative kind, and sometimes even quite hazy: A faith which is completely unwarranted from the point of view of science and which to that extent is metaphysical.*[760]

It is in this way that Popper proceeds to argue for the mythical origin of scientific theories. With his conjectural view of the origin of theories, the latter in the pre-scientific stage are just mythical. In other words, "all prescientific knowledge whether animal or human is dogmatic as science begins with the invention of non-dogmatic, critical method."[761] The conjectural nature of prescientific knowledge makes Popper to assert elsewhere that, "scientific theories are not just results of observation. They are in the main, the products of myth-making and of test."[762] Even when theories have been tested positively, they are not given absolute certainly given that they may still be refuted in the next instance of refutability. It is in this light that Popper talks of the scientific tradition whose myths are different from the ancient tradition of repetition of myths. This difference is rooted in the fact that the myth of science, which is a second order tradition, can be critically assessed and discussed. That is "what we call science is differentiated from older myths not by being something distinct from a myth but by being accompanied by a second-order-tradition-that of critically discussing the myth."[763]

This method of the critical discussion of myths can be traced back to the pre-Socratic period. The critical attitudes of the pre-Socratics consists in that in "telling their myth they were ready in turn to listen to what their listener thought about it."[764] In most cases, the pre-Socratics admitted that the myths of others had better explanations than theirs. The difference between scientific myths and religious myths is that the former adopts a critical attitude. That is, scientific myths are not static but they are improved upon. They clash with observation and can be changed to adopt better ones and they also guide observation. Thus, they give a better account of the world. Thus, Popper affirms that "in other words, under the pressure of criticism, the myths are forced to adapt themselves to the task of giving us an adequate and a more detailed picture of the world in which

[760] Karl Popper, *The Logic of Scientific Discovery,* p. 16.
[761] Karl Popper, *All Life Is Problem Solving*, p. 7.
[762]Karl Popper, *Conjectures and Pefulations*, p. 128.
[763]*Ibid.*, p. 127.
[764]*Ibid.*, p. 126.

we live."[765] We cannot set observation at the base of scientific methodology. This is because we cannot observe observation. We can only observe the yet to be justified conjectures.

In the second articulation of the heuristic role of scientific theories, Popper leaves the mythical research programmes and their role in the development of physical theories. The critical motivation of the introduction of metaphysical research programs is the introduction of the third element of distinction between science and metaphysics. Besides the conditions of the empirical status of theories on one hand and their ability to be tested on the other hand, Popper introduces the third element which is the necessity of understanding the problem situation. The manner in which theories are applied in the problem-situation equally determines their scientificity. This problem situation in science can arise from the following sources:

> *One is the discovery of an inconsistency within the ruling theory. A second is the discovery of an inconsistency between theory and the experimental falsification of the theory. The third, and perhaps the most important one is the relation between the theory and what may be called the "metaphysical research programmes."*[766]

Research programmes play the role of trackers and revealers. They reveal the problems and explanations that a theory may make use of. These programmes are sometimes held unconsciously and can be replaced by another when they are critically discussed. These research programmes can be situated at two levels. That is, "more often they are implicit in the theories and in the attitudes and judgements of scientists."[767] Thus, they are found at every level of the development of science and Popper reiterates that:

> *In every sphere of the development of science we are under the sway of metaphysical that is untestable ideas which not only determines what problems of explanations we choose to attack, but also of answers we shall consider as fitting or satisfactory or acceptable and as improvement of, or advances on earlier knowledge.*[768]

The difference between metaphysical research programs and scientific theories does not only reside in the fact that the former are non-tested while the latter are tested but also in the view that research programs are speculative and embody a series of views on the structure of the world and also contains different views of current problems about our world. Popper thus defines them from their attempt to explain the world on hand and their attempt to resolve problems arising from the world on the other hand. He thus affirms that: "I called them research programmes because they

[765]Karl Popper, *Conjectures and Pefulations,* p. 128.
[766]Karl Popper, *Quantum Theory and the Schism In Physics,* p. 161.
[767]*Ibid.*, p. 161.
[768]*Idem.*

incorporate together with the views of what the most pressing problems are, a general idea of what a satisfactory solution of these problems would look like."[769]

They are programmes thus because of the explanatory power of definite problems. They are considered to be metaphysical on the other hand because of their speculative and generalist characters. Popper thus asserts that: "I call these programmes "metaphysical" also because they result from general views of the structure of the world and, at the same time, from general views of the problem situation in physical cosmology."[770] These programs are thus "speculative physics" or simply "speculative anticipation of testable physical theories."[771]

Popper makes an illustration of some of these program in the development of science. The first programme is Parminedes' block universe. According to Parminedes, the universe is a block and there exist no vacuum or empty space. Thus, his programme excludes every possibility of change. The world to him has a rational structure and it is based on the principle of non-contradiction. The second research programme that contradicts Parminedes' block universe is atomism. According to atomism, developed by Democritus, the world is not full and there exist atoms on one hand and the void on the other hand. Thus, atoms can move in void.

The third research programme is geometrization. It emanated from Pythagoras' view of the world as consisting of numbers. It collapsed however because of the discovery of the irrational numbers. The forth programme is the essentialism and potentialism of Aristotle. Aristotle considers space as matter, that is, position space. Thus, there is no possibility for pure geometry because form is inherent in matter. Form has potentialities which realise themselves due to the final cause for which they exist.

The fifth research programme is the renaissance physics of Corpenicus, Bruno, Kepler and Galileo who simply revived Plato's geometrical cosmology. To Plato, the universe is a product of the handwork of a divine craftsman who, "imitating an unchanging and eternal model, imposes mathematical order on a pre-existent chaos to generate the ordered universe."[772] The sixth programme on the other hand is the clock theory of the world developed by Hobbes, Descartes and Boyle. According to them, the form of matter is the same with special extension. This view reconciles Plato and Aristotle. Every physical theory is thus geometrical for there is no distinction

[769] Karl Popper, *Quantum Theory and The Schism In Physics*, p. 161.
[770] *Idem*.
[771] *Ibid*., p. 162.
[772] Plato's Timaeus, in Stanford Encyclopaedia of Philosophy, Available at http://plato.standford.edu; consulted on 21st of May 2020.

between matter and its physical extension. Motion and causation thus can be explained by the force of push as quantitative geometrical movement produces qualitative change.

The next research programme is dynamism of Newton and Leibniz. To Newton's dynamism, "all physical causation is to be explain either by push or else by central attractive forces."[773] Thus, change in the physical realm depends on another change. To Leibniz, for them to be a push there must exist repulsive forces found in matter. The eight programme which is that of the field of forces by Faraday and Maxwell, refuted the centrality of the repulsive forces in Leibniz and insists on the variations of fields of forces. To them, "there are changing fields of (vectorial) forces whose local action at vanishing distances"[774] understanding matter is thus possible only in the context of the field of forces. This programme thus combines the principle of causality of Newton and Descartes to enact the principle of partial differential equations.

The ninth research programme is the unified theory of Reimann, Einstein and Shrodinger. The fields of forces here are geometrised and matter is predicted as something that can be destroyed. The confirmation of this prediction marked the refutation of materialism. Matter is nothing other than the vibration of fields. This view is in turn rejected by the tenth research programme, which is the statistical interpretation of quantum theory. According to this theory, in each sequence of light wave vibration "there is associated a particle like entity, a photon which is emitted by one action and absorbed by one atom."[775] It is in this light that De Broglie will talk of particle-wave dualism. The panoramic view above thus illustrates how speculative physics deals with problems related to physical cosmology. Some of the problems handed by speculative physics include:

> *The problem of change in general of matter and space (of atoms and the void); of special structure of the universe; of causation (action at a distance or at vanishing distances; of forces and fields of forces); of the (atomic) structure of matter and especially of its stability and the limits of its stability; and of the interaction of matter and light.*[776]

Thus, the various research programmes can be described as metaphysical or speculative physics. They are vast generalisations of a speculative and non-testable order. They create a problem situation, inspires scientific theories and even orientate science to the attainment of its purpose. The history of metaphysical research programmes is that of problem situation. Popper

[773]Karl Popper, *op.cit.*, p. 163.
[774]*Ibid.*, p. 164.
[775]*Ibid.*, p. 164.
[776]*Ibid.*, p. 165.

thus illustrates the problem of dynamism from Descartes to modern physics to highlight on the indispensable role of these research programmes on the development of physics.

Descartes' physics is grounded on Aristotle's essentialist conception of the body as an extended substance. This implies that all space is full and there is no void. Things thus move in the world by pushing each other. That is, "they may move like a tea leas in a tea cup."[777] This is the principle of mechanical explanation given that objects move by pushing each other. This does not give room then for action at a distance. Leibniz produced a speculative refutation of Descartes' view. To Leibniz, the fact that bodies push each other's without penetrating implies that there also repulsive forces that dispose objects to resist penetration during pushing. This programme incorporates Descartes' notion of extension and the idea of push. Matter to Leibniz then can be reduced simply to forces that constitute space. The forces here do not arise from space but from monads; which are unextended geometric points; there is no possibility of a void to Leibniz also. Mottionlessness here can be explained using dynamic equilibrium. That is, when there is equality of resistant forces, there is dynamic equilibrium and thus no motion.

The non-vacuum theory developed by the Eleatics, Descartes and Leibniz had a great challenge of the "problem of the compressibility of bodies and also that of elasticity."[778] Democritus' model could account for elasticity, given the void between atoms but this was further compounded by the dynamics of Newton and Leibniz. The view that atoms were the smallest unit of matter was replaced by the consideration of atoms as instance of repulsive forces. Kant and Boscorich made attempts to reconcile Leibniz, Democritus and Newton. They admitted repulsive forces as central in mechanics, and also asserted that the void can be postulated when forces turn towards infinity; that is when the distance between atoms is zero. However, against the point atomism of Leibniz, Kant develops the theory of the continuity of matter. These programmes of the problem situation of dynamics, influenced the modern theories of physical theories. Popper thus affirms that:

> *Thus, the two theories of Kant and the theories of Boscovich which were the main attempts to out Leibniz'a programme of dynamic theory explaining the Cartesian extended-matter-beame the joint ancestors of all modern theories of the structure of matter "those of Farady and Maxwell, of Einstein De Broglie and Shrodingèr), and of the dualism of 'matter and field; which seen in this light is perhaps not so deeply rooted as it may appear*

[777]Karl Popper, *Quantum Theory and The Schism In Physics*, p. 166.
[778]*Ibid.*, p. 168.

to those who in thinking of matter, cannot get away from Newtonians or even from crude Cartesian and non-dynamic model.[779]

Logical positivism rejected all forms of speculative physics and classified them under metaphysics and thus pseudo-science. Science to them is strictly the affairs of those who adopt the positive scientific mind. Science to them should not take such speculative explanations into consideration as the former is simply a tool for prediction. In giving the panoramic presentation of how metaphysical research programmes have created problem situations for physical theories and how they have influenced the development of physical theories, Popper concludes by rejecting the positivist view that:

The theory of matter must forever remain the private affair of the experts – a specialist – a mystery shrouded in technicalities, in mathematical techniques and in 'semantics': that science is nothing but an instrument void of philosophy or theoretical interest and only 'technological' or pragmatics and or 'operational' significance.[780]

The above development shows that we cannot successfully eliminate metaphysics from science and that a sound understanding of physical theories today is impossible without recourse to great metaphysical research programmes that anticipated them. These research programmes may not be testable at the time of their coinage but they do not only inspire the development of science but some may become scientific theories in the nearest future. This conceptual development thus also has repercussion on the criterion of demarcation. It throws more light why Popper prefers a principle of demarcation that will give distinctive definitions of science and metaphysics, without using the definition of one as the paradigm of the other as the logical positivists did with the criterion of meaning. Mythical stones and metaphysical research programs are fertile grounds for the development of science and the demarcation between science and metaphysics should not be a partial and radical one. Thus, Popper insists that:

I have indicated one of my reasons for this by saying that we must not draw a line too sharply. This becomes clear if we remember that most of our scientific theories originated in myths. The Corpernican system, for example, was inspired by neo-platonic worship of the light of the sun who had to occupy the centre because of its nobility.[781]

The sun in Plato's myth of the cave epitomises the form of the Good, which illuminates other forms like Beauty, among others. Corpernicus was inspired by this Platonic mythical frame work of engage into investigation that led him to initiating a rupture from geocentrism to heliocentric.

[779]Karl Popper, *Quantum Theory and The Schism In Physics*, pp. 171 – 172.
[780]*Ibid.*, pp. 172 – 173.
[781] Karl Popper, *Conjectures and Refutations*, *op.cit.*, p. 237.

Thus, the difference between metaphysical speculations about the universe and scientific theories is only plausible at the experimental level.

In the second moment of this examination, Popper holds that metaphysics does not only play a heuristic role in the development of science but also, there is a possibility of a rational discourse on metaphysics. He demonstrates this using the idea of critisable metaphysics. To begin, It is important then to question what metaphysics traditionally means and to find out if Popper's defence of the role of metaphysical theories in the development of science, refers to metaphysics in the traditional sense of the word, or whether he proposes a restricted definition of metaphysics.

It should be noted that metaphysics as an attitude is as old as the history of philosophy. That is, the pre-Socratics initiated this metaphysical attitude with their posing of their cosmological question. This was the central concern of the Milesian philosophers and the later Ionians philosophers. His problem was in tandem with the question of permanence that witnessed a great divide between Heraclitus' defence of universal mobilism and the Eleatic defence of universal immobilism. In Plato's theory of Forms, the metaphysical problem becomes that of the true nature of things. In his idealism, Plato proposes universal ideas, essences or Forms as the true nature of things, stigmatising the physical world of change, corruption and Falsity. Even though the metaphysical attitude is as old the history of philosophy the term metaphysics originated in the Aristotelian framework. It was Aristotle's Liberian; Andronicus of Rhodes who coined the word metaphysics from the classification of Aristotle's book. His classification proceeded as:

> *« (1) les écrits logiques (que l'on désignera plus tard sous le nom organon) ; (2) les écrits éthiques, politiques, rhétoriques (qui comprennent aussi la poétique) ; (3) les écrits physiques (où se retrouvent aussi de recherches que l'on qualifierait aujourd'hui de biologique ou psychologique) ; les écrits métaphasiques. »*[782]

The origin of the term metaphysics thus in the 12th century had a bibliographical connotation. It is etymologically drown from *« ta meta tu physikà biblia »*, meaning, books that are set after the ones taking about physics. It thus refers to the collection of Aristotle's treaties that are dealing with things beyond the physical world. The metaphysical question as posed by Heidegger, is, "why are these beings at all instead of nothing."[783] This question which goes back

[782] Jean Grondin, *Introduction à la Métaphysique*, Québec, Presse de l'Université de Montréal, 2004. "(1) The Logical writings (that will be designated later under the name of the organism); (2) The ethical, political, rhetorical writings (which also comprise poetry); (3) physical writings (where there is also research on what can be termed biology or psychology); (4) Metaphysical writings"; (my translation).

[783]Martin Heidegger, *Introduction into Metaphysics*, (1959) trans. Georgey Fried and Richard Polt, New Haven, Yale University Press, 2000, p. 1.

to Leibniz's principle of sufficient reason implies that there is a reason why things exist the way they are. This reason in the Aristotelian tradition can be sought by going beyond to study Being as Being. Aristotle refers to metaphysics then as the study of Being qua Being. His definition has three dimensions. Firstly, it is the search for the first causes of things that is 'sophia' or wisdom. Secondly, it is simply first philosophy or 'prôté philosophia' which seeks for the first principles of things and thirdly, it is theological science or 'theologeke' which reflects on God.

Even though, "philosophers have disagreed about the nature of metaphysics"[784] Aristotle and the medieval gave a dual definition to metaphysics; "sometimes they characterise it as the attempt to identify the first causes, or particular, God or the unmoved mover; sometimes as a general science of being qua Being."[785] However, modern rationalism of the 17th and 18th centuries developed by Descartes Leibniz and Spinoza, rejects the definition of metaphysics as the stud of Being qua Being by introducing different types of beings like the problem of the body and the mind, the immortality of the soul and the problem of freedom on the other hand. This rationalist view of metaphysics simply corresponds to the second view of Aristotle and the scholastics. In the first view, the study of Being qua Being or the unmoved mover is generalist but the second view of the variation of beings is specific. The generalist conception of metaphysics resides in examining "general concepts like unity or identity, difference, similarity and dissimilarity that apply to everything that is."[786]

From the above development, two types of metaphysical approaches can be deduced. Firstly, general metaphysics which restricts metaphysical reflection only to the study of Being as Being. This view is defended by Aristotle. The second approach is special and specialised metaphysics defended by the continental rationalists. Special metaphysics is that in which " we can consider Being as it is found in changing things, we can, that is, consider Being from the perspectives of its being changeable."[787] This variation of the conceptual localisation of Being can be apprehended at three levels. Firstly, being can be located in rational Beings in what is called rational psychology. Secondly, Being can be situated in the universe in itself, in what is called cosmology and thirdly Being can have a divine connotation in what is referred to as natural theology. This is the same trilogy Kant gives to speculative metaphysics. To Kant, the latter can take either the form of

[784]Michael J. Loux and Thomas M. Crisp, *Metaphysics; A Contemporary Introduction*, New York-London, Routledge, 2017, p. 1.
[785]*Idem.*
[786]*Ibid.*, p. 3.
[787]*Idem.*

rational theology which deals with God, rational psychology which studies the soul as the first principle of the self and rational cosmology which reflects on the universe as having an origin.

With the exception of deconstructivists metaphysical tendencies expounded by Nihilism, irrationalism and postmodernism, traditional metaphysics from the antiquity to the modern times, situates the metaphysical efforts in the attempt of going beyond the physical world to rationally erect the essences of things. Whether it is general metaphysics that can also be referred to as ontology or specialised metaphysics, transcendent attitude is what they do have in common. To give a univocal definition of metaphysics, it must be noted that: *« toute introduction à la métaphysique doit partir de ce texte fondateur d'Aristote. Il définit la science qui considère l'être en tant qu'être par sa prétention à l'universalité. »*[788] This metaphysics is characterised by its universalist and transcendental characters. Jean Grondin thus defines it as:

> *« Le terme de métaphysique sert alors à désigner tout ce qui se trouverait au-delà du physique, entendons du monde sensible, perceptible et matériel. En sus du monde physique qui nous entoure, qui nous étouffe, mais où nous nous trouvons, il y aurait ce que Nietzsche a appelé, mais par devisons un arrière-monde métaphysique. »*[789]

Metaphysics then is transcendent for it goes beyond the physical world and can also be referred to as theological. It deals simply with beings of reason. This is what Kant refers to as the ideas of pure reason. It thus, accords being to every entity that exist, going beyond the apparent physical complexity to unveil the simple and fundamental structures of entities. That is why Musa Akrami asserts that metaphysics is "a science that has been searching for a description and explanation so simple, so fundamental and so all-inclusive that could apply to everything having some kind of beingness and being entitled to be called entity."[790]

The traditional view presents metaphysics as a speculative and generalist field that attempts explanations of unifying, abstract bases of things. It is important to find out if this is the type of metaphysics Popper defends as necessary for the development of science on one hand and if Popper acknowledges other metaphysical systems that are contrary to the ones he presents as being useful in science.

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[788] Jean Grondin, *Introduction à la Métaphysique*, p. 23. "Every Introduction to metaphysics must begin with this text of the founder, Aristotle, He defines metaphysics as the study of Being as Being by its pretention to universality"; (My translation.)

[789] *Ibid.*, p. 17. "The term metaphysics helps then to designate all that is found beyond the sensible, perceptible and material world. Beyond the physical world which surrounds us, suffocates us, but in which we are found, there is a world which Nietzsche by derision refers to as the backward world of metaphysics"; (my translation).

[790] Susanna Parusniková and Robert S Colen, *Rethinking Popper*, p. 399.

In the first place, Popper acknowledges that metaphysics that is useful to science is speculative and generalist but he does not recognise the transcendent aspect as important in science. This is not only negatively evident in his critique of ultimate explanation in essentialism but it is posively seen in his assertion that the metaphysics of science has to deal with the physical cosmos. Every untested theory about the physical universal to Popper is metaphysical and can be qualified also as "speculative anticipations of testable physical theories."[791] This speculative metaphysics or speculative cosmology constitutes what we shall see later; that is, metaphysical research programs. Popper qualifies these speculative cosmology as metaphysics as he asserts that: "I call these research programmes 'metaphysical' also because they result from general views of the structure of the world and at the same time, from the general views of the problem situation in the physical cosmos."[792]

Popper thus retains the generalist and speculative character of traditional metaphysics but rejects the transcendent connotation for he projects the cosmos as the subject matter of the metaphysics of science. Metaphysics then is defined as what is non-empirical now but has the potentials of being empirically established. Popper asserts that "for metaphysics has usually been defined as non-empirical."[793] The non-empirical status now may be because of lack of adequate instruments of measurements. Once these instruments are constructed, the empirical status may be established. This is the case with the transition from the classical theory of atom to quantum physics.

Another view of Popper's metaphysics is reduced in untested ideas and theories. Popper refers to untested theories as metaphysical. In the context of scientific discovery and the invention of theories, Popper posts unjustified ideas and theories as the foundation. That is, science originates from conjectures and our first confidence on these untested ideas is a matter of faith; that is, "faith which is completely unwarranted from the point of view of science and which to an extent is metaphysical."[794] This applies same to theories that are not yet tested but makes scientific claims and pretentions. This is evident in the history of astronomy as Popper asserts that "to the degree that this is, Aristardius' and Copernicus' theories may be described in my terminology as

[791]Karl Popper, *Quantum Theory and The Schism In Physics*, *op.cit.*, p. 162.
[792] *Ibid.*, p. 161.
[793]Karl Popper, *The Logic of Scientific Discovery*, p. 13.
[794]*Ibid.*, p. 16.

unscientific or metaphysical. To the degree that Copernicus did make a number of minor predictions, his theory is, in my terminology, scientific."[795]

When a theory is not given the boldness to be refuted just like Aristardius, it is metaphysical. The undaring attitude of a theory makes it metaphysical. Prima face, Copernicus' generalist and speculative character made his theory to be metaphysical, but the moment he took the boldness to make predictions and thus open his theory for refutations, he initiated a dialectics from metaphysics to science. Thus, the dialectics from speculative cosmology to science is a reality as Popper affirms that: "for the transition between metaphysics and science is not a sharp one: what was metaphysical idea yesterday can become testable scientific theory tomorrow and this happens frequently."[796]

Moreover, metaphysics according to Popper can be deduced from the causal explanation of events in the physical universe. To Popper, the question is "is the word ruled by laws or not? This question I regard as metaphysical."[797] Scientists in their quest to understand the world search for laws so as to reveal the intelligibility of laws are different from natural laws, but Popper asserts the identity of the two, given his search light theory of knowledge in which we cognitively face the world with conjectures. The search for these laws to him, which are also conjectures is metaphysical. He thus insists that: "the belief in causality is metaphysical it is nothing but a metaphysical hypostatisation of a well justified methodological rule – the scientist's decision never to abandon his search for laws."[798] Even the logical positivists who claims the rejection of metaphysics from science asserts that laws are general statements that guide predictions. To them, these laws are not genuine scientific statements. Even we gran this, it will not still go without saying that these positivist assumption of the existence of these laws and their role in scientific predictions is still in a metaphysical conviction.

Popper may have rejected the of mind-independent about nature dependent laws on grounds of his rationalist conviction and evolutionary view of knowledge, the fact that laws are simply conjectures do not remove their metaphysical status. To him, "to give a causal explanation of an even means to deduce a statement which describes it using as premise of the deduction one or more universal laws, together with certain singular statements, the initial conditions."[799]

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[795]David Miller, *A Pocket Popper*, Popper's Selection, Glasgow, Fontana Press, 1983, p. 120.
[796]*Ibid.*, p. 123.
[797]Karl Popper, *The Logic of Scientific Discovery*, p. 244.
[798]*Ibid.*, p. 245.
[799]*Ibid.*, p. 39.

Scientific laws are thus general or universal statements of predictions but which inturn can be falsified for they exists as prohibition of certain events to happen. From the above, it is evident that Popper's view of metaphysics is neither synonymous to general metaphysics or ontology in the traditional sense nor is it the same with special metaphysics which as presented by Christian Wolff and Kant Popper considers metaphysical as those speculative theories on the physical cosmos but which can either create problem situation for the development of scientific theories or can be tested as scientific theories in the nearest future. The problem now is, what becomes of other metaphysical theories that are not related to problems of the physical cosmos?

Other metaphysical theories that are not related to the physical cosmos may not play a role in the development of science, but Popper holds that it is however possible to carry out rational decisions with them. This does not only aim at slowing the rational grounding of metaphysics but it also serve the latter from the meaningless criterion of logical positivism. To argue for this, Popper begins by posing the question; "is it possible to examine irrefutable philosophical theories critically? If so, what can a critical discussion of these theories consists of, if not of attempts to refute theories?"[800] In the first place, Popper identifies five metaphysical theories which are irrefutable but are critisable. They include determinism, which holds that, "The future of the empirical world (or of the phenomenal world) is completely predetermined by its present state down to its smallest details."[801] Secondly, there is idealism which holds that, "the empirical world is my idea or my dream."[802] Thirdly, there is irrationalism which asserts that given the Kantian argument that reason cannot know things in themselves, we should opt for irrational ways of knowing such as instincts, poetic inspiration or emotions. Fourthly, there is voluntarism which holds that; "in our own volitions, we know ourselves as wills. The thing in itself is the will"[803] an in the fifth place, there is nihilism which asserts that; "in our boredom, we know ourselves as nothings. The thing-in-itself is nothingness."[804]

Even though we cannot establish the irrefutability of the above metaphysical theories, Popper considers them to be out rightly false. The falsity of these theories is grounded on two reasons. Firstly, that gives consistency to Popper's conception of science and secondly

[800]David Miller, *A Pocket Popper, Popper's Selection*, p. 215.
[801]*Ibid.*, p. 209.
[802]*Idem.*
[803]*Ibid.*, p. 211.
[804]*Idem.*

irrefutability does not imply truth as the latter is logical product of refutability. That is why Popper insists that:

> *I am first of all an indeterminist, secondly, a realist, thirdly a rationalist. As regards my fourth and fifth examples, I gladly admit with Kant and other critical rationalists that we cannot posses anything like full knowledge of the real world with its infinite richness and beauty. Neither physics nor any other science can help us to this end. Yet I am sure the voluntarists formula, "the world is will" cannot help us either. And as to our nihilist and existentialists who bore themselves, (and perhaps others) I can only pity them.*[805]

We can use the criterion of refutation to posit the irrefutability of the above theories. However, to establish their falsity there is still need for a rational discourse on them. Logical mathematical and scientific theories can be refuted by critically examining their competing theories. That is how their falsity is established. The problem is to know whether this can also hold for metaphysical or philosophical theories. The first condition for a theory to merit rational discussion is its attempt to answer a definite question or the attempt to resolve a specific problem. Thus, Popper affirms that: "in other words every rational theory, no matter whether scientific or philosophical, is rational in so far as it tries to solve problems. A theory is comprehensible and rational only in its relation to a given problem situation."[806] This is the similarity between irrefutable metaphysical theories and scientific research programmes. Even if a theory is non-empirical and irrefutable, it is logically possible to discuss it within the context of its problem situation. The questions that determine the critisisabilty of metaphysics are three. Firstly, we find out if the theory is based on a problem and secondly we examine if it offers better solutions to the problem, as compared to other competing theories of the same problem-situation. In the third place, we investigate into the fruitfulness of this theory. To Popper, "questions like these kind show that a critical discussion of irrefutable theories may well be possible."[807] Popper here, offers a paradigmatic pedagogy of metaphysics. He offers an excellent method of studying theories within their problem-situations and comparing them with other competing theories, so as to evaluate their degree of increasing our knowledge of the problem-situation.

To illustrate how metaphysical theories can be discussed within their problem situation, Popper affirms that idealism as defined by Berkeley and Hume was motivated by the need to reduce knowledge to sense-impressions and also to the association of images of our memory. Understanding idealism by linking it to the problem situation, makes it possible to, "criticise

[805]David Miller, *A Pocket Popper, Popper's Selection,* p. 212.
[806]*Ibid.*, pp. 216 – 217.
[807]*Ibid.*, p. 217.

Hume's idealism by pointing out that his sensualistic theory of knowledge and of learning was in any case inadequate and that there are less inadequate theories of learning which have no unwarranted idealistic consequences."[808]

Thus, by identifying a problem-situation of a theory and finding out other competing theories that better explain the problem and enhance our knowledge of the problem, Popper concludes that metaphysical theories that are irrefutable can be rationally discussed. Thus, metaphysics is rational and meaningful.

6.2.2. Two contradictory faces of Popper as reason for the 'death' of the demarcation problem

The two contradictory faces of Karl Popper refers to what we call, First and second Popper or early and late Popper. "Early" or "first Popper" attempts to developed a strict criterion to demarcate between science and metaphysics while "late" or "second" Popper calls for a less rigorous criterion on grounds that metaphysics plays an important role in the development of science. That is, with the importance of metaphysics in science, he asserts that, "I have indicated one of the reasons for this by saying that we must not try to draw the line too sharply."[809] This Shows that there are two Poppers; 'Early Popper'[810] that demands for a strict and rigorous principle of scientificity and demarcation and 'late Popper'[811] that defends metaphysics and is moderate and less rigorous on the principle of causality. Thus, if Popper rejects the logical positivists' semantic paradigm of scientificity by proposing falsification as the criterion of demarcation, how can he again assert that metaphysics plays an important role in science? In other words, how can we understand the Popper's insistence on the necessity of demarcation criterion at the same time and his defence of the importance of metaphysics in the development of science? With the demonstration of the importance of metaphysics in science, should we still talk of the necessity to define a criterion that can permit the demarcation between science? These cognitive enigmas betray the pertinence of Popper's scientific rationality as the better alternative to the logical positivists' paradigm.

[808]David Miller, *A Pocket Popper, Popper's Selection,* p.217.
[809]Karl Popper, *Conjectures and Refutations*, p. 257.
[810] Early Popper refers here to Popper of, *The Logic of Scientific Discovery* first published in 1934 and of his early articles before the 1950s.
[811]By Late Popper, we imply Popper of *Conjectures and Refutations* published in 1963 and *Realism and The Aim of Science*, published in 1983.

The criterion of demarcation is an aspect of normative epistemology for it is deemed to be a rule that can permit a sharp distinction between science and metaphysics. In *The Logic of Scientific Discovery* published in 1934, Popper, that we qualify as one of the publications of 'Early Popper' is very prescriptive as he advocates for a sharp and rigorous criterion that can permit the demarcation between science and metaphysics. However in his *Conjectures and Refutations* published in 1963, Popper, that we qualify as 'late Popper' is cautious and less rigorous in defining the criterion of demarcation. In fact, after demonstrating at length how metaphysics is useful in science, Popper in his 1983 edition of *Realism and the Aim of science*, asserts that, "I do not think it possible to eliminate all metaphysical elements from science. They are closely related."[812] This makes the demarcation criterion to be a matter of contingency and not a necessity in the logic of science and that is why he also reiterates that, "but I do not think that the detection of metaphysical elements and their elimination from science can even become part of a routine."[813] This assertion seems to kills the prescriptiveness or the normativity that is supposed to underground the criterion of demarcation.

As pointed out by the critics, Karl Popper in this later writings implicitly acknowledged the difficulty involved in drawing a sharp dividing line between science and metaphysics. Popper's intentions in his early writings such as the *Logic of Scientific Discovery* published in 1934 is to find a suitable criterion which can help to "distinguish between the empirical science on the one hand and mathematics and logicas well as metaphysical systems on the other hand."[814] This is however not the same view Popper holds in his later works. In his *Conjectures and Refutations* published later in 1963, Popper's rigour for a sharp demarcation principle changed. He thus demands for a soft core demarcation criterion as he affirms that:

> *I have indicated one of the reasons for this by saying that we must not draw the line too sharply. This becomes clear if we remember that most of our scientific theories originate in myths. The Copernican system, for example, was inspired by a neo-platonic worship of the light of the sun who had to occupy the 'center' because of his nobility.*[815]

At this level, Popper abandons the rigour which he had in the 1935 edition of *The Logic of scientific Discovery*. This is because we can historically prove the role of metaphysical theories to the development of scientific theories. It is the commitment to Plato's metaphysics that provoke the scientific intuition in Copernicus to develop his heliocentric astronomy. This loss of rigour in

[812]Karl Popper, *Realism and The Aim of Science*, p.179.
[813]*Ibid.*, p.180
[814]Karl Popper, *The Logic of Scientific Discovery*, p. 11.
[815]Karl Popper, *Conjectures and Refutations*, p. 257.

the *Postscript To The Logic of Scientific Discovery*, Published In 1983 tilted *Realism and The Aim of Science* Leads to Popper's acknowledgment of the impossibility of eliminating metaphysics completely from science. The thesis of the metaphysically free science becomes an ideal and not an actuality as Popper asserts that:

> *I do not think it possible to eliminate all 'metaphysical elements' from science: They are closely interwoven with the rest. Nevertheless, I believe that whenever it is possible to find a metaphysical element in science which can be eliminated, the elimination will be all to the good.*[816]

The criterion of demarcation ought to have a prescriptive connotation but Popper seems to abandon this in his assertion above. Demarcating between science and metaphysics then becomes a matter of possibility and not necessity. A demarcation criterion is supposed to be a tool or techniques that can be used to delimit science from metaphysics as Popper asserted in the logic of scientific Discovery. However, in Realism and the aim of science, he affirms that such instrument is impossible to realise. He thus affirms that:

> *My criterion of demarcation is, however, not intended as an instrument for the detection of such elements. I do not intend to imply that it cannot be used as such. I have in fact found it quite useful in a number of cases. But I do not think that the detection of metaphysical elements and their elimination from science can ever become part of a routine or technique.*[817]

If the use of a criterrion of demarcation cannot be 'a routine or technique', then how demarcating is the criterion of demarcation? With this fall in the rigour of the criterion of demarcation, William Warren Bartley III asserts that the demarcation criterion is unimportant in science while Larry Laudan refers to the situation as the demise of the criterion of demarcation, arguing that such criterion is useless in science today. While some philosophers like Lakatos have continued to advocate for soft-core demarcation criterion, others have proceeded to a new problem, that is, the naturalisation of metaphysics.

Bartley III identifies two sub-problems of demarcation in Karl Popper. The first problem consists in testing newly constructed theories in their independent existence. For example, to test the hypotheses, "all planets are in ellipsis" is to discover or observe a planet that is not in this state of affairs. The second sub-problem of demarcation of Popper to Bartley is that of eliminating unscientific theories which make scientific pretention such as Marxism, Adler's individual's psychology and Freud's psychoanalysis. To Popper, they are pseudo-scientific theories for they

[816]Karl Popper, *Realism and the Aim of Science*, p. 179.
[817]*Ibid.*, p. 180.

develop strategems through the reformulation of theories to avoid criticism. Bartley finds the two problems as unimportant because:

> *An important evaluation problem is not to demarcate scientific from non-scientific theories but to demarcate critical from uncritical theories or from theories that are protected from criticism – particularly pseudo-critical theories […]. But in this broader context the demarcation of science and non-science is, per se unimportant.*[818]

Even though we may ask Bartley what criterion will be used for criticism, what is tacit in his assertion is a call for the relativism and plurality of the criteria of demarcation. Thus, what is applicable in distinguishing between one scientific theory and the antithetical pseudo-science should not be generalised as a universal criterion of scientificity.

What Bartley finds logically inconsistent in the evolution of Popper's development of the criterion of demarcation is that even though he recognises metaphysics of science in his later works, he does not alter the bases of his criterion of falsifiability. This change in the position in his later years warrants a readjustment of Popper's principle of Demarcation. Another instance of inconsistency in Popper's view of the epistemological value of metaphysics is in his putative article, "what is dialectics", that appeared in 1940. There are unjustified changes that Popper affects in the ending words of this article in two versions. In the 1940 version that was published by the *mind, New Series,* Popper concludes the article in the following words:

> *The whole development of dialectic should be a warning against speculative philosophy. It should remind us that philosophy must not be made a basic for any sort of scientific system and that philosophers should be much more modest in their claims. For their task, which they can fulfil quite usefully, is the study of the methods of science.*[819]

Popper's conclusion in the 1940 version is positivistic. He asserts that the task of philosophers is to study the methods of science. However, in 1963, the same article appeared as a chapter 15 of *Conjectures and Refutations,* with unjustified changes to suit his defends of the metaphysics of science. Here, he asserts that:

> *The whole development of the dialectics should be a warning against the dangers inherent in philosophical system-building. It should remind us that philosophy must not be made a basis for any sort of scientific system and that philosophers should be much more modest in their claims. One task which they can fulfil quite usefully is the study of the critical method in science.*[820]

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[818]William Warran Bartley III, "Theories Of Demarcation between Science and Metaphysics", p. 49.
[819]Karl Popper, "What is dialectic?", in *Mind, New Series,* vol. 49, no. 196, New York, Oxford University Press, 1940, pp. 403-423, p. 423.
[820]Karl Popper, *Conjectures and Refutations, op.cit.*, p. 335.

There are two unjustified changes in these two versions of the same articles. In the 1940 version, Popper refers to "speculative philosophy" and in the 1963 version, he talks of "philosophical system-buildings". Thus, change which has not caused Popper's revision of his main theses is to corroborate with his thesis of the value of metaphysical research programmes in science, defended sparingly in the same book and extensively in the 1982 version of *Quantum Theory and Schism In Physics*. The second unjustified change in the above cited two versions of the article, "what is Dialectic"? Is that in the 1940 version, Popper asserts that "for their task" is the study of "scientific methods" and in the 1963 version, he holds that, "one task" is the "study of scientific methods. By asserting that, "their task is" in 1940, Popper reduces philosophical problems to the study of science and thus defends an implicit biased naturalism of philosophy that was topical in logical positivism. Moreover, d when he asserts in 1963 that, "one task which" is, he acknowledges that there are proper philosophical problems and that there is a metaphysics of science.

The above illustrates failure of Popper to define a sharp criterion of demarcation and the fallibility of scientific authority to develop a sharp criterion of demarcation between science and metaphysics. Even if we deal only with Popper's early view of demarcation, the problem will not still be solved. For instance, if we accept that a theory is termed scientific when it is falsifiable and falsifiable when there are counterevidence, then falsifiability is not prescriptive for it is judged at the end of experimentation. We cannot apply it directly on a theory presented to us at face value. Popper himself acknowledges that falsification is not encompassing because it exist in degrees. Popper thus asserts that: "there will be well-testable theories, hardly testable theories, and non-testable theories. Those which care non-testable are of no interest to empirical scientist. They may be described as metaphysics."[821]

Unlike Popper's view that a closer study of any theory must depend on whether it is falsifiable or not, this does not go with the above degrees of testability because to connote a theory as scientific, we must first carry out a closer examination of it. Thus, empirical science must study metaphysics. Unlike Popper's claim, falsifiability does not define when a theory deserves closer study. That is why Bartley holds that: "But no crucial experiment of an empirical character is possible before time t. therefore one must wait for time t."[822] Testability and counter-evidence in most cases always intervene after a theory must have been accepted. For instance, Einstein's theory of general relativity that was discovered in 1905 and published in 1915, was highly welcomed

[821]Karl Popper, *Conjectures and Refutations*, p. 257.
[822]William Warren Bartley III, *op.cit.*, p. 56.

before its actual time t. It was only tested in 1919 when it was already considered as an explanatory model of the time. Bartley thus notes that "It had been around several years before it could be tested seriously in the famous crucial experiment conducted by Sir Authur Eddington and Principe, off West Africa, on May 29, 1919."[823]

Another example of a theory that was accepted by the scientific community before crucial experiment was construed was the photoelectric equation of Einstein in 1905 that was only tested in 1916 by Robert A. Milikan. It was tested; it also showed similitude with the quantum hypothesis of Plank. These historically verifiable illustrations then do not evoke how sharp the demarcation criterion has unfold in the history of science. Bartley thus rejects the use of a single criterion to generalise as prescriptive to the whole of science and also attempts to go beyond Popper. He thus conceives a new problem as he states that: "I suggest to Popper that the problem lies not in the demarcation of the scientific from the non-scientific but in the demarcation of the rational from the irrational, the critical from the uncritical."[824]

Approaching the problem from Bartley's point of view will not have bearings on the value of metaphysics in science. Massimo Pigliucci notes that alleged demise of the demarcation problem, survey was conducted in the USA among scientists. Out of 176 members questioned on whether there is a universal criterion of demarcation, 89 percent were negative. This way appear more sociological than philosophical but Massimo Pigliucci points at the plurality of the criteria of demarcation as philosophically supportive to the survey. Massimo offers another argument against Popper's methodological prescriptivity in falsification. His argument goes that:

> *The problem with the falsifiability criterion, however, is that many pseudoscience do contain falsifiable statements and therefore count as science. For example, the central claim of astrology, that there is a clear connection between zodiac signs and human character traits, is testable – and it has been statistically tested and refuted many times.*[825]

Astrology to him fulfils Popper's criterion since it can be contradicted by observational statement. He also proceeds to present some general problems that discredit the problem of demarcation. The first difficulty is that, we do not only have the demarcation between science and pseudo-science but also between science and non-science. There is need thus to clarify the distinction between pseudoscience which is a non-science that pretends to be scientific and non-science which does not make such scientific pretention. He thus asserts that: "the first is that there

[823]William Warran Bartley III, "Theories of Demarcation between Science and Metaphysics", p. 57.
[824]*Ibid.*, p. 64.
[825]Massimo Pigliucci and Maarten Boudry, *Philosophy of Pseudoscience, Reconsidering The Demarcation Problem*, Chicago – London, Chicago Universal press, 2013, p. 30.

is not just the distinction between science and pseudoscience, but also the distinction between science and non-science in general."[826] There is a difference between nonscience and pseudoscience. All pseudosciences are nonsciences but not all non-sciences are pseudo-sciences. A nonscience becomes a pseudoscience only when it pretends to be science. The second challenge of Massimo is that of differentiating between a 'good' from a 'bad' scientist. A scientist who is negligent in handling and manipulating facts or in respecting the precepts of the method is not a pseudoscientist to Pigliucci but simply a bad scientist. The need to clarify this controversy kills the precision that is supposed to undercut the criterion of demarcation between science and metaphysics.

Another difficulty involved in the problem of demarcation is that of distinguishing between proto-science from heterodoxy. Massimo Pigliucci asserts that: "By definition, a proto-science does not posses all the features of a full-blown science, so how do we situate its status?[827] When theories are just developed before testability they are still proto-science, that is, science is its premature stage. The scientific status of protoscience is a difficulty to the criterion of demarcation, one of the proto-sciences is evolutionary psychology and we may as well add astrophysics which are in search for scientific recognition. Most of their hypotheses and claims are metaphysical but as emerging sciences, they may become testable in the future. The debate over the disunity and the unity of science is the third difficulty. It is difficult to develop a general criteria of demarcation in the scientific context, marked by the debate on whether sciences should be united or not.

The fourth serious difficulty of the criterion of demarcation in philosophy of science considered by Massimo is that of the measure of demarcation – while others consider sequential theories, others acknowledge practices, others consider statement, others use problems, others use fields of knowledge and others opt for methods as measuring units of demarcation. For instance:

> *For example, Popper's falsificationist approach concerns statements, as it essentially consists in the application of the modus tollens rule; Lakatos (1970) refers to theories and research programs, Kuhn (1970) focuses on problems, and problem-solving capacity of theories, Kitchner (1982) an Lugg (1987) examine theories and practices; Bunge (1983) and Thagard (1988) refer to entire field of knowledge; and Wilson (2000) analyses the differences in reasoning of scientists and pseudoscientists, that is, their different logic and methodology.*[828]

[826] Massimo Pigliucci and Maarten Boudry, *Philosophy of Pseudoscience, Reconsidering The Demarcation Problem* p. 31.
[827] *Idem.*
[828] *Ibid.*, p. 33.

With the plurality of units of measurement of demarcation criterion, it is then impossible to talk of a demarcation criterion that is general and all-encompassing in science, with the partiality involved in the development of demarcation criteria, Larry Laudan, stipulates that if there is supposed to be any demarcation criterion, it must give not only the necessary but the sufficient characteristic features of science. All the criteria stated above involve only the necessary and not the sufficient definition of the characteristic features of science. He thus asserts that: "We must insist that any philosophically interesting demarcative device must distinguish scientific and non-scientific mattes in a way which exhibits a surer epistemic warrant or evidential ground for science than for non-science."[829] The criterion of scientificity then is not supposed to be hypothetical but categorical and rigorous. A criterion is a rule or standard that when followed one unavoidably obtain a certain phenomenon or practice. Lauden in this way insists that:

> *Minimally, we expect a demarcation criterion to identify the epistemic or methodological features which mark off scientific beliefs from non-scientific ones. We want to know what, if anything, is special about the knowledge claims and the modes of inquiry of the sciences.*[830]

Lauden has just set the pace for the impossibility of such a criteria. We had earlier raised the difficulty of the plurality of the sciences which seemingly cannot enable the development of such "surer epistemic warrant or evidential ground' that Laudan defends. Laudan insists that any criterion to be ranked demarcative should not only be necessary by defining individually necessary conditions of various theories but is should also define "jointly sufficient conditions for deciding whether an activity or a set of statements is scientific or unscientific."[831] A demarcation criterion that is necessary points at some features of science but a sufficient one defines science as a whole. Applying the two conditions on the verification and falsification that are under our reflection, Laudan asserts that they all fall short of expectation. Against the logical positivists' paradigm of meaning, Laudan argues that:

> *Despite its many reformulations during the late 1920's and 1930's verificationism enjoyed mixed fortunes as a theory of meaning. But as a would-be demarcation between the scientific and the non-scientific, it was a disaster. Not only are many statements in sciences not open to exhaustive verificationism (e.g., all universal laws), but the*

[829]Larry Laudan, "The demise of the demarcation problem", in R. S. Cohen and Larry Laudan Eds., *of Physics, Philosophy and Psychoanalysis, Essay in honour of Adolf Grunbaum*, Dordrecht, D. Reidel Publishing Company, 1983, pp. 111-127, p. 118.
[830] Larry Lauden, *Beyond Positivism and Relativism, Method and Evidence*, Oxford, Westview Press, 1992, p. 215
[831]*Idem.*

> *vastmajority of non-scientific and pseudo-scientific systems of belief have verifiable constituents. Consider for instance the thesis that the earth is flat.*[832]

The theory of the flat earth is verifiable but accepting such theory, in the 21st century is considered unscientific. The same view Laudan has about Popper's principle of falsifiability. That is, Laudan reiterates that:

> *A second familiar approach from the same period is Karl Popper's falsificationist criterion which fares no better. Apart from the fact that it leaves ambiguous the scientific status of virtually every single existential statement, however well supported (e.g., the claim that there are atoms, that there is a planet closer to the sun than the earth, that there is a missing link), it has the untoward consequence of countenancing as scientific every crank claim which makes ascertainably false assertions.*[833]

The criterion set by Popper thus opens doors for all sorts of theories which open themselves up to testability and cannot be ranked scientific. Even if we proceed that testability is a matter of degrees, it will be difficult to test the various degrees of theory 1 from theory 2 when the former entails the latter. With these inconsistency, Laudan asserts that, "I do believe, though, that we are warranted in saying that none of the criteria which have been offered thus far promises to explicate the distinction."[834] Some scientific theories are tested using different criteria and others are tested using others. Some theories have very high power of prediction and some are not. Some theories make use of auxiliary hypotheses while some do not. Laudan thus calls for the consideration of the quest for the criterion of demarcation as a useless epistemic adventure. That is: "The evident epistemic heterogeneity of the activities and believes customarily regarded as scientific should alert us to the probable futility of seeking an epistemic version of demarcation criterion."[835]

The problem of demarcation to Laudan thus appears to be a pseudo-problem in epistemology. As a way forward, he proposes a more generic criterion similar to that proposed by Massimo Pigliucci and Maarten Bondry above. He proposes that: "In arguing that it remains important to retain a distinction between reliable and unreliable knowledge, I am not trying to ressurate the science non-science demarcation under a new guise."[836]

It is a generic criterion because it defines the criterion of distinction between acceptable and pseudo knowledge as a whole. It is an arguably position because it is simply prescriptive and does not in practically state how to demarcate on knowledge as a whole. This is also limited because

[832]Larry Lauden, *op.cit.*, p. 120.
[833]*Ibid.*, p. 121.
[834]*Ibid.*, p. 124.
[835]*Idem.*
[836]*Ibid.*, pp. 124-125.

when we talk of knowledge in a generic way, we ignore science and open up to contradictory views of knowledge like rationalism and empiricism, realism and idealism and scepticism and theories of evidence. This view is implicit in Massimo Pigliucci's attempts to go beyond Laudan's generic criterion. He thus asserts that: "finally, even if the destruction between reliable and unreliable knowledge were ultimately the most important one, it would still remain legitimate to try to delineate a more restricted way of knowledge production, namely the scientific one, from other ways of gaining knowledge."[837]

A generic criterion of demarcation in epistemology as a whole is destructive to hegemony and autonomy of science. Mahner Martin poses seven questions about practical life which calls for the urgency of the demarcation problem. The first question is, "should our own as well as others people's health and even lives be entrusted diagnostic or the rapentic methods that are not scientifically validated?"[838] Thus, to answer such public health related question, we need the criterion of demarcation. It is related to another question, "should public health insurance cover magical cures like homeopathy or therapeutic touch?"[839] This question concerns public health administration and can only be settled on grounds of the demarcation criterion.

There are also legal need for an answer to the question of demarcation. That is, "should the police ask deurroyants to search for missing children or to help solve crimes? Should evidence presented in court trials include astrological character analysis or testimony of mechanisms?[840] Moreover, Maliner also links the necessity of a proper demarcation between science and metaphysics to that of finding research by policy makers. That is, "should tax payers' money be spent on finding pseudo-scientific 'research' or it is a better investment to find only scientific research."[841] Finally, the need for the settlement of the problem of demarcation is also grounded on political exigencies. That is, "should people living in modern democratic society base their political decisions on scientific knowledge rather than on superstition or ideology?"[842]

[837]Massimo Pigliucci and Maarten Boudry, *op.cit.,* p. 34.
[838]Mahner Martin, "Demarcating Science and Non-Science", in *Handbook of The Philosophy of Science*, Theo A. F. Kuipers ed., Amsterdam, Elsivier, 2007, pp. 51-75, p. 74.
[839]*Idem.*
[840]*Idem.*
[841]*Idem.*
[842]*Idem.*

6.3. THE METAPHYSICAL GROUNDINGS OF SCIENTIFIC OBJECTIVITY

Given that the scientific status of a theory is in its ability to be falsified, truth becomes tentative as developed above. However, with the influence of Taski, Popper is able to talk of absolute truth that is not tenable but plays a regulatory function. We will then examine the nature of this absolute, universal and unattainable truth that popper defends and the role it plays in science. In the second articulation, we will examine his theory of three worlds which constitute at the same time the bedrock of his scientific objectivity and the crux of his scientific anthropology for the three worlds corresponds to the levels of the emergence of the mind. Popper is also to attempt a solution to the body-mind problem.

6.3.1. The Regulative Role of the Idea of Objective Truth

It is worth reiterating that it is due to Popper's encounter with Taski that he reinterpreted the idea of truth as a semantic concept. The subsequent revalorisation of the correspondence theory of truth culminates to development of verisimilitude as a measure of this correspondence. Agreeing with Taski that be no natural language can formulate a criterion of truth, Popper concludes that the truth is absolute, objective and unattainable. The unattainability of the absolute truth is not equivalent to scepticism for Popper asserts that the idea of truth plays a regulatory rule. By regulatory ideas or principles, we imply "maxims of thought deriving from our interest in a certain possible perfection f knowledge of an object."[843]

The conceptual archaeology of the idea of regulative idea can be traced back to the Kantian criticism and transcendental idealism. To Kant, the ideas of pure reasons are not objects of knowledge but they play but regulative function. Kant thus affirms that:

> *I accordingly maintain that transcendental ideas can never be employed as constitutive ideas […] but on the other hand, they are capable of an admirable and indispensably necessary application to object-as regulative ideas, directing the understanding to a certain aim, guiding lines towards which all its laws follows and in which they all meet.*[844]

Kant in this line of reflection implies that transcendental ideas are neither objects of knowledge nor derivable from objects but are the heterogeneity of experience. Kant refers to them as; "regulatory principles of the schematic unity of empirical cognition."[845] They are three regulative ideas to Kant, that undercut rational psychology, rational cosmology and rational

[843]Simon Blackburn, *The Oxford Dictionary of Philosophy*, p. 76.
[844]Immanuel Kant, *Critique of Pure Reason*, p. 193.
[845]*Ibid.*, p. 201.

theology. They respectively define the ideas of the souls as the first principle of the self, the universe as having an origin and the idea of God existence. These are not constitutive but regulative principles. As for the soul, Kant asserts that, "the aim of reason in this procedure is the attainment of the principles of systematic unity for the explanation of the explanation of the phenomena of the soul."[846] To question the properties of the thinking substance, we must proceed from the entity of subjective experiences. The cosmological idea is not constitutive and corresponds to no object of cognition but it is a necessary condition for knowledge of phenomena. This also applies same to the idea of God, which as a regulative idea, is simply "a demand upon reason that it shall regulate the connection which it and subordinate faculties introduce into the phenomena of the world as originating from one all-embracing being."[847] Thus, regulatory ideas give the mind the nature of schematisation and the power of synthesis of intuition. Objects of regulatory ideas whether in Kant or Popper can not be known with absolute certainty. That is why Sergio L. De C. Fernandes, affirms that:

> *Neither for Kant, nor for Popper can we have knowledge of the object of a regulative idea: we cannot know that nature is a cosmos not a chaos; we cannot know that the world is intelligible; stumbled upon truth; or that there is a reality, absolutely independent or our knowing it.*[848]

The metaphysical agnosticism of Kant on the ideas of pure reason rejects the possibility of any knowledge of them. This is unlike Popper, who asserts that knowledge of the empirical truth is conjectural but that the absolute truth is a standard towards which every search for the truth is directed. Regulatory ideas are simple postulates and also may be qualified as conjectural for we can not experimentally establish their existence. However, "if regulative ideas are conjectures then they must be normative conjectures in this sense, they would have to be either conjectures about how things ought to be in other that other things be possible."[849] This follows that for there to be epistemic virtues like knowledge, objectively and criticism, there must first of all be absolute truth, numenal reality and order in nature.

There are four reason Popper advances to justify the idea of the absolute and objective truth. They include the historical, the semantic, the logical and the epistemic reasons. Historically, the notion of the absolute truth to Popper is historically evident in the pre-Socratic period. He is thus inspired by Xenophanes view that we can never know when we arrive at the truth. Popper thus

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[846]Immanuel Kant, *Critique of Pure Reason,* p. 204.
[847]*Ibid.*, p. 205.
[848]Sergio L. De C. Fernandes, *Foundations of Objective Knowledge; The Relations of Popper's Theory Of Knowledge To That Of Kant*, Dordrecht, Springer, 1985, pp. 255 – 256.
[849]*Ibid.*, p. 246.

corroborate with Xenophanes as he affirms that, "so one great advantage of the theory of objective or absolute truth is that it allows us to say-with-Xenophanes-that we search for truth but may not know when we find it."[850] Empirical truth are tentative but as scientific theories and statements are evaluated from their approximation of the absolute truth.

Semantically, Popper justifies the idea of absolute truth in science on grounds that it is impossible to formulate the criterion of truth in natural language. In agreement with Taski, Popper asserts that, "we have no criterion of truth."[851] The reasons for the impossibility of the formulation of the criterion of the truth are dual. Firstly, scientific language is made up of statements and theories whose truth considered as correspondence is a matter of simple approximation. It is thus difficult to establish the criterion of the truth in such a language. Secondly, the impossibility of establishing a criterion of the truth is due to the fallibility of man. Given human fallibility, it will be difficult for him to establish such an infallible formula. It is in this regards that Popper asserts that: "If we agree to use the term 'true' only when the objective sense then there are statements which we can prove to be true, yet we cannot have a general criterion of truth. If we had such criterion, we would be omniscient, at least potentially which we are not."[852] This applies same to validity of deductive reasoning. There is a no criterion of validity but reductive inference like the *modus ponens* approach of testing theories can be evaluated by simply producing counter-examples. If we produce a counter-example successfully, then the inference under evaluation is valid, if not, we will establish its validity. In this way, Popper equates absolute truth to validity on grounds of the impossibility of the criterion of the latter as he asserts:

> *Yet we have no general criterion of validity not even if we confine ourselves to purely arithmetical statements. As a consequence, we have no general criterion whether or not some given arithmetical statement follows validly from the axioms of arithmetic. Nevertheless, we can describe infinitely many rules of inferences.*[853]

This thus shows the limitations of other subjectivist theories of truth such as the coherency, and the pragmatist, which attempt a formulation for the criterion of truth. Given the fallibility of man, these criterion cannot establish what truth is. They may say what true beliefs are but they cannot give an all-encompassing general formula of truth. Popper conscious of the impossibility of the formulation of the crtiterion of truth, insists that, "there cannot be, in any language

[850]Karl Popper, *Conjectures and Refutations,* p. 226.
[851]*Idem.*
[852] Karl Popper, *Unended Quest,* p. 167.
[853]*Idem.*

comparable in its wealth of expression to our ordinary European language a general criterion of truth."[854]

The third reason which made Popper to posit for an absolute truth in science is logical. This reason is grounded also on human fallibility and on the negativist methodology of falsification. It is exactly this logical reason accords the regulatory rule to the idea of absolute truth. The fact that humans are fallible on one hand and that theories are tested to be falsified, give reason for the ceaseless search for this unattainable absolute truth. As a regulative idea, the idea of Truth guides the human search for true theories. It is in this light that Moundoué and Nguemetta affirms that: « *C'est la recherche maximale et constant de la verité qui motive l'entreprise scientifique.* » [855] It is thus a standard that all scientific theorisation aim at. Popper here illustrates the regulatory role idea of the idea of absolute truth to the analogy of climbing a mountain to reach the peak. That is;

> *The status of truth in the objective sense as correspondence to the facts and its role as regulative principle, may be compared to that of a mountain peak usually wrapped in clouds. A climber may merely have difficulties in getting there – he may not know when he gets there, because he may be unable to distinguish in the clouds, between the main summit and subsidiary peak.*[856]

The clouds here refers to errors and human fallibility while the peak is the absolute truth. The fact that human are fallible and that theories are falsifiable does not imply the non-existence of the absolute truth for, "if the climber tells us, 'I have some doubt whether I reached the actual summit', then he does by implication, recognises the existence of the summit.[857] The fact that a theory is falsifiable and that humans are fallible thus imply the existence of the absolute truth which is the standard of the continues search for true theories in a fallibilist methodology. In other words, "the very idea of error, or doubt implies the idea of an objective truth which we may fail to reach."[858] It is difficult to attain the absolute truth but it is easier to evaluate ourselves when we fail in our attempts to attain it. The idea of the absolute truth as a regulatory principle does not only enhance the evaluation of the degree of approximation correspondence but it is also a standard that helps in the identification of our tumbling into error. That is: "Thus the very idea of error and

[854]Karl Popper, *Unended Quest,* p. 175.
[855]Roger Mondoué and Nguemeta Philippe Nguemeta, *Vérificationnisme et Falsificationnisme. Wittgenstein Vainqueur de Popper?*, Paris, L'Harmattan, 2014, p. 87.
[856]Karl Popper, *op.cit.*, p. 226.
[857]David Miller, *op.cit.*, p. 186.
[858]*Idem.*

of fallibility involves the idea of an objective truth as the standard of which we may fall short. "It is in this sense that the idea of truth is regulatory."[859]

Jean-Françoise Malerhbe goes beyond the mere regulatory role of the truth to posit the possible existence of a world to which that this objective truth corresponds to. This is to him is metaphysical dualism. It is in this light that he holds that; *« le concept de vérité n'est donc pas un concept de l'épistémologie de Popper ; il appartient à sa métaphysique de la science. »*[860]

The Fourth justification of the absolute nature and the regulatory role of the truth is epistemic. It is the grounding of Popper's evolutionary epistemology for the idea of the absolute truth does not only give purpose and meaning to the methodology of conjecture refutation but it also eliminates scepticism from the falsifiabilist methodology of testing theories. From the evolutionary point of view, the regulative role of the absolute truth is plausible for it is the standard of the growth of knowledge. By conjecturing and refuting theories, we do not only approximate the absolute truth but we also learn from our errors, leading to the growth of knowledge. That is why Popper insists that: "yet we also stress that truth is not only the aim of science. We want more then mere truth; what we look for is interesting truth which is hard to come by."[861] Thus the absolute truth plays a regulatory role because the idea of truth is a standard that guides and gives meaning to testability, the search for true theories and the growth of scientific.

6.3.2. The Theory of the Three Worlds as the Base of Scientific Anthropology and the Objectivity of Knowledge

The three worlds as developed by Popper are not transcendent but are immanent in the context of the scientific activity. This theory illustrates the evolution of the mind from the physicality, the psychology so as to attain the logical state of criticism and objectivity. The theory of three worlds thus defends the evolutionary aspect of knowledge, its objective status and this is intandem with the resolution of the body-mind dualism and also evoking Popper's biological anthropology.

The first stage of self-emergence to objective knowledge is situated in world 1. World 1 is nothing other than the physical world. It is the world inhabited by objects of empirical sciences. Popper thus asserts that world 1 is the world of: "processes forces, fields of forces-interact among

[859]David Miller, *The Pocket Popper*, p. 190.
[860] Jean-François Malherbe, *op.cit.*, p. 126. "The concept of truth is thus not a concept of the epistemology of Popper, it belongs to his metaphysics of science"; (our translation).
[861]David Miller, *Pocket Popper*, p. 190.

one another, and therefore with material bodies. Thus, we conjecture them to be real."[862] Physics, chemistry, biology, geology as experimental sciences grapple with world 1 objects. It is a world of our everyday natural experience. As a realist, Popper defends the objectivity of world 1 because "its inhabitants can be experienced also by others; and it is autonomous, because their existence does not depend on us."[863] World 2 on the other hand is the world of the objects of psychology. It is a purely subjective world because it deals with thought processes, dispositions and behaviour. Thus, world of mental states, though subjective is real because the process involved are intrinsically linked to the objects of world 1. To illustrate this claim, Popper asserts that: "a toothache is a good example of a state that is both mental and physical. If you have a bad toothache, it may become the strong reason for visiting your dentist, which involves a number of actions and of physical movements of your body."[864]Admittedly, tooth carries involved create a physical effect through the feeling of pains leading to the action of visiting a dentist.

World 3 is inhabited by products of world 2. It is the world of language, logic and objective knowledge. It is in this light that Popper asserts that: "By world 3, I mean the world of products of the human mind, such as stories, explanatory myths, tools, scientific theories (whether true of false), scientific problem, social institutions and works of arts." The theory of these three world makes popper a metaphysical pluralists, for he acknowledges the existence of their basic realities. That is Godfrey B. Tangwa asserts that:

> *Popper is a metaphysical pluralist. Hen postulates three ontological "worlds" or "universals": World 1- the world of physical objects or of physical states; world 2- the world of consciousness or mental states; world 3- the world of objective contents of thought , the world of problems, arguments, reasons, the world of scientific and poetic thoughts, or artistic expression, etc.*[865]

World 3 is the world of objective knowledge for its products, though produced through the thought processes autonomously and objective from the act of production. World one is not created for its objects are cognised through perception. This perception permits the transit from world 1 to world 2. What permits the evolution from world 2 to world 3 is the emergence of language with language there is the formation of theories and problems on one hand and the possibility of criterion is guaranteed through the argumentative function of language.

[862]Karl Popper and John C Eccles; *The Self and Its Brain*, p. 36.
[863]Stephano Gattei, *Karl Popper's Philosophy*, p. 57.
[864]Karl Popper, John C. Eccles, *op.cit.*, p. 36.
[865]Goddfrey B. Tangwa, *op.cit*., p. 36.

These three worlds do not dispose themselves of ontological independence from one another because of the act of their interaction. World 2 interact both with world 1 and world 3. This interaction is enhanced by the fact the world 2 is formed from the perception of world 1 and world 3 is a production of world 2. World 3 and world 1 on the other hand can only interact due to the mediation of world 2. This interaction shows the transformative role of the scientific activity, Popper's solution to the body-mind problem and his biological anthropology. At the level of the transformative role of science, Popper uses the interaction between the three worlds to show the possibility of the former. For instance, when scientists dream of human possibility of flying is the role of world two, theories and aircrafts are invented as the role of world 3 and these aeroplane unavoidably alter the existential conditions of man in world 1. Another example is gastronomical as seen in reading a cook book and strictly following the precepts of cake baking for instance also involves the interaction between the three worlds.

The interaction between the three worlds equally offers Popper's response to the body-mind problem. Before offering his solution to the problem, we reject four alternative views that were developed on the subject before him. To Popper, immaterialism or spiritualism as a solution to the body-mind problem is limited because it denies the existence of world 1. He is thus against the idealism of Berkeley and the neutral monism of Mach. Pure physiccalism or what he terms philosophical behaviourism is narrow for it denies the reality of world 2. The body-mind parallelism of Spinoza and Malebranche is equally narrow for it resets that world 2 refer to mental states while world 1 simply refers to the activities of the brain. The forth theory is the body-mind interractivism of Descartes which asserts that world 2 mental states exist concomitantly with world 1 of the physical states criticising these theories, Popper proposes psychological interactionism.

Popper reduces the body-mind problem to the problem of the interaction between world 2 and world 1. He thus insists that: "the question whether both physical and mental states exist, and whether they interact or whether they are otherwise related to known as the body-mind problem."[866] As solution to the body-mind problem, Popper asserts that the brain and the mind are linked. The interaction between the mental and physical states is reduced to his tripartite division, which posits a human being as an emergent self or consciousness. The self is the product of the evolution from world 1 to world 3 and a consequent of the interaction between them. Popper's scientific anthropology consist in his trialism for the self is it the mind but, "we could say that man himself condenses in three worlds."[867] The mind in Popper does not have the spiritual connotation

[866]Karl Popper, John C. Eccles, *op.cit.,* p. 37.
[867]Stephano Gattei, *op.cit.,* p. 92.

of an abstract substance called the soul but he affirms that: "I propose instead that we regard the human mind first of all as an organ that produces objects of the human world 3 and interact with them. Thus, I propose that we look upon the human mind, essentially, as the producer of human language,"[868] when objects of world 2 like theories, problems, myths are produced, they can only gain autonomy and objectivity if they are distinguished from the producer. However, the acquisition of a language through learning is the product of the relationship between world 3 and world 1. This is because the capacity that animates the learning of language is genetical while "by contrast the actual learning of a language though influenced by unconscious inborn needs and motives, is not a gene-regulated process and therefore not a natural process, but a cultural process, a world 3 regulated process."[869] Language may be immaterial but it requires material aspects like sounds to be materialised. Language thus has a creative power in the determination of the self. A child for instance becomes aware of himself thanks to language for his ability to speak renders him to acquire knowledge of his environment. Through language, the interaction between man and others and his cognitive contact with the environment leads to the self. Popper reiterates that, with the acquisition of speech "especially when the child becomes conscious of his name and when he learns to name the various parts of his body, and most important, when he learns to use personal pronouns", the child becomes aware of himself.[870]

The body-mind problem is thus the problem of the interaction between the physical states of world 1 and the mental states in world 2 and how they altogether culminate to world 3. Language that is emanates from some physical forms leading to self-consciousness in world 2 and highest level of the evolution of this language is evident in its descriptive and argumentative functions which permits autonomous and objective existence of worlds. The world of objective knowledge is thus a collorary of Popper's evolutionary anthropology which is in tandem with his interactionist solution to the body-mind problem. It is incumbent then to examine the autonomous and objective nature of the third world.

What is worthy of note as preliminary to the discussion of Popper's view of objective knowledge is his affiliations with Plato's theory of Forms and to delineate their specifications. According to Stefano Gattei:

> *Popper's world 3 has strong similarities with Plato's theory of forms or ideas and Hegel's theory of an absolute spirit (absolute spirit), though it is clear to Bolzano's theory of the*

[868]Karl Popper, *Unended Quest*, p. 221.
[869]Karl Popper, John C. Eccles, *op.cit.*, p. 48.
[870]*Ibid.*, p. 49.

universe of statements in themselves and truths in themselves, or Frege's universe of objective contents of thought.[871]

Despite this ontic similitude between Popper's third world and the views of Plato's Forms are eternal, immutable and have a divine connotation while the inhabitants of Popper's third world are products of the human mind. While Plato views the forms as absolutely true, "[…] Popper does not regard objective knowledge as certain and his world 3 objects may well turn out to be false."[872] In Hegel's conception of the absolute, contradiction or the dialects play a positive role but in Popper's theory of the objective world, contradiction is erroneous and negative. Moreover, the absolute mind in Hegel possesses absolute consciousness while knowledge of the objects of Popper's world 3 is knowledge without a knower.

The distinction between Popper's objective world and Plato's theory of forms provokes a difficulty of the reality of the objects of world 3. Is it just a metaphysical conjecture or a world of possible entities? Popper himself raises this question and attempt an answer to its. He questions, "what is the ontological states of these world 3 objects? Or, to use less-sounding language, are problems, theories and arguments real like tables and chairs?"[873] He is fundamentally a realist and thus he posits that: "I have become a realist with respect to the world 3 of problems, theories and critical arguments."[874]

The first argument to buttress his realist claim of the reality of world 3 objects is based on the transformative role of world 3 objects and their influence in world 1. One can read a book which belong to world 3 and use the prescriptions there in to change the physical states of existence. In the macro-level, technology that is the engine of civilisation and development is simply the application of scientific theories belonging to world three. If these theories and problems do not exist, they would not be any development and civilisation. Popper thus affirms that; "the production of a scientific theory, its critical discussion; its tentative acceptance; and its application which may change the face of the earth and thus world 1"[875] is a plausible proof that the objects of world 3 exist. Thus the materialisation of world 3 makes it real. With this, Popper advocates for realism as attitude par excellence of a scientific mind. That is "if we do not admit

[871]Stephano Gattei, *op.cit.*, p. 58.
[872]*Idem.*
[873]Karl Popper, *Uneded Quest*, pp. 213 – 214.
[874]*Ibid.*, p. 214.
[875]Karl Popper, John E. Eccles, *op.cit.*, p. 39.

problems and theories as the objects of stud and of criticism, then we shall never understand the behaviour of scientists."[876]

Before demonstrating the objectivity of knowledge of the third world, Popper criticises the subjective approach to knowledge. Subjectivity of knowledge in science to him is caused by the illicit attempt to situate knowledge in the second world. Subjective knowledge thus is knowledge of world 2 thought processes. The history of subjective epistemology is thus that of the misplacement of knowledge in world 2. It is knowledge of dispositions which makes individuals to hold firm to certain views that are inseparable of their subjectivity. It is knowledge expressed in the first person personal pronouns like "I know" and "I think". To Popper, the study of science and the exercise of epistemology from such personal approach is wrong:

> *« Car la connaissance scientifique n'est pas une connaissance au sens de l'usage habituel des mots 'je connais'. Alors que la connaissance au sens de 'je connais' appartient à ce que j'appelle le deuxième monde, le monde des sujets, la connaissance scientifique appartient au troisième monde, le monde des théories objective, des problèmes objectifs et des arguments objectifs. »*[877]

In subjective knowledge, there is a confusion between thought processes and their products and there is also the identification of knowledge with the subjectivity of the knowing subjects. Popper here, has traditional epistemologists in mind like Descartes, Locke, Berkeley, Hume and Russell. The subjective approach studies knowledge out of the context of problem-situation. Such approach is not critical because it does not integrate the argumentative function of language in their context of justification.

The subjectivity of knowledge vanishes when the subjects involved keep away their subjectivities and engage into inter-subjective criticism viz the argumentative function of language. Objective knowledge on the other hand is that problems, theories and arguments as they are in themselves and as they exist independently of he who cognises them. Problems that either provoke theories or arises from theories are objective, since theories are formed to respond to such problems, their scientificity resides in openness to refutation and arguments that are constructed to defend such theories from competing ones have objective and not subjective appeal. It is thus

[876] Karl Popper and John C Eccles, *The Self and Its Brain* p. 40.
[877] Karl Popper, *La Connaissance Objective*, pp. 121 – 122. "For scientific knowledge is not knowledge of the habitual use of words, 'I know', while knowledge of the form 'I know' belong to what I call the second world, the world of subjects, scientific knowledge belong to the third world, the world of objective theories, objective problems and objective arguments"; (my translation).

in this light that Popper asserts that: *« la connaissance au sens objectif est une connaissance sans connaisseur: elle est connaissance sans sujet connaissant. »*[878]

Positing objective knowledge as knowledge without the knowing subject does not eliminate the subject from knowledge development. This assertion can be rendered consistent at two levels. Firstly, Popper does not deny the role of the subject in the construction of knowledge. He however argues that the subject or the second world plays only a causal role in epistemology. He thus asserts that: *« l'attraction exercée par l'approche subjective est due en grande partie au fait qu'elle est causale. »*[879] Such approach is most common in subjective epistemology because it restricts itself to the behavioural grounding of knowledge. That is, it is limited as it is based on how human behaviour causes the third world. To Popper, human behaviour may cause objective structures but to base knowledge on this causation is wrong. The second point to understand the consistency of Popper's thesis of knowledge without the knowing subject is in conception of the subject and the self as emergent. The self does not have an essentialist and a fixed ontological status is the product of the highest form of cultural evolution. This highest form is in language. If the highest function of language is argumentative then the self in science has no other role than to exteriorise his theories and participate in critical discussion. This thus is a critical self and not an ontological and psychological self.

Karl Popper stipulates three theses of objective epistemology. The first thesis is a negative observation that traditional epistemology is based on knowledge of the second world and thus confuses between the production process and its products. In the second thesis, he asserts that objective epistemology has no other objective than the study of problems, scientific discussion and the understanding of scientific books and periodics. In the third thesis, he affirms that while the study of the third world may illuminate the understanding of the second world, the converse is not true.

Moreover, Popper advances a biological defence of the objectivity of the third world. Analogically, he compares the growth of knowledge to biological evolution of both plants and animals. The study of animals equally reflects the study of knowledge. Same as we can study knowledge by differentiating the behaviourist or causal aspects from the objective structures arising from human behaviour we also study animal growth by distinguishing between their

[878]Karl Popper, *La Connaissance Objective*, p.122. "Knowledge in the objective sense is knowledge without the knower. It is knowledge without the knowing subject"; (my translation).
[879]*Ibid.*, p. 128. "The attraction exercised by the subjective approach is a greater extent due to the fact that it is causal"; (my translation).

behaviour and the non-living structures, they produce. In the first place, our focus, *« […] s'attache encore à la façon dont les animaux se comportent tandis qu'ils construisent ces structures. »*[880] The problem that undercuts the first phase of our understanding of animal growth is that of the behaviour and disposition that they mobilise in the act of production. The second problems then are those linked to the structures themselves. That is, the problem of the type of materials used in construction with their physical and geometrical dimensions. The example here can be that of the bed nest. The manner in which birds construct their nests is different from the objective existence of the nests. We can study the manner in which birds behave in constructing nest without having any knowledge of the nature of the objective existence of the nests. However, the latter cannot be understood without a comprehension of the former.

The biological analogy permits Popper to distinguish between problems of production corresponding to the psychology of science and problems of the structures corresponding to objective knowledge. This plus the view that problems of structures presuppose problems of production and not vice-versa illustrates the scientific prowess of objective knowledge and the limitations of subjective knowledge. The objectivity of knowledge thus does not only reside in the argumentative function of language but it is also plausible from this biological analogy.

Popper anticipates a possible subjectivist interpretation of his third world on grounds that a book is nothing if there is no one to read it. He still uses the biological argument based on the analogy between the growth of knowledge and production in the animal context. In fact, Popper reiterates the view that whether the birds are living or not in a nest, this does not annihilate the existence of the latter. This is buttress by the view that world three contains a variety of theories that are not yet known. Microscopically, to world, Popper construes the possibility of a computer create a complex system of algorithm in a book that will take generations to decipher them. The book then does not only contain knowledge that is true and attainable but it comprises of objective knowledge that is true and false, and also useful and useless. Thus, it is difficult to understand and grasp the totality of knowledge in a single book. Popper thus asserts that: *« Un homme qui lit un livre en le comprenant est une créatures rare. Mais si la chose était plus commun, il resterait toujours quantité d'incompréhensions et d'erreurs d'interprétation. »*[881] What makes a book is not just a combination of doted papers but the content which does not in any way depend on the reader.

[880]Karl Popper and John C Eccles, *The Self and Its Brain.* p. 126. "[…] attaches still to the way the animals behave when constructing these structures." (My translation).
[881]Karl Popper, *La Connaissance Objective* p. 129. "A man who reads a book and understand it, is a rare creature. But if everything was equal, there would always be a quantity of misunderstandings and errors of interpretation"; (my translation).

The reader's possibilities of understanding, interpreting or making errors in appreciating it, suggest the objective and autonomous existence of the book. Popper thus asserts the autonomous existence of the third world as he affirms that:

> *« Nous pouvons donc dire qu'il existe une sorte du troisième monde platonicien (ou bolzanique) de livres en soi, de théories en soi, des discussions en soi, etc. et j'affirme que même si ce troisième monde est un produit humain, il y'a de nombreuses théories en soi, discussion en soi, situations problématiques en soi qui n'ont jamais été produits ou comprises et pourraient n'être jamais ni compris par l'homme. »*[882]

For the autonomous and human creation of the third world, there is perfect consistency but Popper's view of theories that man has never and may never understand, calls from clarifications. His justification here is still analogical and biological. Popper uses the biological example of using a box produced by human as a habitat of birds in a garden. This is just like a table of algorithm that have been created by computers and translated into books. The birds in this box are not aware of the problem-situation of the adequate nature of the box. This is an objective problem of all animal habitat, but these birds are not yet aware of. This applies same to humans within the context of a complex algorithm created by a computer and may be decoded and interpreted by latter generations. The world of science then is the world of objective knowledge. The objectivity of this knowledge is translated by the objectivity of problems, theories and critical discussions.

[882]Karl Popper, *La Connaissance Objective*, pp. 129 – 130. "We can that there exists a sort of 3rd platonian world (or bolzanic) of books in themselves, theories in themselves, discussions in themselves, etc. and I affirm that even if the third world is a human product, there are numerous theories in themselves, discussions in themselves, problematic situations in themselves which have never been produced or understood and which may never be understood by man"; (my translation).

PARTIAL CONCLUSION

It has been our concern to find out the tenets of Karl Popper's criterion of scientificity. It can inferred from the above that Karl Popper's criterion falls within the context of evolutionary epistemology. The biological connotation of scientific knowledge was influenced by Konrad Lawrence and Charles Darwin, while falsifiability is the principle of scientificity, its technical orientation is called falsification. It is a deductive method of testing theories through refutability. Scientific theories are hypotheses and statement of general nature. Each theory has two sub-classes of statements; those that describe the theory and those that contradict it. A theory is falsified when the class of statements that describes it are rejected. In other to demonstrate the effective application of the principle of falisifiability, Popper rejects the meaning criterion of logical positivism. The meaning criterion has limitaions, that vary from the impossibility to verify natural laws to the impossibility to realise conclusive verification. On the effective application of demarcation through falsification, Popper's admiration for Einsteins respect of of falisification leads him to reject pseudo-scientific theories like Freud's psycholanalysis, Marx theory of history, Adler's individual psychology and other historicist theories like Plato's law of decay, Hegel's dialectics, Auguste Comte's law of the evolution of the human mind and Charles Darwin's theory of evolution. These pseudo-scientific theories engage into prediction but do not apply the principle of falsifiability in testing their predictions. On the critique of the logical positivist logic of science, Popper proposes critical rationalism to justificationism, conjectural knowledge as the solution to the logical problem of induction, objective knowledge to subjective knowledge, corroboration to theories as alternative to probability and he prefers verisimilitude as a better altarnative to the notion of truth in evolutionary epistemology. On the importance of metaphysics in science, it can be deduced that Popper prefers realism over instrumentalism. After devising his critiques of instrumentalism, he defends realism and demonstrates that scientific realism is grounded on metaphysical realism. His propensity interpretation of quantum physics is realist in approach. In the same way, Popper demonstrates how myths and metaphysical research programmes are important in the development of science. His argument is not just historical but he also situates this in the scientific context of discovery and justification. Unlike the logical positivists who asserted that metaphysics is non-sense, Popper illustrates that scientific metaphysics is a rational discourse on pure and traditional metaphysics is also possible. Popper then proceeds to make a case for the metaphysical foundation of scientific objectivity.

PART THREE

CRITICAL EVALUATION AND STAKES

PARTIAL INTRODUCTION

This part of our reflection seeks to unveil the critical stakes of Popper's scientific rationality and his revalorisation of metaphysics. It shall be developed around three main axes. In the first moment, we shall examine the limitations of Popper's conception of scientific rationality. That is, we will make a critique of his criterion of scientificity and assess the effectiveness of his revalorisation of metaphysics. We will then unveil the logical inconsistencies that are plausible in Popper's methodology of science, while examining what other thinkers propose as the alternative to Popper's principle of scientificity. Despite the limitation, it will be necessary in the second moment of this work to question the originality and actuality of Popper's rationality of science and his view on the epistemological importance of metaphysics. At this level, it will be necessary for us to propose solutions to two problems; notably to limitation of Popper's principle and to the demise of the demarcation problem. That is, given the limitations of Popper's rationality, how can we rethink falsification on one hand and the relationship between science and metaphysics on the other hand. This thus carries the originality of our work for we are confronted with three challenges here. Firstly how to review falsification as a standard of scientific rationality, secondly how to propose a new naturalism that suits our theoretical contest and thirdly how to defend the thesis of 'positive metaphysics'. Given that the quality of the scientific mind also has social influence, it will be necessary, to find out the social, pedagogic and the African implications of Popper's rationality of science. That is, we will examine the role of Popper's rationality of science in man's relation with the other and man's relationship with the society. Moreover, it will be contextually rewarding to question the role of Popper's thought in the social and cognitive construction of Africa. This will notably be in the context of African philosophical anthropology and also in the way African thinkers represent cosmology.

CHAPTER SEVEN

THE CRITIQUE OF THE REVALORISATION OF METAPHYSICS IN POPPER'S SCIENTIFIC RATIONALITY

I suggest to Popper that the problem has not in the demarcation of the scientific from the non-scientific but in the demarcation of the rational from the irrational, the critical from the uncritical.[883]

7.1. A CASE AGAINST THE LOGICAL INCONSISTENCIES OF POPPER'S CRITERION OF SCIENTIFICITY

In this sub-chapter, we will make an internal criticism of Popper. That is, we will examine inconsistencies intrinsic in popper's scientific rationality. The first of such apparent inconsistencies is the opposition between realism and falsification in philosophy. As a proponent of falsification, Popper claims that we cannot attain certainty in science. However, besides the realist metaphysical thesis of a mind-independent reality, there is also a semantic thesis which holds that scientific language can give us reliable knowledge of the world and the epistemological thesis which holds that science can give us a true picture of the real. How do we understand this opposition between two mean pillars of popper's rationalism. The second opposition is that which exists between conventionalism and falsification. In his logic of falsification, popper denies unanimity in discourse and prefers intersubjective criticism. But how is this possible when popper later develops methodological conventionalism?

7.1.1. The Apparent Asymmetry between Falsification and Realism

The nerve-centre of Popper's revalorisation of the epistemological importance of metaphysics is his realist interpretation of science. However, some critics have highlighted on the opposition between realism which grounds the metaphysics of science and falsification on which the logic of science expressed. It is worthy of recollection that according to scientific realism, "scientists ought to seek to formulate true theories that depict the true structure of universe."[884] Popper claims to be a realist but his realism is seemingly contradictory to his methodology of falsification. Firstly, Popper from the metaphysical angle asserts that there is a mind independent reality as paradigmatically represented in his theory of the three worlds, the propensity interpretation of quantum physics and in the argumentative function of language. In the second

[883]William Warren Bartley III, *op.cit.*, p. 64.
[884]John Losee, *A Historical Introduction To Philosophy of Science*, 4th ed., New York, Oxford University Press, 2001, p. 154.

place, he asserts that this mind-independent reality is knowable. In this respect, Popper waged a logical war against antirealist tendencies like in the critique of induction, idealism and instrumentalisation.

Popper's adoption of the realist approach to science is polemic because while realism fundamentally claims the capacity of science to knowledge and the truth about the world while the falsifiabilist logic of science on the other hand grounds the scientific theory hood on the ability of a theory to be falsified and not confirmed, while realism claims the attainment of knowledge, the truth and the ability to construct true theories, falsification projects theories as conjectural and the truth as tentative. This apparent contradiction is worth evoking and if possible worth resolving to render consistency to Popper's scientific rationality in which consistency is prescribed a great virtue of both philosophical and scientific theories. This poverty of consistence is evoked by peter Godfrey-Smith as he holds that: "despite insisting that we can support or confirm scientific theories, Popper believed that science is a search for true description of the world. How can one search for the truth if confirmation is impossible?"[885] In a helpless tone, peter Godfrey-Smith evokes scepticism as the first negative derivative of the realism-falsification opposition in Popper's philosophy of science. In this way, he asserts that: "all we can do is to try out one theory after another. A theory that we have failed to falsify up till now might in fact be true. But if so, we will never know this or ever have reasons to increase our confidence."[886]

Aware of the above inconsistency, Popper had to introduce the notions of corroboration as the measure of theory's fitness and verisimilitude as the measure of the theory's closeness to the objective and absolute truth. However, corroboration is not synonymous to truth for they cannot offer absolutely true description of the world. They cannot be demonstrated with certainty as Popper insists that: "the old ideal of episteme of absolutely certain, demonstrable knowledge has proved to be an idol. The demand for scientific objectivity, makes it inevitable that every scientific statement must remain tentative forever."[887] The search for objectivity thus overrides Popper's effort to render realism to be consistent with falsification. That is why instead of talking of truth, Popper prefers truthlikeness or verisimilitude as the aim of science. Verisimitude or better approximation does not rescue Popper's methodology from the germs of scepticism because we do not know what truth is. Better approximation does not give us certain knowledge of the real

[885]Peter Godfrey-Smith, *An Introduction To The Philosophy Of Science*, *Theory And Reality*, Chicago and London, University of Chicago Press, 2003, p. 60.
[886]*Ibid.*, p. 61.
[887]Karl Popper, Quoted by Stephano Gattei in *Karl Popper's Philosophy of Science*, p. 44.

since we can never know when we have found the truth and due to the thesis according to which truth can neither be demonstrated with certainty.

Besides the sceptical implications of the opposition between realism and falsifiability in Popper's philosophy of science, Anthony O'Hear notes that this opposition makes Popper to be more of an instrumentalist. According to Anthony O'Hear, Popper's conjunction of falsification and predictions and the fact that predictions can be falsified, "brings his philosophy close to instrumentalism, despite the explicit commitment to realism."[888] O'Hear deduces this instrumentalism is a theory which holds that: "the best the truly scientific theories describe the 'essences' or the 'essential natures' of things – the realities which lie behind the appearances."[889] What Popper criticises from essentialism is their claim to ultimate explanations, however, he accepts the idea of the hidden reality behind the appearances. The hidden exist but we cannot develop ultimate explanation of them and the search for such reality constitutes the aim of scientists. If such reality does not exist, then discoveries such as "the rotation of the earth, or atomic nuclei, or cosmic radiation, or the radio stars"[890] will not have come by. This, he assets that: "I therefore readily concede to essentialism that much is hidden from us and that much of what is hidden may be discovered."[891] What Popper contests from essentialism however, is the claim that: "science aims at ultimate explanation that is to say, an explanation which cannot be further explained, and which is in no need of further explanation."[892] Thus, he accepts the existence of essences but refute essentialist accounts of scientific theories.

With the acceptance of the existence of essences or the hidden reality behind the appearances, Popper refers to his realism as a form of "modified essentialism". The acceptance of the existence of essences and the denial of the tenability of ultimate explanations to O'Hear, makes Popper to be an instrumentalist. The impossibility of ultimate explanations, makes the explanations in Popper's modified essentialism to play simply an instrumentalist role. This is compounded by the fact that the absence of ultimate explanations makes it impossible for us to have access to the underlying reality. Thus, the acceptance of such reality and the development of tentatively true statements to describe it, are simply tools for application as: "an instrumentalist could agree that

[888]Anthony O'Hear, *Karl Popper: The Arguments of The Philosopher*, London, Routledge-Kegan Paul, 1982, p. 90.
[889]Karl Popper, *Conjectures and Refutations*, p. 104.
[890]*Ibid.*, p. 105.
[891]*Idem.*
[892]*Idem.*

they are desirable properties of tool, because the more the application a tool has, the more useful it is."[893]

The second element that renders Popper's scientific rationality to be more of instrumentalism to O'Hear is the negativity of falsification. Popper claims to be a negativist rationalist, thereby challenging optimist and positive rationalists. This to O'Hear does not match with the optimistic stance of realism. Realists to O'Hear fundamentally are committed to giving us knowledge about the world. Popper however, claims realism but in a falsifiabilist posture, does not think we can have reliable knowledge of the world. He simply is "in a fix, because he thinks that we cannot know this beyond saying that some theories have survived some tests."[894] The only positive instance of falisification is corroboration but it does not assure us of any knowledge. In the same way, the falsified old theories could be incorporated into new ones to ensure cognitive continuity and thus knowledge. However, Popper limits scientific rationality and programmed contact between theories and experience. This makes science to be more of an instantaneous chain of unrelated theoretical instance, a strictly positivist approach.

The second critic of the opposition between realism and falsification is Stathis Psillos. He attacks the claim by some Popperian that Popper's notion of verisimilitude translates realism despite his falsifiabilist logic because the search for truth-likeness is one of the tenets of realism. According to Stathus Psillos, such claim is ungrounded because there is no formal proof of verisimilitude Popper does give two conditions to evaluate verisimilitude. He posits that:

> *Assuming that the truth-content and the falsity-content of two theories t1 and t2 are comparable, we can say t2 is more closely similar to the truth, or corresponds better to the facts, than t1, if and only if either (a) the truth-content but not the falsity content of t2 exceeds that of t1, (b) the falsity-content of t1, but not its truth-content, exceeds that of t2.*[895]

This formula to Stathis Psillos is flawed because we cannot obtain the degree of truth likeness of a theory independent of another theory. This is done through comparison of two theories and this is illicit because the contents of the theories can never be the same and their truth-values are not inter-inferential. That is why he affirms that:

> *We cannot compare theories with respect to their relative verisimilitude. If we try to get a more verisimilar theory B from a false theory A by adding more truths to A, we also add falsehood to B, which are not the false consequence of A. similarly, if we try to get a*

[893]Anthony O'Hear, *op.cit.*, p. 92.
[894]*Idem.*
[895]Karl Popper, *Conjectures and Refutations*, p. 233.

more verisimilar theory B from a false theory A by subtracting truths from A, which are not true consequences of B. hence, Popper's definition is flawed.[896]

The relative verisimilitude of a theory thus is identical to the theory in question and should be compared with another for they do not have the same content and thus, the inter-inferentially of their degree of their truth-values to determine their degree of verisimilitude is illicit. The only positive aspect of verisimilitude noted by Psillos is that we can compare theories using their observational consequences. However, this has no bearing on realism. Popper does not prone that the comparison of theories goes beyond their observational consequences and thus Psillos asserts that:

(a) That the truth-likeness of theories extend to their theoretical content and does not stop at the level of their observational consequences and (b) that these are respects and degrees in which current theories are truth-like. Popper's account can defend neither of the above claims, and hence it is of no real service to the realist.[897]

Given that we judge the verisimilitude from the theory's entailment of observational consequences than from "their overall fittingness in the world."[898] These observational consequences of a theory does not provide knowledge of how our world actually is. Thus, Psillos asserts that, "the refutation of Popper's account of verisimilitude has often been taken as a proof that scientific realist cannot have a notion of truth-likeness."[899]

To rescue Popper from instrumentalist tags, Psillos, restitutes the thesis of the possible world by Oddie Graham (1986) and Uka (1987) as a tenable approach to verisimilitude. Truth-likeness here is understood as the distance that exists between the possible and the actual worlds. A theory in the possible world approach, is made up of terms which designates basic states attributed to the world. These basic states constitute the atomic formula according traits to individuals, that is atomic states. The possible world here refers to "all conceivable distributions of truth-values to atomic states."[900] When a theory successfully describes the actual world, it is considered to be true and a false theory however either presents a different possible world or does partially agrees with the actual world. This partial agreement is what they refer to as truth-likeness. This reinterpretation of verisimilitude to create a consistent coexistence of realism and falsification will instead off root

[896]Stathis Psillos, *Scientific Realism, How Science Tracks the Truth*, p. 254.
[897]*Idem.*
[898]*Idem.*
[899]*Idem.*
[900]*Ibid.*, p. 255.

the basic of Popper's critical rationalism. This is because the approach is seemingly inductive and will create a way for the intrusion of psychologism and subjectivity to science.

In other to make an interpretation of the symmetrical existence of falsification and realism in Popper's philosophy, the burden of the argument should not rest on the revision of his falsifiabilist methodology but on examining the type of realism that Popper defends in his work and the motivation of such realism. To do this, it is worth-noting that Popper himself anticipated the instrumentalist interpretation of his methodology as developed by O'Hear and Psillos above. In footnote 17 of his rejection ultimate explanation and the defence ultimate essences, in Conjectures and refutation, Popper anticipated O'Hear's critique as he affirms that: "This criticism of mine is thus frankly utiliterean and might be described as instrumentalist; but I am concerned here with the problem of method which is always a problem of the fitness of the means to an end."[901] It is thus clear that Popper is more concerned with the pertinence methodology and not with the problem of the successful description of an ultimate reality. This is thus a defence of realism at the service of scientific methodology. His realism should thus be differentiated from naïve realism which posits for the adequate and successful description of current theories and their claim to the reliable truth. In Popper's realism, Popper frequently calls it metaphysical realism. This is because it cannot be demonstrated as it is the case with scientific theories. The central problem thus is not in the consistency or adequacy of realism but how the latter guarantees the possibility of the scientific activity. This is emphatically stated by Popper when he asserts that:

> *Indeed, I am not only a realist but a metaphysical realist, as I want to admit at once. That is, my realism is not based on physic; but physics 1. I think, is based on realism. I am a realist in a very simple sense: as we all shall sooner or later […]. And I expect the world to go on after my death, and also after your deaths. This is a simple way of saying that I am a metaphysical realist. For it is, at least for us, impossible empirically to test our expectations that the world will go on after we are dead.*[902]

Popper's version of realism is not thus the naïve version that offers certain and absolutely reliable knowledge about the world. It is a realism that permits the critical approach to the scientific knowledge. This realism thus matches with his view of the tentative version of scientific truth and of his conjectural conception of knowledge. It could thus be asserted that realism in Popper plays simply a regulatory function in Popper's scientific rationalism. That is why he affirms that:

[901]Footnote 17 in *Conjecture and Refutations*, p. 105.
[902]Gino Tarozzi, Alyn Vande Merwe, Karl Popper and others, *Open Question In Quantum-Physics, Invited Papers On The Foundations Of Microphysics*, Dordredit, D. Reidel Publishing Company, 1985, pp. 2-3.

> *Metaphysical realism is nowhere used to support of the solutions proposed in L.SC.D. It is not one of the theses of L.SC.D's nor does it anywhere pay the part of a presupposition. And t, it is very much there. It forms a kind of background that gives point to one search for truth. Rational discussion, that is, critical argument in the interest of getting nearer to the truth, would be pointless without an objective reality, a world which is our task to discover: unknown or largely unknown: a challenge to our intellectual ingenuity, courage and integrity.*[903]

In Popper's *Logic of scientific Discovery*, he proposes solutions to some problems of the methodology and theory of science such as the problems of demarcation, induction, the empirical basis and the interpretation of quantum. In none of these solutions does Popper use metaphysics to defend his view, thus his metaphysical realism does not in any way kill the empirical character of science. It simply plays an evolutionary role. This is because by asserting that there are ultimate essences, and by purporting that the method of testing theories that describe this reality is falisification, Popper gives credence to the necessity to guarantee the growth of knowledge as the optimistic role of science. We may not be able to establish ultimate explanations but by constantly developing tentative theories and learn more about our different problem situations. It is thus the reason why Popper asserts that: "We can combine the two, empiricism and metaphysical realism is only we take seriously the hypothetical character of all 'scientific knowledge' and the critical character of rational discussion."[904]

The view that knowledge is hypothetical or falsifiable is the necessary conditions for the constant empirical confrontation of our theories with the supposedly mind-independent reality through the method of critical discussion or falsification. Even though Popper refers to his realism of science as metaphysical, we can differentiate it from naïve realism by quantifying it as critical realism. This is because the latter does not just reveal the cognitive aspect of science but it also assures, the evolutionary character of scientific knowledge which renders science to be technologically significant in the human society. According to Mathew Longshore Smith:

> *The process of science and scientific knowledge is viewed as historically emergent, politically and incomplete. These limitations imply that our theories are fallible. No knowledge is 100% certain. For this reason, critical rationalism is ontologically bold but epistemologically cautious.*[905]

Resolving the apparent opposition between realism and falsification in Popper thus lies in the circumscription of falisification in the categories of critical realism. As asserted by Longshere

[903]Karl Popper, *Realism and The Aim Of Science*, p. 79.
[904]*Ibid.*, p. 88.
[905]Mathew Smith Longshore, "Overcoming theory-practice inconsistencies: Critical realism and information system research", available on www.sciencedirect.com, consulted on 27-06-2020 at 7:18pm.

above, Popper is ontological bold for asserting the reality of essence but caution s in his view of scientific theories and explanations. Science then is not the faithful but simply the most accurate description of the world and scientific truths are not the most certain but the highly criticised. Theories in science are thus; "fallible and changeable and there will always be a number of competing theories."[906] In his critical realism thus, Popper is cautious about the truth as he posits verisimilitude as the aim of science. The idea of truth may be absolute but we cannot claim the attainment of absolute certainty. This epistemological cautiousness is seen in his assertion, *« nous sommes des chercheurs de vérité, mais nous ne la possédons pas*. »[907] Between the truth and verisimilitude, Popper prefers the latter as the most convincing aim because the former can create the illusion that science has achieved its aim: retarding the growth of knowledge and injecting the spirit of dogmatism in science. In the tone of critical realism, Popper affirms:

> *« La recherche de la vraisemblance est donc un but plus claire et plus réaliste que la recherche de vérité. Mais j'ai l'intention d'en montrer un peu plus : l'entends montrer que si, dans les sciences empiriques, nous ne pouvons jamais avoir d'arguments assez bons pour prétendre que nous avons réellement, atteint la vérité, nous pouvons avoir de forts arguments et raisonnablement bons pour prétendre avoir progressé sur la voie de la vérité. »*[908]

This is the expression of critical realism whose main objective is the projection of the necessary conditions for the growth of scientific knowledge. The most recent form of critical realism is developed by Roy Bhaskar. He does not also lay emphasis on the notion of truth but on the ontological dimension of scientific realism. Roy's version of critical realism posits that: "a school of philosophy that is presented as a critical application of realism which produces stratified understanding of the world, dividing the real from the actual or empirical and the structures and mechanism which produce events or phenomena from event themselves."[909]

In the Kantian sense, Bhaskar Roy talks of transcendental realism but unlike Kant, he posits the existence of things in themselves which are knowable. This is identical with Popper's defence of the third world, theories in themselves and critical discussions in themselves. Popper equally ontologically claims that quantum states are propensities which are things in themselves and it is

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[906]Mathew Smith Longshore*, "Overcoming theory-practice inconsistencies: Critical realism and information system research", available on www.sciencedirect.com consulted on 27-06-2020 at 7:18pm.*

[907] Karl Popper, *La Connaissance Objective*, p. 57. "We are searchers of the truth but we do not posse it"; (my translation).

[908]*Ibid.*, p. 68. "The search of truth-likeness is thus the most clear and the most realist aim than the search for the truth. But I have the intention to show it more: I wish to show that if we are never having arguments that are good enough in empirical sciences to pretend that we have really attained the truth, we have strong arguments and reasonably good ones to pretend that we have progressed on the path of the truth"; (my translation).

[909]Bill Jefferies, "Critical realism – an empirical realist critique", available on www.ribm.mmm.ac.uk/wps/papers/, consulted on the 27-06-2020, at 8:00pm.

the same with the existence of essences. Roy Bhaskar, a renowned proponent of critical realism asserts that critical realism holds that:

> *Both knowledge and the world are structured, both are differentiated and changing; the latter exists independently of the former and experiences and things and causal laws to which it affords us access are nominally out of phase with one another. On this view, science is not an epi-phenomenon of nature, nor is nature a product of man.*[910]

The above assertion bring Roy Bhaskar's realism closer to Popper's and unveils tenability of using critical realism as the best philosophical category to reconcile realism and falsification in Popper. The critical realism of Popper defends the precedence of the ontological dimension over the epistemological. Epistemologically, Popper is cautious about the search for truth and ontologically, he is bold and confident in his projection of a mind-independent world. Thus, Karl Popper's falsification as the methodology of science can be merged with realism, by giving a critical connotation to his version of versions.

7.1.2. The Opposition between Falsification and Conventionalism in Popper

One aspect of logical inconsistency in Popper's scientific rationality evoked by critics is the apparent opposition between his critical rationalism via critical and intersubjective criticism and his concessions to conventionalism that he criticises in the following myth of framework, the critique of Marxism, psychoanalysis of Freud and individual's psychology of Adler and also in his critique of instrumentalism. It is however surprising that after criticising the use of conventions in critical discussions, Popper applies conventionalism in his discussion of the objectivity of the empirical basis of science and in his enactment of methodological rules as conventions. It is thus a question of evoking this opposition that seemingly betrays consistency in Popper's rationalism and to attempt an interpretation of the problem-situation so as to propose a harmonious understanding of the two apparently antithetical elements in Popper's scientific rationalism.

The first moment of this critical itinerary is the examination of Popper's critique of conventional basis of justification. This is the Nexus of his text; the myth of frame-work, in which he opposes critical rationalism to conventionalist justification. The first critique that Popper levies against conventional basis of rational discussion is that, every form of agreement that are apriori to rational discussion is epistemologically suicidal as it obstructs the growth of knowledge. He thus affirms that: "orthodoxy is the death of knowledge since the growth of knowledge depends

[910]Roy Bhaskar, *A Realist Theory of Science*, 1st ed., London – New York, Routledge, 2008, p. 15.

entirely on the existence of disagreement."[911] Agreement thus is a vice for it kills mutual criticism and obstructing critical discussion. In rationalism, Popper prefers "the war of words."[912]

The conventionalist attitude of asserting that rational discussion requires agreement as the necessary condition is called, the myth of framework. It is both the title of a book and the title of a chapter within the same book. Popper defines the myth of framework as the belief that: "a rational and fruitful discussion is impossible unless the participants share a common framework or basic assumption."[913] It is a myth because it is an unjustified claim and assumption that in other to engage in to discussion whether in science or philosophy participants must have a common agreement on certain basis as the framework for such discussion. A productive discussion to Popper is judged not from the number of common points of agreement but from the knowledge acquired from the difficulties of agreeing. Thus, "the more interesting questions and difficult question they are asked, the more new answers they were indeed to think of."[914] Thus, "the greater the gap, the more fruitful a discussion can be."[915]

Conventionalism seeks at conclusive arguments. Conclusiveness to Popper however is a weakness because it obstructs the production of new arguments. It is the clash of views that enhances the growth of knowledge. Logic in all its application whether in science or in philosophy, "neither underpins the myth of framework nor its denial."[916] Conventions not thus the concern of the logic in different forms of application. The most important thing in a rational discussion is: "that we can try to learn from each other whether we succeed will depend largely on our good will and to some extent also on our historical situations and on our problem-situations."[917] The critical discussion thus is not possible where discussions are based on prior agreements. Any discussion that is grounded on common grounds produces instead justificationist logic which secures the accumulation of knowledge. Such accumulation does not lead to growth given that it does not create the forum for new problem-situations. This evolutionary character of critical rationalism that is antithetical to conventionalism to Stefano Gattei possible thanks to mutual criticism. That is why he asserts that: "The growth of knowledge and criticism are closely interconnected:

[911]Karl Popper, *The Myth of Framework*, p. 34.
[912]*Idem.*
[913]*Idem.*
[914]*Ibid.*, p. 35.
[915]*Ibid.*, p. 36.
[916]*Ibid.*, p. 38.
[917]*Ibid.*, p. 38.

According to Popper, we should prefer the theory which, at any given stage of critical discussion, accomplishes a growth of the possibly corroborated empirical content."[918]

The second critique Popper levies against conventionalist theories is in the attitude of the proponent to revise them by adding ad hoc hypotheses to prevent the theory from refutation. This is the case with Marx's theory of history, Freud's psycho-analysis and Adler's individual psychology. While Einstein who opened his theory for falisification if counter-example were discovered, the three uncritical theories use conventionalist twist or stratagem to avoid falsification. About Einstein's theory of gravity, Popper asserts that: "Einstein's theory of gravitation clearly satisfied the criterion of falsifiability. Even if our measuring instruments at the time did not allow us to pronounce on the results of the tests with complete assurance, there was clearly a possibility of refuting the theory."[919]

The critical character expressed in Einstein's theory is not evident in conventionalist theories like astrology and Marxism. Against Marxism, Popper criticise the use of conventionalist stratagems to avoid refutation as he affirms that:

> *The Marxist theory of history, inspite of the serious efforts of some of its founders and followers ultimately adopted this soothsaying practice. In some of its earlier formulations (for example in Marx's analysis of the character of the 'coming social revolution') their predictions were testable and in fact falsified. Yet, instead of accepting the falsifications the followers of Marx re-interpreted both the theory and the evidence in order to make them agree.*[920]

These conventionalist twist consisting in reformulating the theory to match with observations does not only kill the refutability of a theory but it renders a theory to lost its scientific theoryhood and to become a metaphysical theory.

The first usage of conventionalism in Popper is in his conception of the empirical basis of science. Against logical positivism that claims that all knowledge arises from our immediate experiences translated by protocol statements, Popper points the vulnerability of such view faced with the problems of induction and the universals. Grounding knowledge on immediate inference leads to psychologism and the justificationist problem of infinite regress. On the same way, Popper gives a hypothetical and theoretical character to scientific statements. Every scientific statement to him is a hypothesis, and given its corresponding consequences and its disposition of universal

[918]Stefano Gattei, *Karl Popper's Philosophy of Science*, p. 2.
[919]Karl Popper, *Conjectures and Refutations*, p. 37.
[920]*Idem.*

terms, "we can utter no scientific statement that does not go far beyond what can be known with certainty 'on the basis of immediate experience'".[921] Every statement to him has universal names, symbols and ideas and thus has the character of a theory. For instance, "The statement, 'Here is a glass of water' cannot be verified by any observational experience. The reason is that the universals which appear in it cannot be correlated with any specific sense-experience."[922] This is because an experience is immediate when it is spontaneous, instantaneous and it is immediately given just once. However, the word 'glass' does not denote any immediately given because it implies, "physical bodies which exhibit a certain law-like behaviour, and the same holds for the word 'water'. Universals cannot be reduced to classes of experience; they cannot be constituted."[923]

Rudolf Carnap in his defence of protocol statement asserted that theories are tested by comparing them with other statements. A view Popper seems to agree but rejects it because of the psychologistic nature of the empirical bases of test-statements. Test-statements or protocol statements refer to the 'given' or to 'sense-data' and thus describes the content of experience immediately given to us. These protocol statements cannot guarantee the testing of theories and statements for they are, "nothing but psychologism translated into the formal mode of speech."[924] Otte Neurath attempted a correction of the psychologistic connotation of Carnap's view of protocol statements by asserting that terms such as "see", "perceive" should be found in them and that these statements can be removed when they contradict the system of statements. Popper acknowledges this progress by Neurath but criticises him for not formulating rules that guarantee the falsification of protocol statements that contradict the system. Thus, experience cannot guarantee the justification of the empirical bases of science.

With the problem of the relationship between observation statements and facts, Frie, talks of a trilemma of either opting for dogmatism, infinite regress or psychogism. Popper, in the first place goes in for dogmatism as he asserts that: "The basic statement at which we stop, which we decide to accept satisfactorily, and sufficiently tested, have admittedly the character of dogmas, but in so far as we may desist from justifying them by further arguments."[925]

Is this not the myth of framework which Popper criticised a conventionalist and unproductive? Cognisant of this, Popper qualifies such conventionalist attitude as innocuous or

[921]Karl Popper, *The Logic of Scientific Discovery*, p. 76.
[922]*Idem.*
[923]*Idem.*
[924]*Ibid.*, pp. 77-78.
[925]*Ibid.*, p. 78.

harmless dogmatism. The harmless nature of it resides that the statements can further be tested should the need arise. This again renders testing to be a chain of infinite regress; an attitude that Popper criticises in inductive logic. He also qualifies this infinite regress as innocuous or harmless due to the fact that it is free from all forms of justificationism. There is also a degree of psychologism involved, given that our personal experiences play a role in taking such decisions but this is not pure psychologism given that we do not justify basic statements using these experiences.

With the above development, Popper contends that basic statement cannot be accepted by our personal experiences. Their acceptance is "the result of a decision or agreement and to some extent they are conventions."[926] What guides the enactment of such decisions are rules. The first rule of this conventionalism differentiates Popper's convention from those of logical positivism while the logical positivist inductively test isolated basic statements, Popper's first role states that: "we should not accept stray basic statements – that is logically disconnected ones – but that we should accept basic statements in the course of testing theories; of raising searching questions about these theories, to be answered by the acceptance of basic statements."[927]

This is different from the approach of logical empiricists who proceed from assembly of basic statement to the establishing of a theory. In Popper, the acceptance of basic statements is in the context of specific problems and theories. The agreement here thus plays a methodological role for it permits the testing of a theory. This methodological conventionalism is x-rayed in this assertion by Popper:

> *Agreement upon the acceptance or rejection of basic statements is reached, as a rule, on the occasion of applying a theory; the agreement, in fact is part of an application which puts a theory to test. Coming to an agreement upon basic statements is like other kinds of applications, to perform a purposeful action, guided by various theoretical considerations.*[928]

Testing of a theory depends on the basic statement that constitute it. The acceptance of these basic statements on the other hand, "in turns depends upon our decisions. Thus, it is decisions which settle the fate of theories. To an extent my answer to the question, how do we select a theory?' resembles that given by the conventionalist."[929] Agreement and decisions in Popper thus do not only permit the testing of theories but also helps in choosing theories competing in the same

[926]Karl Popper, *The Logic of Scientific Discovery*, p. 88.
[927] *Idem*.
[928]*Ibid.*, pp. 88-89.
[929]*Ibid.*, p. 89.

problem-situation. This is the same approach taken by conventionalists but Popper claims his approach is different on ground that "for the conventionalist, the acceptance of universal statements is governed by the principle of simplicity: He selects that system which is the simplest. I, by contrast, propose that the first thing to be taken into account should be the severity of test."[930]

To the conventionalists, conventions and agreements help in the acceptance of universal statements but to Popper, they play a role instead in the acceptance of singular statements which in turn help in testing theories or universal statements. The acceptance of theory to conventionalist is a practical act but to Popper such decision arise from the "the application of the theory and the acceptance of the basic statements in connection with this application."[931] Popper differs from conventionalist because he asserts that agreements are taken on singular and not universal statements and against positivism Popper asserts that basic statements are not justified by experienced but their acceptance is simply a result of 'free decision'.

The second element that translates Popper's conventionalism is at the level of methodological rules. Before enacting the conventional rules of the method, Popper criticises traditional conventionalism once more on their view of natural laws. Science to conventionalism is not a reflection of the world but a simple logical construction of theories. The world is thus an artificial construction. This leads them to conceive laws of nature not as falsifiable but as guides of observation. Even though Popper acknowledges their methodological prowess but rejects the idea of science. This is because with such view of science there is a possibility of attaining absolute certainty. That is why Popper asserts that: "whilst I do not demand any final certainty from science, the conventionalist seeks in science, a system of knowledge based on ultimate grounds."[932] Such certainty in traditional conventionalism is possible with the revision and introduction of ad hoc or auxiliary hypotheses to make the theory consistent, the correction of measurement tools or the difficulty of attaining certainty can be blamed on the poverty of interpretation.

Falsification to Popper remains fundamental even in the conventionalist approach to science. The Popperian conventionalism consist in testing universal statement using singular statement and in avoiding conventionalist stratagems as Popper asserts that: "We, and those who share our attitude, will hope to make new discoveries; and we shall hope to be helped in this by a newly erected scientific system."[933] Conventional stratagems to Popper is good for exciting imagination

[930]Karl Popper, *The Logic of Scientific Discovery*, p. 89.
[931]*Ibid.*, p. 92.
[932]David Miller, *Pocket Popper*, p. 146.
[933]*Ibid.*, p. 147.

but does not permit the growth of knowledge for they preserve theories from being falsified. Popper thus claims an anti-conventionalist stand but insists that conventionalism can only be overcome with methodological rules.

The first methodological rule to Popper is directed against verification. Popper thus asserts that, "(1) The game of science is in principle without end. He who decides one day that scientific statements do not call for any further test, and that they can be regarded as finally verified, retires from the game."[934] This is against verification. The second methodological rule asserts that:

> *(2) Once a hypothesis has been proposed and tested, and has proved its mettle, it may not be allowed to drop without a "good reason". A "good reason" may be for instance replacement of the hypothesis by another which is better testable; or the falsification of the consequences of the hypothesis.*[935]

These rules are not logical but methodological rules. They do not in any contradict a general rule of falsification but "are constructed with the aim of ensuring the applicability of our criterion of demarcation."[936] Popper is not against the introduction of auxiliary statement but auxiliary statements can be introduced only if they will add the degree of the falsification of theory. Thus, if new hypotheses are introduced, we should not consider as the increase in the empirical content of the theory but, "as an attempt to construct a new system; and this new system should always be judged on the issue of whether it could, if adopted, constituted a real advance in our knowledge of the world."[937]

Even though Popper puts up an anti-conventionalist posture, the decision accept basic statements and the recognition of methodological rules are arbitrary and thus conventional in nature. We cannot test till the end of the world to falsify a theory. Popper's conventional characters is caption by his commentator as: "In order to be able to do scientific research at all, there is nothing to do but to recognise certain basic statements and this is equivalent of the procedure of testing."[938] However, given that these basic statements ground science, then it can be argued that science is based on conventions. This is how critics points out in Popper's methodology for

[934]David Miller, *Pocket Popper*, p. 142.
[935]*Idem*.
[936]*Ibid.*, p. 143.
[937]*Ibid.*, p. 147.
[938]Robert S. Cohen, Marx W. Wartofky and others, *Methodology, Metpahysics and History of Science, In Memory of Benjamin Nelson*, Dordredit, D. Reidel Publishing Company, 1984, p. 266.

conventionalism introduces, "an element of arbitrariness into scientific methods, which nonetheless contradicted rationality as he postulated it."[939]

On the question of the methodological rules and their clash with critical rationalism, it is worth mentioning that the question whether science should be based on rule can be answered in two ways. There is a descriptive answer which simply describes the methods scientists follow to do science in the past and there is normative answer which is prescriptive on how science ought to proceed. The philosophy of science thus how dual roles in relation to laws; to either study how laws undercut the scientific practice and research or to take laws as standards of reference. In the descriptive approach we talk of science as it is practised and in the second case, "science is regarded as an incomplete realisation of an ideal science."[940] In Popper's conception of methodological law, he takes the normative approach which is akin to conventionalism. His view of rules is, "not only intended to explicate the rules which are actually to bring to bear his fallicibilistic methodology as a canon of norms for the scientific procedures."[941]

This clash between falsification and conventionality renders Popper's methodology to lack the consisting we expect from it. The decision to accept basic statement has no logical binding given that their acceptance does not logically follow from each other. The only connection is empirical connection. We can thus assert that even though in "Popper's view of the empirical basis of science, there is no logical connection between basic statements and that they are arbitrary and conventional but "this does not mean that they are pure conventions because empirical considerations play a role in their acceptance as in the case with the verdict of a jury. So from the empirical point of view, they are not conventions."[942] Thus Popper is not an epistemological conventionalists in the likes of Duhem and Quine. He rejects conventionalist stratagems, justificationism of basic statement and the introduction of methodological rules and the agreement on basic statements is simply meant to ease the application of the methodology of falsification. He can thus be connoted as a methodological conventionalist or better still as a critical conventionalist. For even though we come to an agreement to accept basic statement, such agreement must have empirical groundings, it should not protect the statement from being falsified if need arises and thus it is tentative agreement to tentatively hold on to the highly empirical basic statement.

[939]Robert S. Cohen, Marx W. Wartofky and others, *Methodology, Metpahysics and History of Science, In Memory Of Benjamin Nelson,* p. 266.
[940]*Ibid.*, p. 272.
[941]*Idem.*
[942]Philip Catton and Graham Mac Donald, Karl Popper, Critical appraisal, p. 45.

7.2. RECTIFICATIVE TESTING AS ALTERNATIVE TO POPPER'S METHODOLOGICAL RIGOUR

The proponents of rectificative testing assert that the role of a scientist is never to faslsify a theory but to adjust the anomaly and permit the theory to keep predicting phenomena. In the Quine-Duhem thesis, Quine and Duhem assert that hypotheses in science are never tested in isolation. In their holism, they claim that a scientific theory is a network of interrelated hypotheses and besides the main hypotheses, there are always auxiliary hypotheses that can be introduced to the theory. Theories are not then falsified to them but they are rectified and readjusted when ever there is an anomaly. This is the same view that is held by Hilary Putnam in his thesis of auxiliary hypothese.

7.2.1. Holism and Conventionalism in the Challenge of Duhem-Quine Thesis

The rigorous elements of Popper's methodology and scientific rationality a challenged by the Duhem-Quine thesis. Some of these elements include; the rejection of theories when falsified. The determination of the degree of vensilmitude from the logical and empirical contents of two competing theories and the spacio-temporal finitude or limitation of test statements. In fact, Duhem-Quine thesis that translates conventionalism and holism asserts that: "no hypothesis comes before the 'bar of experience' in total isolation. Rather, what comes before the bar of experience is a specific hypothesis and its background context, what Popper calls 'background knowledge.'"[943]

In a more specific way, Duhem's first elaborated this thesis in which he assert that an experimenter testing a theory does not test just one hypothesis in isolation. That is, "The physicist can never subject an isolated hypothesis to experimental test, but only a whole group of hypothesis."[944] This holism and conventionalism of Duhem was later adopted by Quine who "gave it a second life"[945], according to the view of Louis De Broglie in his forward to Duhem's aim and structure of physical theory.

This reflection here thus seeks to examine the basic tenets of Duhem-Quine's hypothesis and their critical bearing on Popper's rationality. Duhem's conventionalism is a revision of the conventionalism of Henri Poincaré. In Poincaré's conventionalism, we test not isolated hypothesis but a system because nature which they describe is characterised by unity and simplicity. This

[943]Thomas A. Boylan, Paschal F. O'Gorman, *Popper and Economic Methodology*, London, Routledge, p. 71.
[944]Pierre Duhem, *The Aim and Structure of Physical Theory* (1906), trans. Philip P. Wiener, Princeton – New Jersey, Princeton University Press, 1954, p. 187.
[945]*Ibid.*, p. xv.

unity is reflected in the interdependency of facts translated by interrelated hypotheses. He thus asserts that: "If the different parts of the universe were not as the organs of the same body, they would not react one upon the other; they would mutually ignore each other, and we in particular should know one part. We need not, therefore ask if nature is one, but how she is one."[946]

In Poincaré's view of a physical-theory, the former is a holistic system but has an heir but given that, "we can know all the facts, since they are practically infinite in number",[947] thus we cannot test all hypotheses. The first hypothesis that are the simplest and permit the generalisation to the complex are not supposed to be falsified. That is, "by generalisation, every fact observed enables us to predict a large number of others; only, we ought not to forget that the first alone is certain and that all the others are merely probable."[948]

In physical as well as theoretical physics, Poincaré argues that theories have falsifiable and unfalsifiable elements. Moreover, he claims that since geometrical systems have strictly definitional characters, any geometry can be imposed on whatever actual experience. Duhem rejects Poincaré's claim that there are unfalisifiable elements in a physical theory. To Duhem, science does not asset that theories should have strictly definitional parts that are unfalsifiable.

The first moment of the argument Duhem unlike Popper advocates for a metaphysics-free science. To be able to study and judge physical theories in their own terms, they should not be grounded on principles of metaphysics or the assumptions of philosophical schools. In other words, the logic of science consists in the search for an appropriate method that can help in the construction of a theory that is, "consistent with its own definition, the theory would imply no principle and have no recourse to any procedure which could not be legitimately used."[949] He is against the realist claim defended by Pierre that theories describe or explain the world. Explanation renders science to be metaphysical and a scientific theory is simply a tool of prediction. This is because, "to explain (explicate, explicare) is to strip reality of the appearances covering it like a veil, in order to see the bare reality itself."[950] Taking the theory of acoustic reality, Duhem asserts that sounds give us sensations and the use of abstract notions like intensity, pitch, timbre to evaluate them. If we should accept explanation as the aim of science, then, it will be incumbent to unveil the structure of the underlying reality. However, Duhem asserts that the question of the

[946]Henri Poincaré, *Science and Hypothesis*, trans. William John Greensheet, New York, The Walter Scott Publishing Co., LTD, 1905, p. 144.
[947]Henri Poincaré, *Science and Method* (1906) trans. Francis Maitland, New York, Ecosimo Classics, 2007, p. 15.
[948]Henri Poincaré, *op.cit.*, pp. 143-144.
[949]Pierre Duhem, *op.cit.*, p. 19.
[950]*Ibid.*, p. 7.

possibility of the reality besides appearances "do not have their source in experimental method, which is acquainted only with the sensible appearances and can discover nothing beyond them."[951] Science to him is limited to physical appearances and "if the aim of physical theories is to explain, experimental laws, theoretical physics is not an autonomous science; it is subordinate to metaphysics."[952] This is a position that Popper defends throughout but which Duhem criticises for "if theoretical physics is subordinate to metaphysics, the divisions separating the diverse metaphysical systems will extend into the domain of physics."[953]

To ensure univocity in the methodology of science, Duhem rejects the thesis of the possibility of erecting, physical theories from metaphysical systems. Duhem indicates that conflict between the metaphysical theories like the Aristotelians, Newton, atomistic and the Cartesians. In the Aristotelians view of the body developed in his hylomorphism, form can be affected by different qualities. The Newtonians reject the qualities and defends the notion of force. The atomists view Newton's forces as fictitious and thus, they defend mass, shape and hardness while in the wax analogy, Descartes defends the notion of extension, rejecting properties from the material substance. With this conflict between metaphysical systems, Duhem rejects every attempt to build science from metaphysics.

There are four stages involved in the construction of theories to Duhem. The first is definition and measurement of physical magnitude. At his level, "we select those that we regard as simple properties, to that others will supposedly be groupings or combination of them."[954] The representation of these simple physical property is done in tandem with a mathematical model of magnitudes that, "the simple properties are made to correspond to and though the method of measurement we can make each state of a physical property correspond to a value of the representative symbol and vice-versa."[955]

The second stage in the construction of physical theory is the selection of hypotheses. This consist in connecting the various magnitudes in the mathematical model using proposition which are hypotheses and principles of deduction. What makes them hypothesis is their theoretical fundamental role but they do not show anything about the instrusic relation between the various properties. Third stage is the mathematical development of the theory. Mathere is a formation of

[951]Pierre Duhem, *The Aim and Structure of Physical Theory*, p. 10.
[952]*Idem.*
[953]*Idem.*
[954]*Ibid*., p. 20.
[955]*Idem.*

rules of analysis through the combination of different hypotheses. It is at this level that the Duhem's holism takes it origin. This is because it is not the correspondence between hypotheses to the reality but their internal consistency in the model and the accuracy of calculating their fitting into the system. The final stage is the comparison of the constructed theory with the experiment. In other words, the consequences of the hypotheses are translated into judgements about physical properties and these judgements are in turn,

> *Compared with the experimental laws which the theory is intended to represent. If they agree with these laws to the degree of approximation corresponding to the measurement procedures employed, the theory has obtained its goal, and is send to be a good theory; if not it is a bad theory, and it must be modified or rejected.*[956]

A good theory does not describe them but it represents experimental laws successfully, while a false theory on the other hand refers to, "a group of propositions which do not agree with experimental laws. Agreement with experiment is the sole criterion of truth for a physical theory."[957] Ideas in the theory are thus represented in numbers so as to subject the theory to the algebraic calculations, that have an exceeding degree of accuracy. Thus the realist claim that theories describe the reality to Duhem is illicit.

Another view of Popper that is contradicted by Duhem's rationality is Popper's defence of the possibility of testing isolated individual hypothesis. There are two types of experiments to Duhem; application and testing theories using their predictive effects and initial conditions. Application has no bearing on the theory. Testing of theories on the other hand does not consist in isolating hypotheses but in testing them in a group. That is,

> *The prediction of a phenomenon, whose non production is to cut off the debate does not derive from the proposition challenged if taken by itself, but from the proposition at issue, joined to the whole group of theories; if the predicted phenomenon is not produced, not only is the proposition questioned at fault, but also is the whole theoretical scaff folding used by the physicist.*[958]

What the experiment shows that there is error in the system but it does not establish the source of this error. It is thus difficult to know if the fault is from the position or the theory and thus it is not easy to determine which of the two is to be falsified. To illustrate holistic testing in the history of science, Duhem highlights on an imaginal experiment of Zenker that was later experimented by O. Weiner. This consisted in the prediction of bands in certain circumstances. To

[956]Pierre Duhem, *The Aim and Structure of Physical Theory*, p. 20.
[957]*Idem.*
[958]*Ibid.*, p.185.

refute it, Weiner did not only use the proposition under experimentation, that is, that the plane of polarisation determines the polarisation of ray vibrations. He equally used besides this proposition, laws, other auxiliary propositions and hypotheses that are widely acknowledged in optics. Besides the proposition under testing, he also admitted,

> *that light consists in simple periodic vibrations, that these vibrations are normal to the light ray, that each point of the mean kinetic energy of vibratory motion is a measure of the intensity of light, that the more or less complete attacks of the gelatine coating on a photographic plane indicates the various degrees of their intensity.*[959]

By considering the above and a litany of other hypotheses and propositions, Weiner was able to falsify the theory using experiment. Thus, "the physicist can never subject an isolated hypothesis to experimental test, but only a whole group of hypotheses."[960] The problem of the method of testing arises. It is to know if we can adequately talk of falsification in Duhen. It is not logically tenable to talk of falsification in Duhen because the finality of testing is the rectification or modification of the theory to assure internal consistency. That is, "when the experiment is in disagreement with this predictions, what he learns is that atleast one of the hypotheses constituting this group is unacceptable and ought to be modified."[961] A physical theory is thus the same like an organism for the functioning of one depends on the functioning of others. Since we do not know which part is faulty, Duhen recommend the method medical therapy to a physicist. That is unlike a watch-maker who scatters his watch to arrange it, a physicist should instead be like a medical doctor who examines from one part of the theory to another, tell the malfunctioning is adjusted.

With Duhem's conventionalism, he criticises the role of crucial experiment, developed by Bacon and adopted by Popper in his modus tollens method of testing theories. Crucial experiment adopted by Popper, from two hypotheses we construe two predictive consequences and if one is false then the other hypothesis is true. This method of reduction ad absurdum to Duhem is adeuqte in geometry that is a system and not proper in physical science whose theory development stems from facts that are relative to observation and also given the infinity of hypotheses that can also imply the observation. That is why he affirms that:

[959]Pierre Duhem, *The Aim and Structure of Physical Theory,* pp. 185-186.
[960]*Ibid.*, p. 187.
[961]*Idem.*

> *Unlike a reduction to absurdity employed by geometers, experimental contradictions does not have the power to transform the physical hypothesis into an indisputable truth: in order to confer power on it; it would be necessary to enumerate completely the various hypotheses which may cover a determinate group of phenomena.*[962]

A physicist can never be sure that he has exhausted all the possible hypothesis about a phenomenon. Thus, using only two hypotheses and testing their predictive consequences is methodologically narrow. To Duhen then, "a scientific test can only be represented as $(H1 \wedge H2 \wedge H3) \rightarrow O, \neg . \therefore \neg(H1 \wedge H2 \wedge H3)$. When the observation contradicts a scientific prediction, we can say that something is wrong with the system of hypotheses but we cannot determine which hypothesis in particular is false."[963]

With the infinity of hypotheses, we do not know which one to falsify. Thus, the decision to change the hypothesis is adopted and revised by Quine. In his celebrated article; the two dogmas of empiricism, Quine in the first dogma attacks the analytic synthetic destruction of logical positionism and in the second dogma he attacks the methodological approach of testing statements in isolation; an approach that is inductively used by logical positivists and used by Popper who accords conjectural status to singular statements. In this seemed dogma, Quine announced his holism and his rejection of isolating testing of hypotheses. Quine states the two dogmas as:

> *One is a belief in some fundamental cleavage between truths which are analytic, or grounded on meaning independently of matters of facts and truths which are synthetic or grounded in fact. The other dogma is reductionism: the belief that each meaningful statements is equivalent to some logical constant upon terms which refer to immediate experience. Both dogmas, I shall argue, are ill-founded.*[964]

The first dogma that constitutes the analytic-synthetic distinction is not having direct bearings on Popper's methodology. However, the second dogma, that is, reductionism might have been developed by logical positivism but it is visible in Popper's conjectural view of singular statement and in isolating testing of basic statements. The dogma of reductionism and verification from experience to Quine holds only on grounds of the "[…] supposition that each statement, taken in isolation from its fellows, can admit confirmation or information at."[965] Popper adopted a version of this dogma by insisting that with the space time coordinates of a basic statement, we can test it using experience. However, Quine turns his back to this approach, proposing holism in which statements are confronted with experience as a group and not individually. Quine states the

[962]Pierre Duhem, *The Aim and Structure of Physical Theory*, p. 190.
[963]Philip Catton and Graham Macdeonald, *op.cit.*, p. 37.
[964]Willard Van Orman Quine, "Two Dogmas of Empericism" in Sandra G. Harding's edition of, *Can Theories Be Refuted? Essays On Duhem – Quine Theses*, Dordrecht, D. Reidel Publishing Company, 1976, p. 42.
[965] *Ibid.*, p. 58.

basic tenet of his holism as he holds that: "my counter-suggestion in issuing essentially from Carnap's doctrine of the physical world in the aufbau, is that our statements about the external world face the tribunal of sense experience not individual but only as a corporate body."[966]

The fundamental reason for Quine's holism is his insistence that truth in science is the product of the conjunction of the linguistic and empirical content. The factical content cannot be tenable when translated by a singular statement that is empirically and spacio-temporally limited. Thus, the empirical content of Quine must, "boil down to a range of confirmatory experience."[967] Thus, we cannot accord a significant factual content to an individual statement. It thus the reason why Quine affirms that: "taken collectively, science has its double dependence upon language and experience; but this duality is not significantly traceable into the statements of science taken one by one. The unit of empirical significance is the whole of science."[968]

With this holistic view of the constitution of science, how does Quine conceive testing? Quine applies holism, not only to physics as Duhem, but he extends it to geography, history, mathematics and logic. He presents all knowledge as man-made and, "total science is like a field of force whose boundary conditions are experience."[969] We do not test a system of statement fundamentally to falsify them. The essence of testing is to do adjustments so as to ensure internal coherency and continuous isomorphism between the theory and experience. Thus, "a conflict with experience at the periphery occasions the readjustments in the interior of the field",[970] given that science is a "field of force" with experientially determined boundaries. To test one statement implies the need to test others on two reasons. Firstly, due to the logical connection of one statement with the other and secondly because of the logical connection between the statement at hand and the system of statement. Given the all-encompassing and complex nature of experience,

> *There is much latitude of choice as to what statements to re-evaluate in the light of any single contrary experience. No particular experiences are linked with any particular statements in the interior of the field, except indirectly through considerations of equilibrium affecting the field as a whole.*[971]

With the arbitrary decision of deciding which statements to re-evaluate, Quine's conventionalism gives an advanced interpretation of Duhem's thesis. Unlike Duhem who asserted

[966]Willard Van Orman Quine, "Two Dogmas of Empericism", p. 58.
[967]*Ibid.*, p. 59.
[968]*Idem.*
[969]*Idem.*
[970]*Ibid.*, pp. 59-60.
[971]*Ibid.*, p. 60.

that we cannot know whether it is a statement, a group of statements or the whole system that need to be readjusted, Quine thinks that through convention we can overcome that methodological quagmire. At the same time, Quine illustrates the futility of the analytic-synthetic distinction in his methodological principle of systemic revision. He thus asserts that: "it becomes folly to seek a boundary between synthetic statements, which hold contingently on experience, and analytic statements, which holds come what may, if we make drastic enough adjustments elsewhere in the statements."[972]

With the possibility of making as more revisions as possible, then any statement can be rendered to be true. Unlike Duhem who accepts some statements from testing, Quine insists that, "conversely, by the same token, no statements is immune to revision. Division even of the logical laws of the excluded middle has been proposed as a means of simplifying quantum mechanics."[973]

It becomes clear that science for Duhem as well as Quine does not pre-occupy itself with the search for the truth. It is simply a tool for prediction. This is pure instrumentalism. The use of physical objects by both Duhem and Quine does not mean concession to realism as the former are simply, "intermediaries" or "irreducible posits". He compares physical objects to gods in Hommer's mythology. They are thus simple inventions of imaginations which do not have ontological status.

In his critique of historicist theories, Popper rejects holism for it is a theory of social determinism. At the epistemological level, he equally points at some insufficiencies of the Duhem-Quine thesis. In the first place, the methodological challenge of the Duhem-Quine thesis is not so destructive as regards Popper's system. The conventionalism of Duhem-Quine thesis translates instrumentalism and Popper's rejection of the latter throughout his work and his defence of realism renders this thesis to be weak, faced with Popper's rigorous fallibist approach. Popper insists on the importance of crucial experiment. Crucial experiment does not only permit the testing one theory in competition with others but also to establish the corroboration of theories that stand the test of crucial experiment. Popper points at Duhem's error in criticising crucial experiment as he asserts that:

> *But this criticism overlooks the fact that if we take each of the two theories (between which the crucial experiment is to decide) together with all this background knowledge, as indeed we must, then we decide two systems which differ only over the two theories which are at stake. It further overlooks the fact that we do not assert the refutation of the*

[972]Willard Van Orman Quine, "Two Dogmas of Empericism", p. 60.
[973]*Idem.*

theory as such, but of the theory together with that background knowledge; part of which if crucial experiments can be designed, may indeed one day be rejected as responsible for the failure.[974]

Duhem's error thus consists in criticising crucial experiments as if the two theories have independent background knowledge. Popper treats the two theories under testing as having, "a considerable amount of common background knowledge"[975] because "criticism never starts from nothing, even though everyone of its starting points may be challenged, one at a time, in the course of the critical debate."[976] Duhem's critique of crucial experiments does not apply directly to Popper because the latter's testing of the two theories is grounded on the similitude of the background knowledge. We can thus restate Popper's evaluation of verisimilitude of two theories as: (B∧T1)→O(B∧T2)→¬O

$$\frac{\neg O}{\therefore \neg(B \wedge T1)} \quad \frac{O}{\therefore \neg(B \wedge T2)}$$

B in this case refers to the common background knoweldge shared by the two theories. With common background knowledge, it is thus easy to refute one theory on the basis of a designed crucial experiment. Unlike Duhem and Quine who do not think that we can test all our knowledge, Popper believes in piecemeal testing. He thus asserts that, "yet though one of our assumptions may be challenged, it is quite impractical to challenge all of them at the same time. Thus criticism must be piecemeal (as against the Quine)."[977]

It should be noted that Popper's defence of piecemeal testing is not synonymous to conclusive falsification.Popper agrees that it is possible to test "a large chunk of a theoretical system and sometimes perhaps the whole system"[978] as Duhem and Quine claims, but such should be admitted only if we consider theories as guesses. Duhem-Quine thesis is not useless in Popper's methodology for Popper just like the former, agrees that the acceptance of background knowledge as well as the acceptance of basic statements. However, the great divide between Duhem-Quine and Popper resides the former's claim of instrumentalism and the latter's defence of realism.

[974]Karl Popper, *Conjectures and Refutations*, p. 112.
[975]*Ibid.*, p. 238.
[976]*Idem.*
[977]*Idem.*
[978]*Ibid.*, p. 239.

7.2.2. Hilary Putnam's Idea of Auxiliary Hypotheses and the Inappropriateness of Falsification in the History and Practice of Science

The dual interrogation that Putnam poses here is, have scientists always conceived theories to falsify them in the history of science? and does falsification play a fundamental role in science as a practice? At first sight, the Popperian negativist methodology is not really plausible in the history of science. For scientific knowledge may grow by replacing old theories with new ones through testing, but this does not mean that the scientists in history always develop theories with the intention to falsify them. Science is a social practice which his mostly influenced by existential problems to develop its theories. They, a scientist develop a theory as a respond to a particular social or cognitive need and the finality is always application and adoption.

It is in this light that Hilary Putnam intervenes to elucidate the methodological and historical insufficiencies of Popper's criterion of demarcation. The first element Putnam conjectural nature of laws. Natural laws to Popper are conjectural for the search for regularity in nature is an anticipation which preceeds observation. Thus, natural laws are human inventions and exists in form of hypotheses. This follows that laws can be falsified like every other universal statement in science. this contentment to Putnam does not correspond to science as an actual practice. He asserts that:

> *When a scientist accepts a law he is recommending to other men that they rely on it-rely on it, often in practical contexts – only by Wrenching science altogether out of the context in which it really arises – the context of man trying to change and control the world – can Popper even put forward his peculiar view on induction.*[979]

With the inflinching inclinations to realism, Popper misses the point as he does not want to conceive of theories as mean for application. Putnam's view seems advanced for it can be argued that even if Popper as a realist posits the search for the truth and knowledge as prime in the development of theories, such knowledge for the sake of knowledge is of no importance to a society where it is developed. Putnam thus indicates the absence of pragmatism in Popper's view of the scientific min. In other words:

> *Ideas are not just ideas; they are guides to action. Our notions of "knowledge", probably, certainty; etc., are all linked to and frequently used in context in which action is at issue: May i confidently rely on a certain idea? Shall I rely upon it tentatively with a certain caution? Is it necessary to check on it?*[980]

[979]Hilary Putnam, "The Corroboration of theories", in Schilpp edition of, *The Philosophy of Karl Popper,* p. 222.
[980]*Idem.*

It is true that the logic of Scientific Discovery contains passages on the application of theories but Popper in most cases distances himself from the pragmatic question of theories for it opens the doors for the intrusion of induction and instrumentalism to his philosophy. For instance, Popper asserts that: "the purpose of this last kind of test is to find out how far the new consequences of the theory – whatever may be new in what it asserts – stands up to the demands of practice, whether raised by purely scientific experiments, or by practical technological application."[981]

Here, we can deduce efforts to application of theories but this remark is contrasted with other anti-pragmatic assertions. In the myth of framework, Popper criticises pragmatism as a form of instrumentalism. He asserts that:

> *There is a group of philosophers who may (somewhat precipitately) be pleased about what i have been saying the pragmatist or the instrumentalists. For it is their creed that we should not, or cannot, aim at "pure" knowledge – or at truth – with our scientific theories that are mere nothing but instruments – instruments, that is, for prediction or practical application for we assert that we learn from science something about the structure of our world .*[982]

Here again, Popper's realism leads him to the rejection of pragmatic aspect of science. He expresses the same attitude to pragmatism as a theory of truth. Popper does this, by defending pure scientific knowledge, criticising the instrumentalist claim of theories on instruments of application. He expresses his text; conjectures and refutations as he affirms that: "Later certain pragmatists based their whole philosophy upon the view that the idea of 'pure' knowledge was a mistake; that there could be no knowledge in any other sense but in the sense of instrumental knowledge; that knowledge was power, and that truth was useful."[983]

Despite the attempt to exclude scientific theories from application, Popper keeps making recourse to action. He asserts elsewhere that, *« mais nous devions préférer pour l'action la théorie la mieux testée »*[984] and he equally talks of application as the fourth level of testing theories as he asserts that, "and finally, there is the testing of the theory by way of empirical applications of the conclusions which can be derived from it."[985] The aim of these illustrations are not only to show Popper's constant recourse to application, which he despises but to make a case for Putnam's view that science is inseparable from action and practice. One may argue that being a realist warrants

[981]Karl Popper, *The Logic of Scientific Discovery*, p. 9.
[982]Karl Popper, *The Myth of Framework*, pp. 173-174.
[983]Karl Popper, *Conjectures and Refutations*, p. 99.
[984]Karl Popper, *La Connaissance Objective*, p. 32. "The best tested theories should be chosen for action"(my Translation)
[985]Karl Popper, *The Logic of Scientific Discovery*, p. 9.

Popper's refusal to make recourse to application but despite the fact that Putnam is an internal realist he defends realism using the success or application of science. This is the famous no-miracle argument which affirms that realism is the only theory that accounts for the access of science.

Putnam attacks Popper's notion of corroboration because the only thing it offers is that a law has survived severe testing but does not give any hint on the future reliability of such law. That is why Putnam affirms that: "they were no suggestion at all that a law which has stood severe tests is likely to withstand further tests involved in the application or attempted application, the Popper would be right; but then science would be wholly unimportant activity."[986]

Given we are never certain that the law that has corroborated will survive the next stage of crutial experiment, Popper doubts their reliability in the context of human action. The only result of corroboration is the observation that the present law hypothesis and theories are not reliable but that they have simply not yet been refuted.

One of the reasons why Popper ignores application is the refusal to acknowledge the practical orientation of induction. Popper taxes induction just at the level of justification. His central argument as seen above is that there is no principle for induction and thus no logical justification and so, it should not be integrated into science. In the same way, Popper asserts that the present scientific laws cannot successfully predict the future. Putnam insists that scientists in practice do anticipate the future and thus; "Popper is not right in maintaining that induction is unnecessary."[987] It is practically unscientific to Putnam to discourage scientists from anticipating the future or making predictive inferences. Popper's reason is that knowledge is conjectural but the question of the practical dimension so such conjectural knowledge remains unsettled. In a rather trivial tone, Putnam illustrates the uselessness of conjectural knowledge in human action using the analogy of strike action. If man strike against poor working conditions, they can, at one point call of the strike on the basis that, "It is only a personal conjecture that the boss is a bastard."[988] In practice thus human apply the actual knowledge they have and there is no indecision or skepticism. The skepticism of Popper thus arises from the consideration of knowledge as an end in itself.

Putnam's contribution to the revision of Popper's falsification criterion is in his notion of auxiliary hypotheses. To Popper, a theory is falsifiable when it makes bold predictions. However, Putnam uses the theory of universal gravitation to assert that some theories may not make precise

[986]Hilary Putnam, *The Corroboration of Theories*, p. 222.
[987]*Ibid*., 223.
[988]*Idem.*

predictions but they are scientifically practical. The theory of universal gravitation "consists of the laws that everybody 'a' excerts on every other body 'b', a force fab whose direction is towards and whose magnitude is a universal constant g times mamb/d2, together with Newton's three laws."[989]

The law of universal gravitation as stated above, does not imply just one statement. It can also account for every form of motion and it is difficult to make predictions from it given the forces fab can not be practically measured, thus we can not limit the productions of a scientific theory to just one prediction. With this difficulty, Putnam proposes the application of the theory within the astronomical context, followed by simple assumptions called, "auxiliary hypotheses". The orbit of the earth from the theory of universal gravitation, we can make the following assumptions: "(I) No bodies exist except the sun and the earth (II) The sun and the earth exist in a hard vacuum. (III) The sun and the earth are subject to no forces except mutually induced gravitational forces."[990]

To Putnam, the theory of universal gravitation alone does not permit the making of predictions and the latter is only possible if the theory of universal gravitations is conjoined with the three assumptions above. For instance, the prediction of Kepler's laws is a consequence, of the preceeding theory- auxiliary statements conjunction. As we integrate other bodies into the system, we can make as many predictions as possible. Thus, "but it is important to note that these predictions do not come from the theory alone but from the conjunction of the theory with auxiliary statements."[991] Scientists to Putnam mostly ignore auxiliary statements, focusing on the theory only. This is because auxiliary statements are accidental and known to be false while a theory is a system of laws that we want to establish its truth.

Thus, scientists in most cases use auxiliary statements unconsciously. Unlike Popper who prescribes the falsification of the theory, Putnam argues that auxiliary statements are easily revised than the theory. When Auxiliary statements do not lead to predictions, they are revised and not the theory, since the aim here is to prove the truth of the theory. The example Putnam gives is that of the prediction of the orbit of Uranus using the gravitational theory but the assumption that all the planets were already known was false when Neptune was predicted and confirmed. In the prediction of the orbit of Uranus, the assumption that all planets were already known became false when the New planet; that is, Neptune was predicted. The difficulty in observing a new planet

[989]Hilary Putnam, *The Corroboration of Theories*, p. 225.
[990]*Idem.*.
[991]*Ibid.*, p. 226.

directly is due to the irregular behaviour of stars and their non-visibility in the telescope leads to the assumption that stars do have dark companions which can not be visible in the telescope. This made Putnam to assert that: "The fact is that many assumptions made in the sciences can not be directly tested – there are many 'dark companions' in scientific theory."[992] Thus where there is no alternative theory to replace the theory in place, what scientists do is to revise the basic assumptions till predictions are made and confirmed.

From the above example of the theory of universal gravitation, Putnam asserts that scientists engage into testing to correct and revise the anomalies and not to falsify the theory. That is, "Scientists for over two hundred years did not derive prediction from U. G. in order to falsify U. G. J. they derived predictions from U. G. in order to explain astronomical facts."[993]

The law of universal gravitation is not then strictly falsifiable in Popper's terms. This makes Putnam to exclude falsification as a principle in both the practice and the history of science. That is, "Popper's doctrine gives a correct account of neither the nature of the scientific theory nor the practice of the scientific community in this case."[994] The fact that theorists of the law of gravitation has as objective the explanation of facts by the application of theorists do not then make them less scientists as Popper's falsification entails.

From the above, there is then a clash between falsification and application of theories. Putnam settles the matter by advocating for restrictive falsification which does not only consider the clash between the theory and facts but also the correspondence between theories and action, via application. Epistemologically, a theory may be proven unfit through crucial experiments but has an all-encompassing pragmatic value. This to Putnam is not justified only by the social orientation of science but on the fact that auxiliary assumptions which are construed alongside the theory in question are generally false. Thus, "since we are very unsure of the A. S. S. we cannot regard a false prediction as definitely falsifying a theory; theories are not strongly falsifiable."[995] We cannot then talk of conclusive falsifications because the problem of the incompartibility between the theory and experience may arise from the use of auxiliary assumption that are non-relevant to the situation. In this way, Putnam stipulates that:

> *Thus, even if a theory is "knocke-out" by experimental test, the theory may still be right and the theory may come back in later stage when discovered the A. S. were not useful*

[992]Hilary Putnam, *The Corroboration of Theories,* p. 227.
[993]*Ibid*.
[994]*Ibid*.
[995]*Ibid.*, p. 228.

approximations to the true situations. As has previously been pounted out, falsification in science is no more conclusive than verification.[996]

In this approach, Putnam adopts and inductivist posture using the success of science as the evaluation of the correction of theories. That is: "scientific theories are shown to be correct by their success; just as all human ideas are shown to be correct, to the extent that they are, by their successes in practice."[997] At this level, Putnam insists on the importance of practice and critics Popper's dissociation of scientific theory from applications makes science to appear useless to human existence. Science to him plays a transformative function and it is suppose to be the origin of human development and civilisation. Such transformation function is a product of the conjunction of the conjunction of theory and application. Popper consistency in the defence of a rigorous principle of demarcation. The demarcation between science and non-science using the rigorous principle of falsifiability to Putnam is destructive for science for, "it corresponds to Popper's separation of theory from practice and his related separation of the critical tendency in science from the explanatory tendency of science."[998] On a pragmatic note, Putnam insists that in science, "practice is primary"[999] and this practice is not in the context of testing theories as Popper holds but in the context of applying theories to resolve salient human problems. The evaluation of the success of an idea via application is rendered possible by induction. It is not logical to limit induction at the level of the question of justification but it should be reorientated to the sphere of application. Thus, Putnam regrets the habit of Popper and some critics, who demands a rational principle of induction. He reiterates that fact that, "induction has no deductive justification; induction is not deduction."[1000]

Alain Chalmers has a similar view with Hilary Putnam. To him, in every epoch of the evolution of science, each time there are contradictions in the theory there are always new confirming instances. For instance, Niels Bohr's theory of quantum physics was adopted and used at that time, even though it was found to be inconsistent. In the similar way, the Kinetic theory of gas was proven to be inconsistent during publication due to the specificities of gases, but was more over, the historical inadequacy of Popper's rigorous falsification can be deduced from the reality of biomedical sciences. Biomedical scientists do not test theories to falsify them but to inductively ascertain the probability of the confidence to be cause for the revision or falsification of a theory

[996]Hilary Putnam, *The Corroboration of Theories*, p. 228.
[997]*Ibid.*, p. 229.
[998]*Ibid.*, p. 238.
[999]*Ibid.*, p. 239.
[1000]*Idem.*

is the negative impacts on human life and not the rigid crucial experiments. It is in this way that a historian of science observes that:

> *Our scientific knowledge does not seem to be purely negative and if it were, it would be hard to see why we have such confidence in certain scientifically informed beliefs. After all, it is because doctors believe that penicillin fights bacterial infection that they prescribe it for people showing relevant symptoms.*[1001]

Like in most instances, Popper attempted a response to Putnam's criticism of his views. Even though his responses are mostly focused on showing and showing some similarities between his views and those of Putnam, the pragmatic aspect of science, pointed out as lacking in his philosophy is not addressed by him. If the same level of the similarities between Putnam and him, Popper asserts that, "Putnam's on auxiliary sentences are called by me initial conditions"[1002], however Popper categorically rejects Putnam's conclusions, "but Putman's conclusions are all wrong."[1003] Popper's case against Putnam is that the latter has not read his logic of scientific discovery. In his reformulation of the minor premise of Putnam's argument, Popper asserts that, "(1) The minor argument is that I have observed the existence of natural laws, but overlooked that of certain auxiliary sentences, but Putnam's auxiliary sentences are well known to my readers under the name of initial conditions."[1004]

There may be similarities between Putnam's auxiliary statements and Popper's initial conditions, but they do not play the same role. In Popper, the theory is falsified when it is contradicted by test statements but Putnam argues that the theory as a system of laws is meant to be proven to be true and where there are no successful prediction, the auxiliary sentences are first of all revised and the theory is only falsified when there is an advanced alternative theory. The second argument of Putnam that Popper criticises is that in which "Putnam finds that universal laws alone without the support of additionally assumed 'auxiliary sentences', cannot be falsified."[1005] Popper agrees that without auxiliary statements or unnitial conditions, it becomes difficult to make successful predictions but Popper goes beyond this to affirm that we can make negative predictions from any theory. For instance, from the statement, "All swans are white", we can obtain an unusual and negative prediction, "you will not encounter at 10pm tomorrow a black swan."[1006] Logically, Popper's illustration is tanable, but it is pragmatically lacking because such

[1001]James Ladyman, *op.cit.*, p. 386.
[1002]Karl Popper, "Replies to my critics", in Shilpp ed. of, *The Philosophy of Karl Popper, (*Part II), p. 993.
[1003]*Idem.*
[1004]*Ibid.*, p. 994.
[1005]*Idem*.
[1006]Karl Popper, "Replies to my critics", in Shilpp ed. of, *The Philosophy of Karl Popper,* (Part II), p. 998.

negative predictions may be good theoretically but they say nothing about the world and thus they have no practical impact on human life. It should be highlighted that Popper seeks more of logical consistency in his methodology more than the pragmatic requirement of the theories. Even when he talks of the successes of science, he limits it at the logical level as he asserts that: "scientific success consists of unsuccessful attempts at refutation."[1007] Hence, an advanced examination of Popper's methodology requires the integration of this pragmatic aspect. This is one of the contributions of this thesis, examined in Chapter 8.

7.3. THE ANTI-FOUNDATIONAL CRITIQUE OF POPPER'S "NAÏVE FALSIFICATION"

At this level, we will examine the anti-foundational critique of Popper. Anti-foundationism rejects the grounding of science on strict and rigourous standards. Thomas Kuhn is not only going to give a sociological connotation to science but he will attempt a rupture from the logic-based to a paradigm-based science. Paul Feyerabend on the other hand will question popper's methodological monism which to him obstructs science. Feyerabend in his postmodernist tone develops anarchism and methodological pluralism as better alternatives to popper's falsification. In this sub-chapter then we will examine how the anti-foundationists develop their arguments against Popper's logic of science.

7.3.1. Kuhn's Critique in his Rupture from Logic-based to Paradigm-Base Science

Kuhn's sociological conception of the scientific practice is the challenge not only to Popper's but to the whole of the enlightenment conception including logical positionism. In the traditional or enlightenment view, science is a body of knowledge construed by individuals in specific epochs in history. Science is conceived by enlightenment scientists like logical positivism and Popper as having an ultimate end and purpose as seen with notions like the truth and objectivity. Kuhn however reflects on science in its sociology and history. This histographic view which specifies Kuhn from logical positivism and Popper is highlighted by James A. Marcun as he affirms: "That difference is hinged on a shift from a logical analysis and an explanation of scientific knowledge as a finished product of an historical or natural description and explanation of the scientific

[1007] *Ibid.*, p. 996.

practice, and processes by which scientific knowledge is produced by a community of practices."[1008]

Thus, the epistemological shift of Kuhn in the history of science has the same connotation with the notion of tacit knowledge developed by Michael Polanyi. As such, "it was a shift from the subject (the product) to the verb (to produce)."[1009] Even though Kuhn elsewhere asserted that he has similar views, with Popper on science, this is not tenable because not only does he reject falsification and verisimilitude but Popper is equally against his view of normal science. In one of his conference paper, Kuhn claims his epistemological proximity with Popper as he asserts that:

> *Sir Karl's view of science and my own are very nearly identical. We are both concerned with a dynamic process by which scientific knowledge is acquired rather than with the logical structure of the products of scientific research […] both of us reject the view that science progresses by accretion; both emphasise instead the revolutionary process by which an older theory is rejected and replaced by an incompatible one, […], finally, Sir Karl and I are united in opposition to a number of the most characteristic theses of classical positivism.*[1010]

Kuhn and Popper may be concerned with the growth of scientific knowledge through the replacement of old theories by new reliable ones, but they differ in the basic tenets of their epistemology. Kuhn is not only on anti-foundationist but he gives a sociological connotation to scientific practice. In building his antifoundationalism and histography of science, he inevitably opposes Popper's falsibility principle of scientific rationality. The opposition between the basic tenets of the epistemology of Kuhn and Popper can be elucidated by examining the different moments of scientific production in Kuhn.

The histography of Kuhn's view of scientific production falls under four moments. From the pre-paradigm science, normal science emerges and the anomalies in normal science will lead to crisis leading to extra-ordinary science, where competing paradigms to replace the old one are tested and one is adopted leading to new normal science. While Popper concerns a scientific theory to be a universal statement, a law or hypotheses that make bold predictions about the world and attempt an explanation of this world, Kuhn conceives paradigm as the exemplary model of science. A model is unlike Popper's theory is produced by a community of experts, or scientists. Paradigms

[1008]James A. Marcum, *Thomas Kuhn's Revolution: An Historical Philosophy of Science*, London-New York, Routledge, 2005, p. 7.
[1009]*Idem*.
[1010]Thomas Kuhn, *The Essential Tension, Selected Studies In Scientific Traditional Change*, Chicago – London, Chicago University Press, 1977, p. 267.

to Kuhn refer to community's concrete achievement. They are explanatory models of normal science.

The first moment of the scientific practice is the pre-paradigm period. Consensus or conventionality in Kuhn's methodology is both at the level of the choice of the phenomenon under investigation and in theoretical explanation. The pre-paradigm period is characterised by a plethora of schools of thought. These schools are just like medieval guides and they do not agree, due to the variation of their choices of phenomena and the complexity of facts. There is thus competition between schools and there is no significant progress in solving problems. This is immature science which to Kuhn is not science at all because there exists no paradigm to regulate the scientific practice. The example that Kuhn points out as pre-paradigm science is the pre-Newtonian optics.

The transition from pre-paradigm to paradigm or normal science occurs when one school develops a theory that is spectacular, open-ended and open horizon of problems to be solved. Kuhn gives a definition to normal or paradigm science as follows "In this essay, 'normal science' means research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its further practice."[1011]

Normal science thus is found in text books and it consists in successful aplications with corresponding observations and experiments. These successful applications and their legitimate problems and methods are found in books and are not just useful for the present generation but important for the next posterity. Some of these successful applications are in great works like "Aristotle's Physica, Ptolemy's Almagest, Newton's Principia and Opticks, Frankline's Electricity, Lavoisir's Chemistry and Lyelle's Geology."[1012] These successful applications are exemplary for two reasons. Firstly, it draws followers from competing theories and it is open-ended for its leaves other problems for further resolutions. They play the role of paradigm, that is, they are just accepted examples of the actual scientific practices and examples which can be law, theory, application which provide models from which springs particular coherent tradition of scientific research.

The scientific spirit in normal science consists only in learning the paradigm. In Popper, the scientific mind consists in the spirit of rational criticism in which scientists offer their theories for

[1011]Thomas Kuhn, *The Structure of Scientific Revolutions*, Chicago, Chicago University Press, 1962, p. 10.
[1012]*Idem*.

intersubjective criticism. To Kuhn, learning the theoretical and instrumental aspect of the paradigm dispose students with the scientific spirit. The realisation of this spirit is in their insertion into the scientific community to participate in the practice of normal science. A paradigm is not established once and for all. That is, it is not established to procure ceaseless replication of examples like linguistic paradigms or standards. Its in-exhaustive nature implies that normal scientists have the role nto to falsify but to work for its consistency. That is, "a paradigm is rarely an object of replication. Instead, like an accepted judicial decision in the common law, it is an object for further articulation and specification under new or more stringent conditions."[1013]

What renders paradigms acceptable is not their consistent nature but the fact that they are more successful than others. The role of normal scientists is not to discover new facts and theories but to view and explain nature in the light of existing paradigm. Kuhn refers to this practice as mopping-up. Through this practice, normal scientists:

> *closely examined, whether histirically are in the contemporary laboratory, that enterprise seems an attempt to force nature into the performed and relatively inflexible box that paradigm supplies like part of the aim of normal science is to call forth new sorts of phenomena; indeed those that will not fit the text are often not seen at all. Nor do scientists normally aim to invent new theories and they are often intolerant of those invented by others.*[1014]

Thus, normal scientists overcome the complexity of facts by selecting thus a section of nature to have an in-depth study of it. Once a theory is given, a paradigmatic nature, the major role of normal scientist will be limited only to the articulation of the phenomena and theories inherent in the paradigm.

Normal science thus has sociological undertones. It is not a product of individuals as Popper thinks because "in order to have normal science, you have to have some exemplary achievements on which to build. And the best way to explain where those came from is to regard them as variant products of more or less traditional activities that already exist."[1015]

The critical character of normal science is in puzzle-solving. Puzzles refer to scientific problems accepted by the scientific community. The puzzles do not only define the scientificity of paradigms but they also play the role of testing the ingenuity. That is, "puzzles are, in entirely standard meaning here employed, that special category of problems that can serve to test ingenuity

[1013]Thomas Kuhn, *The Structure of Scientific Revolutions,* p. 23.
[1014]*Ibid.*, p. 24.
[1015]Michael Friedman, Gary Gutteng, John Worral and others., *Thomas Kuhn*, Cambridge, Cambridge University Press, 2003, p. 146.

or skill in solution."[1016] However, these problems should be solvable. It is at this level that Kuhn draws the great divide between science and metaphysics. Problems that are not solvable are simply metaphysical. That is, "other problems, including many that had previously been standard, are rejected as metaphysical, as the concern of another discipline, or sometimes as just too problematic to be worth the true."[1017] This goes same to social problems. When they are not reducible to puzzles of the paradigm in place, they are simply considered as destruction. While puzzles ground the scientificity of the paradigm, they also evaluate scientists. Scientists in normal science aim at resolving puzzles that have not been resolved before them.

Kuhn's anti-foundationism does not consists in rejecting the rules of scientific methodology. It consist in arguing that rules are paradigm-based and that paradigms can direct scientific research without rules. In the first place, Kuhn asserts that besides puzzles, "there must also be rules that limit both the nature of acceptable solutions and the steps by which they are to be obtained."[1018] In an analogy with solving the jigsaw puzzles, we do not only need the picture but the directives on how to arrange the sizes of pieces so that they should interlock well. It can be deduced then that paradigm proceed rules and thus Kuhn marks a methodological revolution from logic-based science defended by Karl Popper to model-based science. There are two types of laws that arise in the definition and application of paradigms. The first category are laws of generalisation. These are "explicit statements of scientific law and about scientific concepts and theories."[1019] They refer to laws that define the theoretical and application aspects of the paradigm. That is, they, "set the puzzles and limit acceptable solutions."[1020] This to Kuhn is historically verifiable in the role of Newton's laws in the 18th and 19th centuries. This is because, "quantity of matter was a fundamental ontological category for physical scientists and the forces that act between bits of matter were dominant topics of research."[1021] The rules of generation thus define the concepts delineate the problems and delimit the acceptable solutions in the execution of normal science.

The second category of rules to him applies to the reality. In other to understand the world, the scientist choses just aspect of nature. As such:

[1016]Thomas Kuhn, *The Structure of Scientific Revolution*, p. 25.
[1017]*Idem*.
[1018]*Ibid.*, p. 26.
[1019]*Ibid.*, p. 40.
[1020]*Idem*.
[1021]*Idem*.

> *That commitment must in turn lead to scrutinies, either for himself or through colleagues. Some aspect of nature in great empirical details. And if that scrutiny displays pockets of apparent disorder, then there must challenge him to a new refinement of his observational techniques or to a further articulation of the theories*.[1022]

With these rules, we are tempted to give a fundamentalist nature to Kuhn. Kuhn's response is that, "rules, I suggest, derive from paradigms but paradigms can guide research even in the absence of rules."[1023] The rules are thus at the service of paradigms and a research tradition based on rules is an endless attempt because it will not be easy to specify common points. At the level of paradigm science, basing science on rules leads to disagreement and the impossibility of enacting a paradigm for a common scientific practice.

Kuhn's anti-foundationism is expressed by his claim that paradigms, can guide research in the absence of rules. The first argument to justify this claim is that it is difficult to get prescriptive rules that define normal science. This is basically because normal science is not static given that, the most successful and new paradigms replace old ones. To a lesser extent, it is difficult to set the rules that should govern scientific practice in normal science because paradigms are based on definite aspects of nature and thus cannot produce rules that are applicable to nature as a whole.

The second argument to show how paradigm do not need logic to direct scientific research is at the level of the nature of scientific education. Scientists do not acquire various concepts, laws and theories theoretically. That is, "instead, these intellectual tools are from the start encountered in a historically and pedagogically prior unit that displays them with and through their applications."[1024] The learning of rules has no prescriptive undertones because every new theory is construed with its application and rules. Given that learning of rules is theory-based and each theory defines its rules in relation to its specific reality, it can thus be argued with Kuhn that the rules learned in the particular paradigm theory will be useless in another paradigm and theory. Thus, Kuhn asserts that: "if for example, the student of Newtonian dynamics, ever discover the meaning of terms like, 'force', 'mass', 'space' and 'time', he does so less from the incomplete through sometimes helpful definitions in his text than by observing and participating in application of these concepts to problem-solution."[1025] This is contrary to Popper who grounds science on a logical method and even asserts that laws are also theories expressed in hypothetical form.

[1022]Thomas Kuhn, *The Structure of Scientific Revolution.*, p. 42.
[1023]*Idem*.
[1024]*Ibid.*, p. 46.
[1025]*Ibid.*, p. 47.

In the third argument to show the pre-eminence of models over logic, Kuhn points out that the conventionality of the scientific community is sufficient for this. That is, when normal scientists agree on particular problem-solutions, rules become useless. The rules in this case intervene only when normal science is in crises. The example is evident with the Newtonian physics whose professional insecurity created debates on the basis of science, leading to a revolution and the installation of quantum mechanics.

The fourth argument in favour of the model-based science developed by Kuhn is grounded on the plurality of science. This is because while an accepted paradigm unifies scientific practice, rules creates disagreement because their interpretation and applications are relative to particular scientific theories.

The transition from normal to extra-ordinary science is rendered possible by anomalies. Even though the rule of normal science is not to discover new facts and theories, discoveries do occur. The emergence of scientific discoveries is in tandem with the realisation of anomalies. Anomalies occur when the paradigm's expectations are violated by nature. Thus, "discoveries commences with the awareness of anomaly, that is, with the recognition that nature has some how violated the paradigm-induced expectations that govern normal science."[1026] Kuhn unlike logical posivists and Popper, conjoins the existence of facts and theories. Facts and theories evolve together and given the complexity of facts, it takes a long time for observation to warrant the integration of a new fact into the paradigm. Consequently, anomaly always lasts for long. This is a heavy charge against induction, verification and falsification given that spontaneous comparison of a theory to the world does not justify inductive inferences, verification of the theory or its falisification.

It is not only the complexity of facts that render the anomaly to exist for log but also the confidence in its past successes and applications which make normal scientists to resist any change in the category of the paradigm. Kuhn uses history to buttress his point as he affirms that:

> *The state of Ptolemaic astronomy was a scandal before Copernicus' announcement. Galileo's contributions to the study of motion depended closely upon difficulties discovered in Aristotle's theory by scholastic critics. Newton's new theory of light and colour originated in the discovery that none of the existing pre-paradigm theories would account for the length of spectrum, and the wave theory that replaced Newton's was announced in the midst of growing concern about anomalies in relation to diffraction and polarisation effects to Newton's theory. Thermodynamics was born from the collision of two existing nineteen century physical theories and quantum mechanics from the variety*

[1026]*Tho*mas Kuhn, *The Structure of Scientific Revolution,* pp. 52-53.

of difficulties surrounding black body radiation, specific heats and the photoelectric effect.[1027]

Unlike Popper's falsification principles which calls for the punctual rejection of a theory once the anomalies is realised, Kuhn's historical examples give a pride of place to his contention that the period of professional insecurity usually go for a long time before a revolution is effected.

The core aspect where Kuhn explicitly rejects both the verification principle of logical positivism and the falsification criterion of Popper is at the level of the scientist response to science in the period of crisis. To logical positivists, the theory is verified and if it does not correspond with facts, it should be considered meaningless and metaphysical and to Popper, it is falsified using crucial experiments. Kuhn on the other hand holds that the scientist's reaction is not absolutely and spontaneously negative, though there is a reduction in their facts in the paradigm. Unlike Popper, Kuhn holds that scientists, "do not, that is treat anomalies as counter instances though in the vocabulary of philosophy of science that is what they are."[1028]

The period of crisis arise from the discovery of anomalies. When the anomalies cannot be resolved there is a proliferation of theories to propose a new model. This is a kind of indeterminism that Kuhn defends; a theory which holds that there are always many theories to explain a fact, making it difficult to choose the best. Kuhn thus makes concessions to under-indeterminism but he is cautious to restrict it only to the scientific period of crisis. As such, the community is consensus override indeterminism in normal science. A paradigm in crisis is only replaced if there is a better alternative to replace it. That is, "the decision to reject one paradigm is always simultaneously a decision to accept another and the judgment leading to that decision involves the compensation of both paradigms with nature and with each other."[1029] To Kuhn then the historical study of the evolution of scientific practice does not "resembles the methodological falsification by direct comparison with nature."[1030] Normal science has but the role to mop-up theory and facts. That is, "normal science does and must continually strive to bring theory and fact into closer agreement, and that activity can easily be seen as testing or as search for confirmation or falsification. […] failure to achieve a solution discredit only the scientist and not the theory."[1031]

[1027]Thomas Kuhn, *The Structure of Scientific Revolution* p. 67.
[1028]*Ibid*., p. 77.
[1029]*Ibid*., p. 77.
[1030]*Idem*.
[1031]*Ibid*., p. 80.

Blaming a theory and not the scientist as seen with logical positivism and Popper is a mark of bad faith to Kuhn for, "it is a poor carpenter who blames his tool."[1032] The change of a paradigm is only through a revolution. But if the paradigm is made to be articulated and not falsity, then what is the need for a revolution? Kuhn offers an analogical argument based on the nature of political revolution. He asserts that:

> *Political revolutions are inaugurated by a growing sense, often restricted to a segment of a political community that existing institutions have ceased adequately to meet the problems posed by an environment that they have in part created. In much the same way, scientific revolutions are inaugurated by a narrow sense, again after restricted to a narrow sense, again after restricted to a narrow subdivision of the scientific community that an existing paradigm has ceased to function adequately in the exploration of an aspect of the nature to which that paradigm itself had previously led the way.*[1033]

Major revolutions are like the Copernican revolution and minor ones are like the invention of the x-ray or the discovery of the oxygen. The period of revolution is the end of extra-ordinary science and the beginning of a new normal science. Normal science is thus cumulative while extra-ordinary science is a reconstruction of normal science. Scientists in normal science solve puzzles while those in extra-ordinary science test paradigm.

Kuhn first rejects verification by asserting that, "noting that no theory can ever be exposed to all possible relevant tests, they ask not whether a theory has been verified but rather about it probability in the light of the evidence that actuality exists."[1034] Kuhn's argument against verification holds on grounds that we cannot make observations that are sufficient to ascertain verification. Against falsification, Kuhn asserts that there is no perfect, exhaustive or anomaly-free paradigm. Thus, if we adopt falsification, no theory will have scientific theory hood. That is:

> *no theory ever solves al the puzzles with which it is confronted at a given time; nor are the solutions already achieved often perfect. On the contrary, it is just the incompleteness and imperfection of existing data theory fit that, at any time, define many of the puzzles that characterise normal science. If any and every failure to fit were ground for theory rejection, all theories ought to be rejected all the time.*[1035]

Even if falsification is recommended, it will lead to the same problem logical positivist face. That is, if falsification is actually recommended, then: "the Popperian will require some criterion of improbability or degree of falsifications. In developing one they will almost certainly encounter

[1032]Thomas Kuhn, *The Structure of Scientific Revolution,* p. 80.
[1033]*Ibid*., p. 92.
[1034]*Ibid*., p. 145.
[1035]*Ibid*., p. 146.

the same network of difficulties that has haunted the advocates of the various probabilistic verification."[1036]

Kuhn acknowledges Popper's counter examples which he calls anomalies but he does not agree that counter-examples are enough to falsify a theory. That is:

> *Popper's anomalies experience is important to science because it evokes competitions for existing paradigm. But falsification, though it surely occurs does not happen with, or simply because of, the emergence of an anomaly or falsifying instance. Instead, it is a subsequent and separate process that might equally will be called verification since it consist in the triumph of a new paradigm over the old one.*[1037]

By uniting theory and fact, Kuhn equally rejects the monolytic orientation of knowledge into rationalist and empiricist tenets. We cannot dissociate the two because nature is viewed from the angle of the paradigm. Thus Kuhn is an anti-foundationalist in his regard towards empiricism and rationalism. His second postmodernist inclinations in his view that there is no ideal language, logic or rules that can lead to the truth, unlike Popper's realist inclinations. One of the commentators of Kuhn thus evokes the latter's postmodernist concession of Kuhn. He asserts that:

> *Kuhn denied that there is any such thing as the "scientific method" or even methods (plural) construed as sets of timeless rules of inquiry. Kuhn posited communities of specialist rather than solitary individuals as the bearer of knowledge and insisted that there is no higher form of justification than the assent of the relevant community of experts.*[1038]

This implies that the rigorous logic of science defended by Popper is not teneable in a paradigm-based science. Like in most of his critiques, Popper responds to Kuhn's critique. Popper in the first place acknowledges that Kuhn's criticism is the most constructive of all: "Professor Kuhn's criticism of my views about science is the most interesting one I have so far come across. There are, admittedly some points more or less important where he misunderstands me or misinterprets me."[1039] Popper acknowledges Kuhnian originality in the distinction between normal and extra-ordinary science but assets that such distinction is not sharp one. This he asserts is because of the dogmatic nature of normal science. Science is essentially critical and Popper insists that normal science lacks this fundamental aspect because:

[1036]Thomas Kuhn, *The Structure of Scientific Revolution* p. 147.
[1037]*Idem*.
[1038]Michael Fredman, Gary Gutteny, John Worral and others., *op.cit.*, p. 6.
[1039]Karl Popper, "Normal science and its dangers" in Alan Musgrave and Imre Lakatos edition of *Criticism and the Growth of Knowledge, The proceeding of the international colloquium in philosophy of science*, New York, Cambridge University Press, 1970, p. 51.

> *The normal science; as described by Kuhn has been badly taught. He has been in a dogmatic spirit: he is a victim of indoctrination. He has learned a technique which can be applied without asking for the reason why (especially in quantum mechanics). As a consequence he has become what may be called applied scientist in contradistinction to what I should call a pure scientist.*[1040]

As an applied scientist, Popper argues that the normal scientist operates mechanically and not rationally. Popper iguòres the great attention that Kuhn offers to the problem-solving nature of science. Such way of conceiving science makes the scientific practice to lack creativity and innovation as the puzzle-solving role, "is rather a routine problem, a problem of applying what one has learned."[1041] Such attitude to Popper is adequate for engineering and not for pure scientists. Popper accepts that dogmatism is sometimes needed to develop the critical method because, "if we give into criticism too easily, we shall never find out where the real power of our theories lie."[1042] However, his dogmatism is a kind of conventionalism which he calls the myth of framework which can also be falsified in the process of criticism. It is not then equivalent to Kuhn's dogmatism, for "this kind of dogmatism is not what Kuhn wants. He believes the domination of a ruling dogma over considerable periods; and he does not believe that the method of science is, normally, that of bold conjectures is criticism."[1043]

Whatever be Popper's response to Kuhnian criticism, Kuhn's view remain a challenge to Popper's scientific rationality. Science to him remains a social practice and theories in the history of science are never falsified immediately they present anomalies. Kuhn's pragmatism equally exceeds Popper's realism for the practical aim of science to Kuhn is not the search for the truth or verisimilitude but to transform the scientists, change the ways the society perceive the world to change the world and thus to initiate development.

7.3.2. The Postmodernist Critique of Popper's Methodological Monism

Post-modernism is termed by Jean-François Lyotard as the period of meta-narratives. It aims at demystifying two central myth of science; notably; "that of the liberation of humanity and that of the speculative unity of all knowledge."[1044] The liberation of mankind, a great enlightenment narrative influence science. This is because the question of the legitimisation of science ushered

[1040]Karl Popper, "Normal Science and Its Dangers", in *Alan Musgrave and Imre Lakatos edition of Criticism and the Growth of Knowledge, The proceeding of the international colloquium in philosophy of science*p, 53.
[1041]*Idem*.
[1042]*Ibid*., p. 55.
[1043]*Idem*.
[1044]Jean-François Lyotard, *The Post-Modern Condition: A Report On Knowledge*, trans., Geoff Bennjington and Brian Massumi, Minnea-Polis, The University of Minnesota Press, 1984, p. ix.

the prescription of diverse methods in the philosophy of science. However, the meta-narratives of post-modernism rejects the imposition of methodological standards in science. That is:

> *A post-modern artist or writer is in the position of a philosopher. The text he writes, the work he produces are not in principle governed by pre-established rules, and they cannot be judged according to a determining judgment, by applying familiar categories to the text or to the work .Finally, it must be clear that it is our business not to supply reality but to invent allusions to the conceivable which cannot be presented.*[1045]

This is the artistic orientation of the definition of postmodernism. At the level of knowledge and science, it is a defence of delegitimation. The reason for this delegitionation which Feyerabend refers to as methodological plurality is due to the effect of the Second World War, where emphasis is laid on techniques and technologies and this "has shifted emphasis from the ends of actions to its means."[1046] There is the disappearance of the causes, foundations and standards. On the nature of science then, postmodernism annihilates the architectonic and hierarchical classification of sciences and demarcation of science from non-scientific disciplines. That is:

> *The classical dividing lines between the various fields of science are thus called into question-disciplines disappear, overlappings occur at the borders between sciences and from these, new territories are born. The speculative hierarchy of learning gives way to an immanent and, as it were, "flat" network of areas of inquiry, the respective frontier of which are in constant flux.*[1047]

It can be interpreted from the above that the metaphysical motivation of postmodernism is the complexity of real. Ernest Cassirer identifies all forms of knowledge as the products of human reason. Reason to him then construct using symbolic forms such as language, science, myth, religion and arts. All these forms are different symbolic episodes of the phenomenology of the human mind in its attempt to construct the world. Each of these symbolic forms constitutes its own specific which influences others but that influential character should not be used as a standard to judge other forms of knowledge. Thus, Cassirer asserts that : *« Car chacun de ces réseaux de signification, le langage comme la connaissance scientifique, l'art comme le myth, possède son propre principe de construction qui imprime en quelque sorte son sceau à tous ses produits particuliers. »*[1048]

[1045]Jean-François Lyotard, *The Post-Modern Condition: A Report on Knowledge*, p. 81.
[1046]Paul Feyerabend, *Against Method*, 3rd ed., New York, Verso, 1993, p. 38.
[1047]*Ibid*., p. 39.
[1048]Ernst Cassirer, la philosophie des formes symbolique, Tome 1, le langage, trad., Jean Lacoste, Paris, les éditions de Minuits, 1972, p. 40. "For each networks of meaning, language just as scientific knowledge, arts just like myth, possesses its own principle of construction, which imprints its mark on its particular products.

The above implies that there is a transition from specialisation to the epistemology of complexity in postmodernism. The real is not simple as Popper and his enlightenment proponents of science conceives. The real is complex and multidimensional. In his epistemology of complexity, Edgar Morin argues that the real cannot still be given a unilater nature. That is, *« la connaissance est donc bien un phénomène multidimensionnel dans le sens où elle est de façon inséparable à la mentale, psychologique, culturelle, sociale. »*[1049] Science as defended by Popper and logical positivists, is empirical and thus grounded on empirical facts. This specialisation is mutilating to human reason. To liberate human minds from such narrow epistemology, Edgar Morin prescribes that:

> *Pertinent, knowledge must confront complexity. Complexus means that what is woven together. Infact, there is complexity whenever the various elements (economic, political, sociological, psycholoqual, emotional, mythological […] that compose a whole are in separable, and there is inter-retroactive, interactive, independent tissue between the subject of knowledge and its context, the parts and the whole, the whole and the parts, the parts among themselves. Complexity is therefore the bond between unity and multiplicity. Developments proper to our planetary era confront us more frequently, ineluctably with the challenge of complexity.*[1050]

Edgar Morin thus effects a rupture from the epistemology of simplicity defended by Popper. The epistemology of simplicity is limited thus because it makes the partial study of the reality. Popper for instance prefers experimental science which he reduces it simply to the study of the empirical reality.

It is in this postmodernist spirit that Paul Feyerabend criticises Popper's view of science. In the first moment of Feyerabend's argument, he posits that falsification as Popper defended as a criterion of scientific theoryhood is not historically verifiable. Unlike Popper who stipulates that once a theory is challenged by counter examples, it should be falsified, Feyerabend observes that the successful corroboration of a theory in the present experiments, does not make it superior to others. The success of the theory may not arise from the theory itself but in the fact that too much attention was given to it more than other defeated ones. It could also be argued that the defeated theory did not have apt applications. Thus; "a setback for a theory, a point of view, an ideology must not be taken as a reason for eliminating it."[1051] Observing the history of science, Feyerabend

[1049]Edgar Morin, *La Méthode*, tome 3, *La Connaissance De La Connaissance*, Paris, Editions du Seuil, 1987, p. 12. "Knowledge is thus a multidimensional phenomena, in a way that it is inseparable from the mental, the psychological, cultural and social"; (my translation).
[1050]Edgar Morin, *Seven Complex Lessons In Education For The Future*, Trans. Nidra Poller, Paris, UNESCO, 1919, p. 15.
[1051]Paul Feyerabend, "Democracy, Elitism, and Scientific Method", in *Inquiry: An Interdisciplinary Journal Of Philosophy*, vol. 23, no. 1, New York, Routledge, 1980, pp. 3 – 18, p. 5.

notes that some defeated ideas today may still arise the future and defeat the successful ones. This is plausible in the theory of atomism as Feyerabend states that:

> *The philosophy of atomism is an excellent example. It was introduced (in the West) in antiquity with the purpose of 'saving' macrophenomena such as motion. It was overtaken by the dynamically more sophisticated philosophy of the Aristotelians, returned with the scientific revolution, was pushed back and almost annilulated during the nineteenth century, returned early in the twentieth century and is now again restricted by complementarity. Many facts that first seemed to refute atomism on closer analysis turned out to support it.*[1052]

Another example is the idea of the earth movement that arose in the ancient times and was refuted by Aristotelians but in the 19th century, it came back. Consequently, all ideas matter in the scientific practice and "a science interested in finding truth must therefore, retain all the ideas of mankind for possible use."[1053] Thus, sutmoded ideas should not be falsified as Popper asserted because there will always be proponents of such ideas and because "most advanced theories cannot be understood and examined without their help."[1054]

After fiving a historically motivated argument against falsification, Feyerabend engages into the critique of falsification as a methodology. Thus second argument against falsifiability is grounded on the complexity of the relationship between hypotheses and facts. There is no hypotheses in science that does not have an infinite series of counter-examples. Thus, no hypotheses or theory can survive if we effectively apply falsification. Falsification then will not only destroy every theory subjected to it but it will destroy science as a whole. Commentator of Feyerabend in this way argues that; "Every hypothesis in science encounters empirical insurmountable obstacles. Every hypothesis in science encounters empirical deviations big enough to falsify it. Therefore, falsificationist methodology would destroy science without giving us any substitute."[1055]

This follows that if science still continues to exist today, thus two consequences arise. Firstly, it shows that the history and practice of science ignores falsification and secondly it implies that if such falsification is taken note of, then ad hoc hypotheses are probably accountable for the persistence of science. It is therefore unsound to argue that for a theory to be considered scientific, it must be refuted. This is not tenable for theories that have not been practically contradicted by

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[1052]Paul Feyerabend*, "Democracy, Elitism, and Scientific Method"*, p. 5.
[1053]*Idem*.
[1054]*Ibid*., p. 7.
[1055]Gouzalo Munérar, *Beyond Reason*, *Essays on The Philosophy Of Paul Fayerabend*, Dordreicht, Springer, 1991, p. 281.

facts. A theory does not clash only with one fact but with a multitude of facts. Feyerabend thus considers falsification not only to be historically insignificant in science but it also is destructive to the survival of science. He thus argues that:

> *Any theory that is only moderately interesting clashes with numerous experimental results. A principle of falsification that removes theories because they do not put the facts would have to remove the whole of science or it would have to admit that large part of science is irrefutable. The limit that a good theory explains more than its rivals (it explains the successes and the failures of its rivals, and it predicts new and as yet unknown facts) is not very realistic either.*[1056]

From the above, it is admitable that facts are wider than both hypotheses and logic of justification. At this level, Feyerabend engages into an anarchistic critique of Popper's methodological monism. By methodological monism, we imply the attitude of subjecting scientific practice to one method, which serves as the criterion of the legitimation of theories. Feyerabend grounds his argument for methodological pluralism on the notion of the complexity of the real. Thus, logic or standards cannot make an exhaustive study of the real. Feyerabend asserts that: "Turning now to logic, we realise that even the simplest demands are not satisfied in scientific practice, and could not be satisfied because of the complexity of the material."[1057] Science thus has to reflect the complexity of the real in its methodological outlook. This reflection of the complexity of the real can be realised by guaranteeing an elastic connotation to science. My attempt to subject the scientific practice to narrow and rigorous standards, "would rob science of the elasticity without which progress cannot be achieved."[1058] Facts are too wide and complex but logic renders science to be narrow and thus, incapable of grasping the real. Facts then cannot be material acts for either falsification or verification for, "the range they leave thought is too wide. Logic and methodology eliminate too much, they are too narrow."[1059]

The critique of methodology extends to the critique of philosophy of science as a whole. To Feyerabend, philosophy of science imposes rules, standards and methods on the scientific practice. The aim of these prescriptive rules by philosophy is to exalt reason and initial progress. To Feyerabend, this narrow-minded attitude, marks "the end of the philosophy of science (and of the very popular idea of reason) as an aid to scientific practice"[1060] is then effectivelybecause of this that Feyerabend thinks that the incommensurability between the narrow nature of methodology

[1056]Paul Fayerabend; "Science: The Myth and Its Role In Society", in *Inquiry: An Interdisciplinary Journal Of Philosophy*, vol. 8, no. 2, New York, Routledge, 1975, pp. 167-181, p. 170.
[1057]*Idem*.
[1058]*Idem*.
[1059]*Idem*.
[1060]Paul Feyerabend, "Democracy, Elitism, and Scientific Method", p. 9.

and the wide nature of facts can be resolved by the contextualisation of methodology. That is: "scientists proceed in a manner most appropriate to the subject under investigation, that new types of research often require new types of standards and that even the laws of formal logical are not exempt from revision."[1061]

Feyerabend points out that one of the arguments advanced for methodological monism is that scientific methods assures us to progress of knowledge. He argues against this as he holds that:

> *Scientists don't solve problems because they possess a magic wand-methodology – but because they have studied a problem for a long time, because they know the situation fairly well, because they are not too unintelligent, and because the excesses of a scientific school are almost always balanced by the excesses of some other school*.[1062]

This goes same with the procedures science uses to make new discoveries. The history of science to him is characterised by the mixture of non-scientific and scientific elements, where the former has always benefited from the latter. This is historically verifiable from astronomy which has always benefited from myths and unjustified assumption, to develop astronomical theories. Feyerabend notes that: "While astronomy profited from pythagoranism, medicine profited from herbalism, from the psychology, physiology, the metaphysics of witches, midwives, wisemen wandering druggists. It is well known that the sixteenth century medicine was quite helpless in the face of disease."[1063]

Science today continue to draw inspiration from unscientific ingredients and the contemporary example Feyerabend gives is, "the revival of traditional medicine in communist China."[1064] This to Feyerabend disqualifies the seriousness of Popper on the necessity to demarcate between science and non-science. The principle of demarcation is thus destructive for two reasons; "we arrive at the result that the separations of science and non-science is not only artificial but also detrimental to the advancement of knowledge."[1065] It is artificial because every science is embedded with non-scientific ingredients and it obstructs the progress of science because the success of demarcation will deprive science from the n on-scientific realm which inspires and contribute to the development of scientific knowledge. Thus, a historic comprehension of the real

[1061]Paul Feyerabend*, "Democracy, Elitism, and Scientific Method",* p. 9.
[1062] Paul Feyerabend, *op.cit.*, p. 169.
[1063]*Ibid*., p. 172.
[1064]*Ibid*., p. 173.
[1065]*Idem*.

implies the integration of all forms of knowledge into the epistemic prison. This thus challenges methodological monistic view that there is no extra-scientific knowledge. Thus:

> *If we want to understand nature, if we want to master our physical surroundings, then we must use all ideas, all methods and not just a selection of them. The assertion, however, that there is no knowledge outside science – extra scientiam nulla salus – is nothing but a second fairy tale.*[1066]

The futility of the inseparability between science and non-scientific knowledge also implies that the view that science alone can guarantee the wellbeing of man is a myth. The exclusively scientific character of humanism is one of the motivations of the enlightenment narratives of modernism. To Feyerabend, science cannot be accorded the exclusivity of humanism. This is because non-scientific discipline and practices in the past and present play a great role also in improving on the living conditons of man. It is evident in the therapeutic role of traditional medicine. Feyerabend holds that: "unscientific' procedures such as the herbal lore of witches and wisemen the astronomy of mysticism, the treatment of the ill in primitive societies are totally without merit. Science alone gives us a useful astronomy, an effective medicine, a trust-worthy technology."[1067]

Feyerabend's argument can be contextualised with the contemporary debate of the use of alternative medicine practices to treat Covid-19 virus. Most African countries like Madagascar, Cameroon and Nigeria have integrated herbal and traditional medicine in the treatment of the Covid-9. Thus, the argument that science deserves special standards and regulations since it is the safest tool of improving on the wellbeing of man is simply a fairy tale.

If non-scientific disciplines play a role in the development of science and are also having humanistic undertones, how then can we justify the supremacy of science today? Feyerabend thinks two reasons are accountable for the illegitimate authority of science today, which are the capitalist and the ideological orientations of the scientific activity.

The reign of science today is not due to its rationalism as Feyerabend thinks capitalism is the reason. This capitalism proceeds in using science and rationalism to cause terror to those who are uninformed of their modus operandi. Feyerabend notes that the best way to overcome the capitalism of science and rationalism, Feyerabend proposes the vulgarisation of science, through

[1066]Paul Fayerabend, "Science: The Myth and Its Role In Society*",* p. 174.
[1067]*Ibid*., p. 170.

the participation of the public in the scientific practice. The popularisation of science is important because:

> *such participation is the best scientific education the public can get a full democratisation of science (which include the protection of minorities such as scientists) is not in conflict with science. It is a conflict with a philosophy often called "rationalism", that uses a frozen image of science to terrorise people unfamiliar with its practice.*[1068]

The capitalist undertones of the reign of science today is historically verifiable from the tragic event of colonisation. Feyerabend recalls that the western world colonised the world and imposed their way of the representation of the world. The country that resisted the assimilation of western science to Feyerabend is China. That is, "Chinese technology for a long time lacked any western scientific underpinning and yet it was far ahead of contemporary western technology."[1069] Western science is thus a capitalist instrument of domination and destruction. This thus makes it lost its epistemological states as an instrument of research. This is in the creation of arms, nuclear weapons that has ushered in terror in the world. Feyerabend in this way asserts that, "Western science so far has created the most efficient instruments of death."[1070]

Faced with the capitalist and destructive nature of science, Feyerabend pro-advocates for the democratisation of knowledge by admitting epistemological relativism. This relativism can be situated at the level of the method and also at the level of knowledge. At the level of scientific methodology, Feyerabend proposes and anarchistic conception of the procedure of the scientific practice. He asserts that; "science is an essentially anarchic enterprise: theoretical anarchism is more humanitarian and likely to encourage progress than its law-and-order alternative."[1071] Thus, no foundation or method is good or bad but every approach in so far as it is applicable in that domain is legitimate. This methodological pluralism enhances the advancement of knowledge, since "without 'chaos', no knowledge, without a frequent dismissal of reason, no progress."[1072] Feyerabend thus sets the pace for his anti-foundationism by taking up the posture of a methodological anarchist. He asserts that "anarchism is opposed to the existing order, it wants to destroy this order."[1073] Anarchism is more humanistic because unlike methodological monism that alienates people from their methodological specificities, it acknowledges and respects the freedom of people to choose whatever approach they deem it helpful for the development of knowledge

[1068]Paul Feyerabend, *Against Method*, p. 2.
[1069]*Ibid*., p. 3.
[1070]*Idem*.
[1071]*Ibid.*, p. 5.
[1072]*Ibid*., p. 155.
[1073]Paul Feyerabend, "Science: The Myth and Its Role In Society", p. 176.

and for survival. Epistemological anarchism is neither nihilism nor scepticism nor political anarchism. It is not nihilism because Feyerabend does not deny the existence of science. This is asserted by him elsewhere as he affirms that: "I am not against science so understood […]. But I am against ideologies that use the name of science for cultural murder."[1074] On the other hand, epistemological anarchism is neither scepticism nor political anarchism. Feyerabend to justify this asserts that:

> *Epistemological anarchism differ from scepticism and from political (religious) anarchism. While the skeptic either regards every view as equally good or equally bad, or desist from making such judgements altogether, the epistemological anarchist has no compunction in defending the most right or the most outrageous statement. While political anarchist may want to defend it for he has no everlasting loyalty to and no everlasting everion against, any institution and any ideology.*[1075]

Unlike a methodological monist who imposes his approach on the audience, an epistemological anarchist depends on the quality of the audience to sell his knowledge. When he is faced with scientists and philosophers of science, anarchist has the function of showing that anarchy is the cause of the advancement of science. When confronted with an ideologist, he teaches that there is no single methodological rule.

Methodological monism Feyerabend renders science to be an ideology. Science with them ceases to be a tool of research to be a tool of propaganda. The science that prescribes only one method is an ideology and is thus destructive both to the state and to education. That is,

> *A science that insists on possessing the only correct method and only acceptable result is ideology and must be separated from the state and separated from the state especially from education. One may teach it but only to those who have decided to make this particular superstition their own.*[1076]

At the level of education, methodological monism imposes a narrow vision to learners. Feyerabend insists that such science should not constitute the curriculum of scientific pedagogy. On the contrary, the science that is methodological plural, tolerant and opened, is fit to be taught. At the level of the state, methodological monism turns to an ideology such like religion. A science based on such narrow methodological outlook should be separated from the state. Mature citizenship to Feyerabend implies psychological exposure to a plurality of options and methods. A

[1074]Paul Feyerabend, *Against Method*, p. 4.
[1075]Paul Feyerabend, *op.cit*., p. 177.
[1076]*Ibid*., p. 175.

science grounded on a unique methodological outlook cannot thus dispose the citizen for social and civic integration. Feyerabend asserts that:

> *A mature citizen is not one who has been instructed in a special ideology, such as periteirism or critical rationalism and who now carries the ideology with him like a mental tumour. A mature citizen is someone who has learned how to make up his mind and who has then decided in favour of what suits him.*[1077]

In order to have mental boldness, a mature citizen should study the multitude of ideologies. That is, science will be studied not as the only reliable discipline but as a phenomenon in the history of man. A mature citizen to Feyerabend then will study science alongside other historical approaches to the reality like fairitales and myths of ancient societies. This is a holistic scientific pedagogy and the logical importance to Feyerabend is the immunisation of man's critical attitude towards existing propaganda and ideologies. He thus reiterates that: "An essential part of a general education is of this kind is acquaintance with the most outstanding propagandists in all fields, so that 'pupil' can build up his resistance to all propaganda to all, including the propaganda called 'argument'."[1078]

It is when the pupil has been exposed to all forms of ideologies and methodologies, "that he will be called to make up his mind on the issue rationalism – irrationalism, science-myth, science-religion, and so on."[1079] Feyerabend proceed to develop the thesis of the democratic relativism of science. This thesis is based on the freedom of different traditions in the human society. Thus no tradition has a right to impose standard on others. Feyerabend insists that, "people have the right to live as they see fit."[1080] No institutions thus has a right to impose its forms on others. For instance, "some tribes in Central Africa do not want to be x-rayed because they do not want their internal organs exposed to view."[1081] Science is also a traditional form and just like rationalism, "are instruments put at the disposal of the people to be used by them as they see fit. Scientists are salesmen of ideas and gadgets, they are not judges of truth and falsehood."[1082]

Feyerabend then uses the proliferation argument to show how methodological pluralism promotes the humanism of traditions and the maturity of the citizens. That is, "a society that

[1077]Paul Feyerabend, "Science: The Myth and Its Role In Society", p. 175.
[1078]Ibid., pp. 175-176.
[1079]Ibid., p. 176.
[1080]Paul Feyerabend, "Democracy, Elitism, and Scientific Method" p. 15.
[1081]*Idem*.
[1082]*Idem*.

contains many traditions side by side has much better means of judging each single tradition than a monistic society. It lances both the quality of the traditions and the maturity of its citizens."[1083]

The second argument for democratic relativism is grounded on the finitude and incomplete nature of scientific knowledge. Most of the arguments in science are based on mere assumptions. We can recall Karl Popper's view that criticism is impossible without initial consensus which is dogmatic in nature, which is not directly linked to research. As thus, Feyerabend insists that: "The lesson to be learned from this phenomenon is that fundamental debates between traditions are debate between laymen which can and should be settled by no higher authority than again the authority of laymen; that is democratic councils."[1084]

With these, Feyerabend insists that the guiding rule of scientific research is, "anything goes."[1085] Critical rationalism of Popper is thus one among the many approaches of orientating science. To prescribe falsification as the criterion of scientific theoryhood as Popper does is to render science as an instrument of terror on those who are not familiar with. Critical rationalism then is an ideological orientation of science which is dangerous for the state and education. Given that the real is complex and that every tradition has the freedom to choose their practices, Feyerabend concludes by advocating for an anarchical view of science within the context of methodological pluralism.

CHAPTER EIGHT

POPPER'S SCIENTIFIC RATIONALITY AND SCIENTIFIC METAPHYSICS: IMPACT AND STAKE

Whether Popper himself is alive or dead, his ideas continue to pose problems, to have consequences still to be fully explored and so to bear intellectual fruit.[1086]

8.1. CONTRIBUTION TO THE SURVIVAL OF SCIENCE

Popper's rationalism and logic of science are important for they permit the survival of science. In the first moment of the reflection, we will examine the pillars of scientific dynamism in Popper. Besides other views of scientific change such as the incorporation approach and the revolutionary approach, Popper prefers progress through revolutionary overthrow and

[1083]Paul Feyerabend, "Democracy, Elitism, and Scientific Method", p. 15.
[1084]*Ibid*., p. 16.
[1085]Paul Feyerabend, *Science In a Free Society*, London, Lowe and Brydon Ltd., 1978, p. 39.
[1086]Anthony O'Hear, *Karl Popper: Philosophy and Problems*, p. 1.

incorporation. It will then be a question of unveiling how Popper develops this and what criteria he proposes as best for the evaluation of progress in science. We will examine the growth of knowledge both at the cognitive and theoretical level. In the second moment of this scientific dynamism, we will argue that the negativist spirit of Popper, in which he valorises error over truth is important for it arms science against antiscience and irrationalism.

8.1.1. Popper on Scientific Progress through Revolutionary overthrow and Incorporation

Scientific progress which enhances scientific dynamism does not only illustrates the operational character of scientific knowledge but it also demonstrates the privilege that science has over other symbolic, representative and cultural forms. There are two categories of theories that clash on the concept of scientific progress; notably the conception of progress as gradual and incremental and on the other hand, progress that is strictly discontinuous and revolutionary. John Losee defines scientific progress in the following terms:

> *Progress is a normative term. A "progressive" sequence is constituted by stages each of which is superior to its predecessors such a sequence is upward directed overtime with respect to "goodness". The upward movement may be achieved in diverse ways, progress may be gradual and incremental (1) or sharply discontinuous (2).*[1087]

Progress is incremental when the succeeding theory is the incorporation of the previous one. Progress at this level is gradual and takes the form of theory subsumption. On the other hand, scientific progress is be discontinuous when it is revolutionary and marked by the drastic replacement of old theories by new ones. In the former case, progress is through the new theory subsuming the old one and in the latter case, the new theory is a revolutionary replacement of the old one. It is in this light that Larry Laudan argues that scientific progress is not directly evaluated on the existential impact of science, even though such progress implicitly affect human existence. Scientific progress in this way is thus strictly theoretical and cognitive. That is why Larry Laudan asserts that: "my exclusive preoccupation will be with what I call 'cognitive progress', which is nothing more or less than progress with respect to the intellectual aspirations of science."[1088] The aim of this reflection is not only to show how Popper contributed to the debate on the nature of scientific progress but to unveil Popper's reconciliation of the two antithetical approaches. That

[1087]John Losee, *Theories of Scientific Progress*, New York – London, Routledge, 2004, p. 1.
[1088]Larry Laudan, *Progress and Its Problems Towards a Theory of Scientific Growth*, London, University of California Press, 1977, p. 7.

is, Popper's view of scientific progress will be demonstrated as progress through revolutionary overthrow and incorporation. It would be noted that:

> *Just as scientists seek to under cover the underlying mechanisms responsible for the development of physical systems, philosophers of science seek to uncover the mechanisms responsible for scientific progress. The most widely promulgated theories about underlying mechanisms take progress in science to be analogous to biological evolution.*[1089]

The most plausible theory of progress by incorporation in the mid nineteen century was developed by William Whewell. To him, science progresses in an ascending way and to define the pattern of such progress, he examined the history of science as a whole. Whewell in his tributary conception looked at science as a hierarchical structure in which; "each individual science has a structure determined by a set of axioms and sate relations among its characteristic fundamental predicates."[1090] Progress in astronomy to him is analogous to the tributary river, making science to be a network of branches constituting a unifying whole. There are three conditions which a theory should fulfil to replace the old one for to be progress. Firstly, the new theory should be consistent, secondly it should incorporate the old one and thirdly, it should have a higher degree of the subsumption of the previous one.

In the 20th century, the most evident example of the conception of scientific progress by incorporation is developed by logical empiricism. This is notably translated in their method of reduction. The outstanding proponent of reductionism is Ernest Nagel and to him, science progresses when more inclusive theories replace old ones. John Losee asserts that key terms in the reducing theory are always subsumed by more simplistic terms in the reduced theory. John Losee summarises Nagel's thesis as "often the reduced theory includes terms not found in the reducing theory. Nagel labelled such instances of 'heterogeneous reduction'. The relationship between the Kinetic molecular theory and classical thermodynamics is an example."[1091] In the reduction of the classical thermodynamics into the Kinetic molecular theory, terms like "temperature" and "pressure" that are found in the classical theory are not included in the Kinetic theory. In the two theories of scientific progress cited, science proceeds through the subsumption of one theory by the other.

[1089]John Losee, *Theories of Scientific Progress*, p. 3.
[1090]*Ibid*., p. 9.
[1091]John Losee, *Theories of Scientific Progress*, p. 29.

The second category of theories of scientific change are those that view progress as revolutionary through overthrow. The most glearing historical example of revolutionary progress is seen in the overthrow of Aristotelian physics by Newtonian physics. The simple replacement of a theory by another is however the necessary but not the sufficient condition of scientific revolution. For them to be a revolution, the overthrow should be accompanied by the change in the methodological rules of evaluation and the new theory should be applied and developed by scientist for the main time. Bernard Cohen in this way proposes four precepts to use as evaluative of scientific revolution. Such change must be attested by: "1. The testimony of contemporary witnesses; 2. References to the achievements in subsequent document in the field; 3. Judgment of competent historians of science; and 4. The opinions of scientists in that field today."[1092]

Another proponent of this revolutionary approach to the problem of the nature of scientific change is Thomas Kuhn. Scientific progress to him is not spontaneous and piecemeal but it unfolds in two episodes. Normal science proceeds by cumulation because its practitioners are not mobile scientists. They have as role, the extension and the articulation of the paradigm. To Kuhn, scientists usually resist change in normal science. The examples cited by John Warral, a commentator of Kuhn are: "David Brewster, who continued to believe in the corpuscular theory of light long after Fresnel's wave theory was developed and Joseph priestly who persevered in defending the phlogiston theory Lavoisier's oxygen theory."[1093]

There are thus resistant and mobile scientists when faced with a theory in the context of change. The former are experts of Kuhn's normal science and the latter are paradigm who intervene at the revolutionary stage; that is, in the context of extraordinary science. Kuhn was influenced by Duhem who held the same view. To Duhem, when a theory is holistically confronted with facts and they are anomalies, it is always difficult to know whether to change but a hypothesis, a group of hypotheses or a theory. Kuhn's revolution by overthrow operates when the paradigm can no longer resolve the anomalies that are intrinsic in it. In the crisis period, the first step towards scientific revolution is the emergence of a plurality of competing theories. The theory that will resolve the anomalies unsolved by the previous theories, exhibit a huge degree of consistency and evokes puzzles for subsequent experts to resolve, overthrows the anomalies paradigm while in normal science, change involves the maintenance of concepts, the second episode of change, which is realised by revolution through overthrow, involves the change in the theoretical lexicon.

[1092]*Ibid*., p. 65.
[1093]Antony O'Hear, *op.cit*., p. 78.

Before examining Popper's originality in reconciling the two tendencies of scientific progress it is incumbent to unveil his evolutionary conception of science. Popper in the first moment rejects the bucket theory of knowledge. This view defended by empiricists claim that knowledge is received passively by the mind from experience. Knowledge is thus cumulative. Such view that "human as passive receives information knowledge pours into our minds as water pour into a bucket",[1094] renders humans powerless and is detrimental to rationalism. To Popper, "The method of learning by trial and error – of learning from our mistakes – seems fundamentally the same whether it is practised by lower or by higher animals, by chimpanzees or by men of science."[1095]

Thus, organisms actively construct knowledge through the innate mechanisms of expectations and anticipations. Knowledge then is not inductively attained but it has a conjectural status. Popper's view of the growth of knowledge illustrates his preference for science over other symbolic and representational forms. He thus asserts that: "For the growth of scientific knowledge may be said to be the growth of ordinary human knowledge Writlarge."[1096] This follows that the growth of scientific knowledge is not on the microcosm of the growth of knowledge as a whole but a paradigm of how every tenable knowledge is supposed to progress.

Popper's view of the growth of knowledge can be situated at two levels; at the cognitive and at the theoretical level. Cognitively, Popper examines how human knowledge as mental constructs grow and theoretically he illustrates how scientific theories progress. Cognitively, organism do not observe the world tabular raza but every observation is problem-laden and anticipations are betrayed by observation. This is growth of knowledge in the context of learning. There is growth in learning not only when we realise that our conjectures are false but why they are false. Popper thus affirms that: "we are always learning a whole host of things through falsification. We learn not only that a theory is wrong; we learn why it is false."[1097]

Popper also gives an evolutionary connotation to the progress of scientific theories. Science starts from problems and progresses through error-elimination of its hypotheses. That is: "The natural as well as the social sciences always start from problems, from the fact that something

[1094]Jememy Shearmur, Geoffrey Stokes and others, *The Cambridge Companion to Popper*, p. 147.
[1095]David Miller, *Popper's Selections*, Princeton – New Jersey, Princeton University Press, 1985, p. 171
[1096]*Idem*.
[1097]Karl Popper, *All Life Is Problem-Solving*, p. 13.

inspires amazement in us. To solve these problems sciences use fundamentally the same method that common sense employs, the method of trial and error."[1098]

Due to our fallibility and the erroneous nature of theories, the progress of science becomes an endless progress. Popper insists on this as he holds that; "in particular, is there a danger that the advancement of science will come to an end because science has completed its task? I hardly think so, thanks to the infinity of our ignorance."[1099] As an ardent critique of historicists theories, Popper asserts that science does not have a fixed pattern of progress. To him, there is no determinism in the historical and historic evolution of science. The history of science is simple the progress from one erroneous theory to other erroneous theories. We may talk of change in other disciplines that science is the rare human discipline that grows from the criticism of errors. That is:

> *Science is one of the few human – activities – perhaps the only one – in which errors are systematically criticised and fairly often, in time, correction. This is why we say that in science, we often learn from our mistakes and why we can speak clearly and sensibly about making progress there.*[1100]

Other discipline can talk of change but progress is possible only in science. Progress in science is revolutionary and not cumulative. The intensity of progress then is interpreted from the theory's power to resolve problems. The condition for change then is the ability of a new theory to resolve problems that the old theory did not. That is: "For the scientific method is not cumulative (as Bacon of Verulem and Sir Jeans taught); it is fundamentally revolutionary. Scientific progress consists in the replacement of earlier theories by later theories."[1101] A good example is the revolution from Newton to Einstein. Einstein theory resolve the problem of the motions of planets and macro-mechanics and thus exceeded and superseded Newton's Mechanics.

An indication of an instance of progress in science is thus problem. The old theories inability to solve problems costs its life and the new theories resolution asserts its scientificity. It is in this way that Popper asserts that: "science, as it appears in this logical sketch, in a phenomenon to be understood as perpetually growing. It is essentially dynamic, never something finished; there is no point at which it reaches it goal once and for all."[1102]

[1098] *Ibid.*, p. 3.
[1099] David Miller, *Popper's Selection*, p. 171.
[1100] *Ibid*., p. 172.
[1101] Karl Popper, *op.cit.*, p. 11.
[1102] Karl Popper, *All Life Is Problem-Solving*,, p. 15.

Progress is not only when the theory can no more solve problems for which it was construed but also when new problems arise that the theory is unconscious of or that it cannot solve. Popper gives a historical allusion to this other source of progress as he notes that: "I would argue that the progressive and dynamic character of the advance is much clearer if one compares the problems discovered by critics of Newtonian theory (Ernest Mach, for instance) by the problems discovered by critics of Einsteinian theory (mainly Einstein himself)."[1103]

The main issue Popper is faced with at this level is how to evaluate the degree of progress in the scientific practice. The first criterion to evaluate progress I the empirical criterion. This criterion even preceeds the testing of the theory. This criterion consists insubmitting a theory to crucial test. It is the empirical and logical content that permits us to evaluate its ability to be falsified, before proper testing. Thus, there is progress in a theory "provided it passes certain crucial tests. And it is thus (meta-scientific) knowledge which makes it possible to speak of progress in science, and of rational choice between theories"[1104] when a theory passes tests, it is thus selected and preferred to others. There is progress because the change from the old to the new theory is marked by the giving off of old conjectural knowledge and the acquisition of new conjectural knowledge. Popper refers to this as the criterion of relative because it varies from context to context depending on the problems and background knowledge. It is this: "relative potential satisfactoriness, or potential progressiveness which can be applied – to a theory even before we know whether it will turn out by the passing of some crucial tests, to be satisfactory in fact."[1105]

How then do we identify the degree of progress through relative satisfactoriness? Popper asserts that it is simple and intuitive. A theory that is logically stronger; that is, that which explains more and thus predicts more can be highly tested. With the greater explanatory strengths, it says more and thus has higher possibilities of being tested or falsified such a theory is preferred to rival theory due to its logical and empirical contents. It is not a criterion of probability since, probable theories say less while improbable or falsifiable theories say more. As such "the criterion of potential satisfactoriness is thus testability, or improbability: only a highly testable or improbable theory is worth testing."[1106]

[1103]*Ibid*., pp. 15-16.
[1104]David Miller, *Karl Popper's Selection*, p. 172.
[1105]*Ibid*., p. 173.
[1106] David Miller, *Karl Popper's Selection,* p. 176.

The history of science is thus a progress from less testable, probable and less falsifiable theories to more testable, improbable and highly testable theories. Popper situates this critical nature of scientific progress as he affirms that: "the theories of Kepler and Galeo were unified and superseded by Newton's logically and better testable theory, similarly. Frenel's and Fariday's by Marxwell's. Newton's theory and Marxwell's in turn, were unified and superseded by Einstein's."[1107]

Progress in the history of science then is realised in the move "towards a more informative and therefore logically less probable theory: towards a theory which was more severely tested because it made predictions which, in a purely logical sense, were more easily refuted."[1108]

Another way to evaluate progress in science is to compare the old and the new problems. Progress in science thus lies in the great devide between old and new problems. Popper asserts that, "Thus, if one compares the old with new problems, one sees the great distance, the great advance."[1109] This is the evolutionary criterion which evaluates how we learn from our errors. This evolutionary and critical nature of science also leads to discoveries. Some of these major discoveries in the history of science include; Galle that discovered Neptune, Hertz discovered electromagnetic waves Eddington's observation of the eclipse to confirm Einstein's prediction, and Elsasser's interpretation of Davisson's maxima in a way that it resembles the interference of De Broglie's waves. These discoveries advance knowledge in two ways. Firstly, they falsify previous theories in the same problem situation, giving us knowledge on why previous theories should be rejected. Secondly, they advance our knowledge from the new theories with their intrinsic problems. Popper thus summarises his view on the evolutionary view of the growth of knowledge as he insists that:

> *Perhaps event his picture of science – as a procedure whose rationally consists in the fact that we learn from our mistakes – is not quite good enough. Yet what I really wish to suggest is that science should be visualised as progressing from problems – to problems of even increasing depth.*[1110]

In the complex and whole situation of the scientific practice and research, progress in science has an unattainable aim. That is, the search for the truth. This end cannot be applied and that is why Popper talks of approximation to the truth. Faced with a problem situation, a scientist construes a theory that solves the greater number of problem that rival theories could not or

[1107] *Idem*.
[1108] *Idem*.
[1109] Karl Popper, *op.cit*., p. 16.
[1110] David Miller, *Popper's Selection*, p. 179.

develop a theory that can solve all problems in the problem-situation. Popper enunciates three conditions under which we can talk of progress in scientific theories.

The first condition for progress to be possible is simplicity. That is, "The new theory should proceed from some simple, new and powerful, unifying idea"[1111] concerning relations, facts or theoretical entities. This requirement appears polemic because of its purporting of the precedence of an idea over a theory. In his conjectural view of knowledge, Popper insisted that ideas and hypothesis are theories. It thus seems polemic when he again asserts that the condition of simplicity is judged from the nature of the theory arising from an idea. However, Popper acknowledges the limitation but insists that his focus is on the logical aspect of simplicity, which is testability.

The second requirement is thus testability. That is, the new theory should be capable of being tested in an independent way. That is, besides explaining the phenomena, the new theory, "must have new and testable consequences (preferably consequences of a new kind); it must lead to the prediction of phenomena which have not so far been observed."[1112] The essence of this requirement is to avoid the conventionalist twists of using ad hoc statements to save theories from falsification. By making bold and new predictions not implicit in the old theory, the new theory assumes the scientific status. Given the multiplicity of solutions and theories in the problem situation, the first requirement of simplicity and the second conditions of testability help to "restrict the range our choice among the possible solutions (many of them uninteresting) of the problem in hand."[1113] In the same way, when the bold and new predictions in the second requirement and made, "then our theory will represent a potential step forward, whatever the outcome of the new test will be."[1114]

It at this second level that we can talk of Popper's thesis of progress through overthrow with incorporation. There is incorporation because the new theory must solve the problems that the old theory could not explain before addressing new problems and making new ones. There is incorporation and overthrow due to, "the fact that it explains all the explicanda of the previous theory, and that, in addition, it gives rise to new tests."[1115] This leads to the third requirement which assess the revolutionary nexus of the theory. That is, "we require that the theory should pass some new, and sever, tests."[1116] Unlike Popper's insistence elsewhere that a scientists aim of testing a

[1111]Karl Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, p. 241.
[1112]*Idem*.
[1113]*Ibid*., p. 242.
[1114]Karl Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge*, p. 242.
[1115]*Idem*.
[1116]*Idem*.

theory is falsity it, he asserts in this third requirement on the contrary that a theory that assures progress should not be refuted so soon.

Unlike Kuhn for instance who thinks refutation shows the failure of a scientist, Popper thinks that refutation is an achievement for a scientist. It shows the scientific powers of a scientist to have created the experiment to contradict the theory. This shows that the third requirement is not sacrosanct because if a theory does not survive it, it is not considered as a complete failure. However, for science to progress, there is need for predictions to be corroborated in by experience. If we limit the progress of science just to the first two conditions, science will remain cumulative and not opened to change and success.

The third requirement of confirming successful prediction is important for three reasons. The first reason is that, "successful predictions – though they are not, of course sufficient conditions for the truth of a theory are therefore at necessary conditions for the truth"[1117] This holds effectively since truth to Popper plays a regulatory role. The second reason why we should aim at positive conformation of the theory is to realise the aim of science as the search for verisimilitude. That is, if we hope to get closer or nearer to the truth, then the aim should not only be to falsify a theory but we should also be "be anxious not only to reduce the falsity content of our theories but also to strengthen their truth content."[1118]

The third requirement for the growth of knowledge seems to contradict Popper's previous thesis. It is more of a confirmation criterion developed by Redolf Carnap. That is, Popper holds that: "first we require of a good theory that it should be successful in some of its new predictions; secondly we require that it is not refuted too soon."[1119] This to Popper does not mean that individuals should use individuals.

From the above, it is plausible that Popper's scientific rationality in every aspect gives an evolutionary approach to knowledge. At the level of the origin of knowledge and theories, Popper holds that organisms and humans face the world with the innate mechanisms of expectations and anticipations. Thus, theories and hypotheses are conjectural and they by nature are falsifiable. This is against the inductive approach which renders knowledge to be cumulative. At the level of the scientific methodology Popper proposed falsification. The aim of testing theories is to falsify and to confirm them. Even if theories survive on our corroborated, they are considered as tentative

[1117]*Ibid*., p. 246.
[1118]*Idem*.
[1119]Karl Popper, *Conjectures and Refutations*, p. 247.

truths. Truth thus plays a regulatory function. It is not attainable but it is the ideal towards which every theory aim at. What matters thus is verisimilitude or approximation to the truth. The degree of verisimilitude or approximation to the truth is only through testing. This renders essentially evolutionary. Thus, Popper's conception of the function of language enters into the evolutionary prism also. This is because the superior functions of language which are the descriptive and the argumentative permit the testing of theories and also intersubjective criticism. At the level of the view of the objectivity, Popper holds that the third world is the world of arguments and criticism and thus objects of world three can be evaluated and criticised. As such Popper grows the whole edifice of his epistemology pattern and thus evolutionary pattern and thus making scientific progress to be inevitable.

On the other hand, Popper thinks that even though the progress of science is supposed to be autonomous from individual influence, it has some obstacles that must be avoided. These obstacles can be classified under economic ideological types. In the first place, Popper notes that, "on the economic side, poverty may be an obstacle."[1120] The obstacle of poverty narrow the technical dispositions of scientific research and discoveries. On the other hand, too much money could also be an obstacle because "too many dollars may chase too few ideas."[1121]

At the level of ideological obstacles to the progress of science, Popper cites, "ideological or religious intolerance usually combined with dogmatism and lack of imagination."[1122] These obstacles do not imply the possibility of science. This is because when such ideological influence lead to suppression, the finality will be the positive influence on progress. In the mediaeval periods, the church had an ideological grip on the spirit of scientific progress. Inquisition committees were set to track down scientific ideas, discoveries and hypotheses that were antithetical to the religious hegemony. Great men of science like Giordano Bruno and Galileo were molested because of their attempt to put forth a strictly scientific outlook of existence. They might have been impressed, but Popper argued that "the martyrdom of Giordano Bruno and the trial of Galileo may have done more in the end for the progress of science than the inquisition could do against it."[1123]

Popper proposes tolerance to new ideas as the best way to overcome the attitude of setting obstacles on the path of scientific progress. In other word:

[1120]Karl Popper, *The Myth of Framework*, p. 13.
[1121]*Idem*.
[1122]*Ibid*., p. 14.
[1123]Karl Popper, *The Myth of Framework,* p. 14.

> *We should not only keep alternative theories alive by discussing them, but we should systematically look for new alternative. And we should be worried whenever there are no alternatives whenever a dominant theory becomes too exclusive. The danger to progress in science is much increased if the theory in question obtain something like a monopoly.*[1124]

This monopoly can make a theory assume a status of "an intellectual fashion, a substitute for religion, an entrenched ideology."[1125] Popper, uses the examples of the Copernican and Darwinean revolutions to differentiate between scientific and ideological revolutions. This distinction is important because scientific revolutions can create ideologies which do not only appeal to the public but does seduce scientists and can obstruct scientific progress. In this distinction Popper asserts that: "The Copernican and Darwinean revolutions were ideological in so far as they changed man's view of his place in the universe. They clearly were scientific in so far as each of them overthrew a dominant scientific theory, a dominant astrological theory and a dominant biological theory."[1126]

The clash of the two theories with the religious outlook of existence was certainly unavoidable but such clash should be considered ideological and not scientific. This is because in examining the scientific theory hood of the two theories, the ideological clash play certainly no role. The ideological revolutions which proceed from scientific revolutions can be given a rational tag but that is simply contingent and arbitrary. This is because, "while we have a logical criterion of progress in science and thus of rationality – we do not seem to have anything like the general criterion of progress or of rationality outside science."[1127]

However, a good number of theories in the history of science initiated revolutions but had no concessions to ideological tendencies. Some of these include the revolutions of Faraday and Maxwell that overthrew Newton's dogma of central forces, J. J. Thomson's discovery of election that overthrew the theory of the individuality of atom among others. Popper insists on the distinction between scientific and ideological revolutions so as to guard scientific progress from the influence of ideological tendencies.

[1124] *Ibid*., p. 16.
[1125] *Idem.*
[1126] *Ibid*., p. 17.
[1127] Karl Popper, *The Myth of Framework,* p. 18.

8.1.2. The Negativist Spirit as the Immunisation of Science against Anti-science and Irrationalism

As evoked under the critics of Popper, postmodernism, spearheaded by Edgar Morin and Feyerabend on the epistemological plan, rejects the methodological monism that goes with the advocate of pure science like Karl Popper. The relaxation of the rigour of scientific methodology stems from Thomas Kuhn's cumulative view of normal science. The attitude of normal scientist is to work for the expansion and application for the paradigm. Even at the first crisis moment, there is resistance and the adoption of the paradigm is not more on any reason but on the nostalgia of its pass successes. Feyerabend takes the issue further by dismissing the attempt for force science into the prism of a single method. He considers it as a form of scientific naivety as he holds that:

> *It is clear, then, that the idea of a fixed method or a fixed theory of rationality, rest on two naïve a view of man and his social surroundings. To those who look at the rich material provided by history, and who are not intent on impoverishing it in order to please their lower instincts, their craving for intellectual security in the form of clarity, precision, objectivity, "truth" it will become clear that there is only one principle that can be defended under all circumstances, and in all stages of human development. It is the principle: Anything goes.*[1128]

The methodological pluralism and epistemological anarchism defended by Feyerabend implies that science is not the only approach to knowledge and that even if science is the most dominant intellectual form, it cannot narrowed into a unique method or judge using a unique standard. In the absence of a universal or most acceptable definition of science, it loses its status and equally risks extinction.

The postmodenist critique also dethrones science from its epistemological hegemony and also weakens the rationality that goes with the scientific enterprise. It is in developing this, that Edger Morin criticises the three main pillars that assured the hegemony of modern science. He notes that: *« la pensée scientifique classique s'est édifiée sur trois piliers que sont, 'l'ordre', la 'séparabilité', la 'raison'. »*[1129] The necessity of order to him was due to the need to give a unifying and synthetic connotation to the plurality that comprises nature. This needs for order then culminated to scientific determinism and the explanation using order. However, this order is challenged by the disorder in modern scientific innotations in thermodynamics, microphysics, cosmo-physics and physics of chaos. In the postmodern view of the complexity of knowledge,

[1128]Paul Feyerabend, *Against Method*, pp. 18-19.
[1129] Edgar Morin and Jean-Louis Le Moigne, *L'intelligence de La Complexité*, Paris, l'Hamattan, 1999, p. 318, "The Classical Scientific thought is Based on Three Pillars which are "Order", "Separability" and "Reason"; (my translation).

then there is an indusive treatment of the order and disorder of the reality. Edger Morin in this way affirms that:

> *« Les idées l'ordre, et de désordre cessent de s'exclure absolument l'une l'autre : d'une part en ordre organisationnel peut naitre dans des conditions voisines de la turbulence, d'autre part de processus désordonnés peuvent naitre à partir d'état initiaux déterministes. »*[1130]

In complex thought that characterises postmodernism, there is the reconciliation of order and disorder. That is, the chaos and determinism unfold in an inclusive way. There is thus no specialisation or separability and also there is a reconciliation of the disjunction between the observer and the reality. Edgar Morin makes a historical reference to Heisenberg's interpretation of microphysics where the observer interfers observation in an active way. The question of legitimation, decidability, justification and methodology that assures the hegemony and autonomy of science from other disciplines is rendered futile. There is a reconciliation of all forms of knowledge, both the scientific and the non-scientific.

The futility of the logic of distinction between science and non-science cultiminates to Edgar Morin's advocacy for the abandonment of methodological monism. Highlighting on the limitations of the different logical methods of science, by referring to Popper who criticise inductive inferences and Godel's theory of incomplitude that elucidates the limitations of deductive inference, Edgar Morin asserts that: *« La pensée complexe appelle non l'abandon de cette logique mais une combination dialogique entre son utilisation segments par segments et sa transgression dans les trous noirs où elle cesse d'être opérationelle. »*[1131]

This implies that science should not in itself draw the principle of the legitimacy of non-scientific domains of knowledge. This view of Edgar Morin was already developed by Friedrich Nietzsche in his notion of nihilism as the devaluation of ideas. To Nietzche, a standard or a method is just part of the whole and it should not be used to evaluate the whole. He asserts that: "For in this cause nothing exist in isolation: the smallest things bear the greatest, upon your wrongful act

[1130]*Ibid*., p. 319. "The ideas of order and disorder cease to absolutely exclude each other: On one part, an organisational order can be born in the neighbouring turbulences and on the other hand, the processes of disorders can be born from the initial determinist states"; (my translation).
[1131]Edgar Morin and Jean-Louis Le Moigne*, L'intelligence de La Complexité,* p. 322. "Complex thought does not call for a dialogical combination between its segments by segments use and its transgression in the black holes where they cease being operational"; (my translation).

stands the entire structure of the future, every critique of the smallest thing also condemns the whole."[1132]

This complexity of knowledge renders science to be just one among many narratives in the post-industrial age. Science in the post-industrial age is in the hands of the states. This is the view defended by Jean-Francois's Lyotard who presents postmodern science as an object of exchange and has more of economic value and has thus lost its intrinsic value. He affirms that in the post industrial age: "knowledge is and will be produce in order to be sold, it is and will be consumed in order to be valorised in a new production: in both cases, the goal is exchange. Knowledge ceases to be an end in itself, it loses its cause-value."[1133]

Lyotard thus notes that the fight to control information in the future will be as rude as the fight for the control of territories during the age of imperialism. The proof today is on the question of who controls computerised knowledge and telematics. In cybernetics, information is in the hands of corporate bodies and on telematics there is a serious problem of who controls satellite information. Science to Lyotard is just one among many discourses. Discourse in the postmodern age plays functions like Wittgenstein's language games. About language, Lyotard makes the following remarks:

> *The first is that their rules do not carry within themselves their own legitimation, but are the object of a contract, explicit or not, between players (which is not to say that the players invent the rules). The second is that if there are no rules, there is no game, that even an infinitesimal modification of one rule alters the nature of the game, that a "move" or utterance that does not satisfy the rules does not belong to the game they define. The third remark is suggested by what has just been said: every utterance should be thought as a "move" in a game.*[1134]

Science is then a form of language game and has its own specific and definite rules that apply therein and should not be used to judge other forms of language and thought. Thus, Lyotard stipulates that: "Knowledge (savoir) in general cannot be reduced to science nor even learning (connaissance). Science is a subset of learning."[1135] It is thus wrong to give science a paradigmatic status of legitimate knowledge.

[1132]Friedrich Nietzsche, *The will to power* (1901), trans. Walter Kaumann and R. J. Hollingdale, New York, Vintage Books, 1968, p. 180.
[1133]Jean-Francois Lyotard, *A Postmodern Condition: A Report On Knowledge*, pp. 4-5.
[1134]Jean-Francois Lyotard, *A Postmodern Condition: A Report On Knowledge,* p. 10.
[1135]*Ibid*., p. 18.

This postmodern critique has provoked a contemporary anti-scientific trend that has declared the death of science. That is, science as pure, independent discipline has lost its hegemony. This is the view of Andrew Holster who uses the premise of the capitalist control of science today to announce the death of science. He thus affirms that: "while technology runs rampant today transforming our physical and social world, beyond recognition, the creative vocation of scientist and institution of science that originally produced the platform for the technology are in a death-spirit."[1136]

In the post-industrial world, the neutrality and autonomy of science is claimed to have been thwarted by; "bureaucratised organisation of state control capitalist society. Science is fatally corrupted by forces that flourish in this mode of organisation."[1137] Thus, the rationality, neutrality and autonomy of science are engulfed by capitalists forces like power politics, intellectual mediocrity, mass propaganda, ambition and greed. Andrew Holster makes this observation and proceeds to the conclusion that:

> *Science itself is forgotten, and our scientific institutions are converted into industrial-bureaucratic corporates, dominated by swarms of technologies and managers of most mediocre scientific ability. In the main time, the real scientists, the rare creative talents intents on science as a form of intellectual discovery, have left the building.*[1138]

There are two sources of the death of science according to Andrew Holster. They are the intellectual and the pragmatic forces. The intellectual cause is based on the corruption of the ideals of science and the pragmatic aspect is the rise of technology which has led to less consideration of science. Science is not only given less consideration but it is subdued to the control of corporal bodies. This is the same argument developed by Gunther S. Stout whose observation lead him to the conclusion that science today is an economic good in the hands of advanced industrialised societies. The post-industrial age according to Gunther is marked by science's completion of its objectives. Science has provided solutions to almost all human needs. Gunther S. Steut in this way asserts that:

> *But as the quest for dominion over hostile nature is nearing its goals, as technological advances made possible by the application of the results of scientific research vanquish*

[1136]Andrew Holster, *The Death of Science, A Comparison Study To Martin Lopez Corredoira's The Twilight Of Scientific Age*, Florida, Universal Publishers, 2016, p. 1.
[1137]*Idem.*
[1138]*Ibid*., p. 2.

all threats posed to human survival by hunger, cold, and diseases. Further scientific research appears of ever-decreasing utility.[1139]

Another argument tabled against science is developed by John Horgan. According to him, the very limitation of knowledge supposes the weakness of science. Scientist to him do not always approach the reality using rationality or a widely acceptable methodology. They are also motivated and influenced by their irrational tendencies. That is, he asserts that: "It has become a truism by now that scientists are not mere knowledge-acquisition machines; they are guided by emotion and intuition as well by cold reason and calculation."[1140]

Limitation to knowledge are not only from human irrational tendencies but also from systemic forces. He thus notes that: "the scientific enterprise is threatened by technophobes, animal right activists, religious fundamentalists, and, most important, stingy politicians. Social, political and economic constraints will make it more difficult to practice science, and pure science in particular, in the future."[1141]

The third limitation to knowledge are from the science itself. Every scientific discipline always sets limit in its attempt to understand the real. He quotes four of those theories in the history of science which in an attempt to define the way of studying the real effectively, ends up by limiting itself from knowing the real. They include:

Einstein is theory of special relativity prohibits the transmission of matter or even information at speeds faster than light; quantum mechanics dictates that our knowledge of the microrealm will always be uncertain; chaos theory confirms that even without quantum indeterminacy many phenomena would be impossible to predict; Kurl Gödel's incompleteness theorem denies us the possibility of constructing a complete, consistent mathematiced description of reality. And evolutionary biology keeps reminding us that we are animals, designed by natural selection not for discovering truths of nature, but for breading.[1142]

With the above elucidations of the limitations of science has rendered the above proponents of antiscience to advocate for the death of science. The declaration of science is accompanied by the defends of the irrational basis of the management and control of scientific knowledge today.

[1139]Gunther S. Stout, *The Coming Of The Golden Age, A View Of The End of Progress*, New York, National History Press, 1969, p. 110.
[1140]John Horgan, *The End Of Science; Facing The Limits In The Twilight of The Scientific Age*, New York, Perseus Books Groups, 2015, p. xxix.
[1141]*Ibid.*, pp. xxix-xxx.
[1142]John Horgan, *The End of Science; Facing The Limits In The Twilight Of The Scientific Age* p. xxx.

Some of these irrational bases defended by anti-scientist include greed, the quest for power, capital, the state and corporate organisations.

The only way to rescue science from such post-industrial and post-modern attempts to destroy the hegemony of science is to develop an effective scientific mind. Given the highly criticised spirit of positivism, science can resist irrational predatory forces if it adopts the negativist scientific mind developed by Gaston Bachelard and Karl Popper. It is thus important to highlight the scientific qualities defended by Bachelard and Popper that can enhance the survival of science in the post-industrial world.

Gaston Bachelard and Karl Popper develop a negative scientific mind. This refers to the disposition which consist in rejecting authority and in rectifying scientific theories. This negative scientific spirit is defined by Gregory J. Feist, who holds that: "Perhaps, the most essential of these is ability and disposition to reject ideas that are based on authority. Science and the scientific attitude begin where dogmatism and adherence to ideas based on authority end."[1143]

The negative scientific mind is thus based on knowing through error elimination because, "it is knowing what one does not know that is the driving force before experimental investigation."[1144] This is the same view level by Gaston Bachelard who thinks that the psychology of knowledge can be better understood in terms of continuous resolution of obstacles. That is: "When we start looking for the psychological conditions in which scientific progress is made, we are soon convinced that the problem of scientific knowledge must be posed in terms of obstacles."[1145]

These obstacles are not external to science given the autonomy of science from external forces. The obstacles of science are intrinsic in its very nature and neither arise from systemic orders nor do they arise from the complexity of real as postmodern thinkers hold. Thus, to think of scientific obstacles, in terms of external systemic threat is to miss the point, for, "it is at the very heart of the act of cognition that, by some kind of functional necessity, sluggishness and disturbances arise."[1146]

To do science to Bachelard is to recognise scientific knowledge as essentially fallible in nature. Thus, "knowledge of a reality is a light that always cases a shadow in some nook or cranny.

[1143]Gregory J. Feist, *Origin of The Scientific Mind*, New Haven-London, Yale University Press, 2006, p. 214.
[1144]*Ibid.*, p. 215.
[1145]Gaston Bachelard, *The Formation of The Scientific Mind, A Contribution To A Psycho-Analysis Of Objective Knowledge*, (1938), trans. Mary Mc Allester Jones, Manchester, Clinamen Press, 2002, p. 23.
[1146]Gaston Bachelard, *The Formation of The Scientific Mind, A Contribution To A Psycho-Analysis of Objective Knowledge*, p. 24.

It is never immediate, never complete."[1147] In the French version of the text, the expression is very explicit *« La connaissance du réel est une lumière qui projette toujours quelque part des ombres. »*[1148] Knowledge science is not thus cumulative for to know is to break away with previously held knowledge. That is, "we know against previous knowledge when, we destroy knowledge that was badly held made and surmount all those obstacles to spiritualisation that lie in the mind itself."[1149] The scientific mind is not then a product of confirmatory instances but it is entangled in the web of its own errors.

The scientific mind is essentially revolutional because it constantly breaks away with the past. A science that is cumulative and build on confirmative positive spirit is simply a system of opinion and this is irrational because, "opinion thinks badly. It does not think but instead, translates need to knowledge."[1150] Opinion becomes the first epistemological obstacle to overcome and thus, "The scientific mind forbids us to have an opinion on questions we do not understand and cannot be formulated clearly."[1151] Scientific knowledge should not then be given the same status among other forms of narratives because of the rationality of the scientific mind. The scientific mind to Bachelard is, "very old, infact, as old as its prejudices when we enter the realm of science, we grow younger in mind and spirit and we submit to sudden mutations that contradicts the past."[1152]

The fallibility of the scientific mind influences Bachelard to stipulate that the true mark of the scientific mind is to identify and pose problem. He reiterates that, "it is indeed this sense of problem that marks out the true scientific mind."[1153] Thus, every knowledge in science is properly a response to specific questions and problems. Knowing in science is not to dominate as the post-industrial critique of modernity claims but knowledge is needed for the resolution of problems of the theoretic and cognitive order. Bachelard in the same way asserts that; "to sum up, the scientific mind may make us desire to know, but this from the first is so that we may ask better question."[1154] A sound scientific education requires that learners be stimulated to break away with previously held knoweldge and to dispose themselves of the problem-solving attitude. This is thus an address to the cumulative systems of today in which there is the computerisation and treatment of

[1147] *Idem*.
[1148] Gaston Bachelard, *La Formation De L'ésprit Scientifique* (1938), 6e éd., Paris, Librairié philosophique, 1967, p. 16 ; "Knowledge of the real is light that always projects darkness somewhere"; (my translation).
[1149] Gaston Bachelard; op.cit., p. 24.
[1150] *Ibid*., p. 25.
[1151] *Idem.*
[1152] *Idem.*
[1153] *Idem.*
[1154] Gaston Bachelard, *The Formation of The Scientific Mind, A Contribution To A Psycho-Analysis of Objective Knowledge,* p. 27.

knowledge as pierces of information. Unlike the post-modern capitalist culture, Bachelard advocates for a revolutional scientific culture as he asserts that: "we must put scientific culture on the alert so that it is always ready to move, we must replace closed, static knowledge that is open and dynamic and dialectise all experimental variables."[1155]

If the first mark of the scientific mind is the identification of problem, then the second specification to Bachelard is the confession of human fallibility. This confession has to be intra-personal with the awareness of personal epistemic limitations and interpersonal of one's limitations in our interaction with one another. There is then no general certainty. Certain is special and the dictum of critical discussion and scientific rationality to Bachelard is in the positive consideration of error. He holds that, "and let us in our turn, in our wholehearted devotion to the intellectual life, utter these words: You, error, are not an evil."[1156] Errors in science are not symptoms of weakness but stimulus for the continuous development and survival of science. Gaston Bachelard thus identifies two qualities of the scientific minds, rationalism and realism. Rationalism consists in the continuous rectification of our knowledge and realism consist in the recognition of the external world. He thus concludes that: "science is a product that conforms to both the laws of thought and the outside world."[1157]

Karl Popper takes after Gaston Bachelard to define the attitude that are necessary for the promotion and survival of science. Besides Bachelard's examination of rationalism and realism as qualities of the scientific mind Popper also treats objectivity and openness as a necessary determination of a scientific enterprise. The necessary pillars for the survival of science to Popper are; rationalism, openness, realism and objectivism.

Even though critical rationalism has been examined under the argumentative function of language, it is a question of opposing rationalism to irrationalism and elucidating the advantages rationalism has over irrationalism in the elaboration of scientific theories. Rationalism to Popper as the quality of the scientific mind should not be mistaken with Plato's and Descartes' view of rationalism as the recognition of the generic connotation of reason. Rationalism in science is more than viewing humans as having the ability to think. Having reason does not implies rationality as, "clever men may be very unreasonable; they may cling to their prejudices and many may not

[1155]*Ibid.,* p. 29.
[1156]*Ibid.,* p. 241.
[1157]Gaston Bachelard, *The New Scientific Spirit* (1934), trans. Arthur Goldammer, Boston, Beacon Press, 1984, p. 2.

expect to hear anything worthwhile from others."[1158] Rationality as a precondition for science then is not judged from individual's possession of a faculty. There are no degrees of reasoning and also, there is no paradigmatic reasonableness. Any attempt to set the fixed rules that we must conform to, in other to be evaluated as rational, leads instead to authoritarianism. Thus, "according to our view, however, we not only owe our reason to others; but we can never excel others in our reasonableness to a degree that would establish a claim to authority."[1159] Rationalism of science to Popper just like to Gaston Bachelard is equivalence to the recognition of our fallibility and in the constant commitment into criticism. This thus is discursive and not dispositional rationality.

Popper's view of the rationality of science shows that the post-modernist critique of his methodology as a monistic limitation of science from progressing should be considered as an arguable position. This is because rationalism of Popper excludes every claim to heuristic or theoretical authority. The freedom of thinking, the recognition of fallibilism and the giving up on untenable ideas and theories, places Popper above the postmodernist methodological anarchism. Popper is not against social institutions censure of science as Feyerabend claims but those institutions that have any relation with the scientific practice of a period should be those which favour the freedom of thought and promote rational discussion. The theoretical pre-emission of Popper's rational discussion over the postmodernist anarchism and antiscientism is that while the former sets the grounds for scientific progress and preserves science, the latter sets the basis of prediction and kills the scientific spirit. Popper thus affirms that: "reason, like science, grows by way of mutual criticism; the only way of 'planning' its growth is to develop those institutions that safeguard the freedom of this criticism, that is, the freedom of thought."[1160]

Popper then proceeds to unveil the limitations of irrationalism and the dangers of grounding science on it. Irrationalism in this context does not means wrong reasoning but the act of basing science on non-rational grounds. Popper notes that, "the irrationalist will insist that 'human nature' is in the main not rational."[1161] To them, man is either lesser than being rational or he is determined by other trials that are not rational. The proof that the irrationalists use to defend the fact that man is lesser than being rational is the claim that only few men open up for criticism. Man is more than being rational because he is determined by other irrational forces such as emotions and passions which more often override the sense of rationality. They equally claim that the choice of rationality

[1158]Karl Popper, *The Open Society and Its Enemies*, vol. 2, *The High Tide Of Prophecy: Hegel, Marx And The After Math,* London, Routledge, 1947, p. 214.
[1159]*Idem*.
[1160]*Idem*.
[1161]Karl Popper, *The Open Society and Its Enemies,* p. 215.

is irrational and not rational because adopting criticism is a matter of affection for it. Some of the irrationalist even argue that creativity which is the driving force of science is irrational and mystical. This is the view of the Cameroonian philosopher; Meinrab Hebga who defends a possibility of a rational discourse on the paranormal phenomena. Hebga holds that: *« Si l'on parvient ainsi à établir la rationalité d'un discours africain sur les phénomènes paranormaux, alors ce discours, contrairement à l'opinion de la grand majorité des occidentaux et des Africains occidentalisés, ne baigne point dans l'irrationnel »*[1162]

The regionalistion of rationality to Hebga is seemingly a rational approach to life. Such groundings of rationality on non-rational bases constitutes but irrationality to Popper. Despite the claims of irrationalism, Popper advances the arguments to justify the pre-eminence of rationalism over irrationalism in science. The first point is that excess rationalism is better than excess irrationalism. Excessive irrationalism cannot be moderated but excess rationalism can be moderated. In the face of excessive rationalism, Popper asserts that, "a modest and self-critical rationalism which recognises certain limitations"[1163] should be adopted.

Popper distinguishes between critical rationalism which recognises limitation and fallibilism and uncritical or comprehensive rationalism. Comprehensive rationalism consists in asserting that, "I am not prepared to accept anything that cannot be defended by the means of argument or experience."[1164] This is a self-destructive principle because by claiming that we should not accept anything which is not defended by experience or argument, we nullify the very principle that we are enunciating. The principle itself is destroyed, "for since it cannot in it turn, be supported by argument or by experience, it implies that it should itself be discarded."[1165] Popper thus agrees with methodological anarchists that dogmatism plays a role in the start of the scientific procedure but it is later superseded by criticism. He thus asserts that, "Since all arguments must proceed from assumptions, it is plainly impossible to demand that all assumptions should be based on arguments."[1166] Thus criticism is impossible without assumptions and the claim that we can proceed without assumption is also an assumption. Therefore, our acceptance of rationality is simply due to, "an irrational faith in reason."[1167] Rationalism then is neither comprehensible

[1162]Meinrab Hebga, *La Rationalité d'un Discours Africain sur les Phénomènes Paranormaux*, p. 30. "if we succeed to establish the rationality of an african discourse on the paranormal phenomena, then this discourse, contrarily contrary to the opinions of the great majority of western and westernised africans is not grounded on irrationality"; (my Translation).
[1163]Karl Popper, *op.cit*., p. 217.
[1164]*Idem*.
[1165]*Idem*.
[1166]Karl Popper, *The Open Society and Its Enemies* p. 218.
[1167]*Idem.*

neither, is it self-contained. Given that assumptions and dogmas constitute the starting point of every rational discussion, Popper affirms that, "irrationalism is logically superior to uncritical rationalism."[1168] Thus, comprehensive rationalism is thus destructive in the practice of science. Popper prefers critical rationalism which is based on an uncritical and irrational faith in reason. This is rationalism "which frankly admits its limitations and its basis is an irrational decision, and in so far, a certain priority of irrationalism."[1169] Such rationalism is important because it determines and moderate our relationship with other men and the society and it equally realises the ambition of the unity of mankind. Irrationalism on the other hand, defended by postmodernist thinkers is prioritised emotions over reason and this is wrong because it can "lead to an appeal to violence and brutal force as the ultimate arbiter in dispute."[1170]

The equality par excellence of the scientific spirit is thus critical rationalism. From the profession of our fallibility and the adoption of interpersonal criticism, we render science to be a ceaselessly active enterprise that will never come to the end of its objectives as some antiscientists claim. In this line of reflection, Popper asserts that, "I may be wrong and you may be right, and by an effort we may get nearer to the truth is closely akin to a scientific attitude."[1171]

This notion of rationality is epitomised in the context of testing theories by falsification. Theories are not developed to be confirmed but to be falsified. This rationalism is closely related to the second quality of the scientific mind, which is the search for objectivity. This objectivity in methodology holds that, "nobody should be his own judge, it suggests the idea of impartiality."[1172] Personal opinions or belief do not matter in the context of criticism and thus, "objectivity is based, in brief, upon mutual rational criticism, upon the critical approach, the critical tradition."[1173] This criticism is the argumentative function of language and it is exercised on objective knowledge; that is autonomous knowledge that inhabit world three.

The third quality of the scientific quality is openness. This is an anti-cumulative attitude which views science as a dynamic and an open system. The crux of Popper's argument for the openness of science is that the latter proceeds from problems to problems. The basic hypothesis of this argument is that the scientist does not always start from observation. In most cases, science starts from problems which arise at two levels; other from "practical problems or from a theory

[1168] *Idem.*
[1169] *Idem.*
[1170] *Ibid.*, p. 221.
[1171] *Ibid.*, p. 224.
[1172] *Idem.*
[1173] Karl Popper, *The Myth of Framework*, p. 70.

which has run into difficulties – that is to say, a theory which has raised, and disappointed certain expectations."[1174] This is contrary to the position of the advocates of post-industrial science like Gunther S. Stoutt, who claims that we are now in an age where science has resolved almost all its silent problems. Just like Bachelard, Popper insists that: "even the best solutions – those able to resist the most severe criticism of the most brilliant and ingenious minds – soon give rise to new difficulties, to new problems."[1175] It is the positivist claim that the construction of theories always start from observation that has influenced post-industrial thinkers to declare the death of pure science. To Popper, science does not only start from problems but it also aims at understanding problems. This understanding is not done through the development of perfect theories as it is " by producing a very inadequate solution, and by criticising this inadequate solution, only in this way can we understand the problem."[1176] To understand a scientific problem then is not to produce the best solution but to understand the reason why it cannot be easily soluble. Understanding thus means having reason for the untenability of existing solutions and this should not be interpreted as scepticism for it improves on the quality of the solutions. The more we work on the problem, the more we come to understand the intrigues, the complexity and the ramifications of the problem. The openness of science is thus guaranteed by understanding theories in the light of problems for which they were developed. Popper thus proposes commitment to the ceaseless resolution of problems as the true quality of the scientific mind. It is in this way that, the affirms that: "Thus, like science itself, which begins and ends with problems and progresses through wrestling with them, the individual scientist should also begin and end with his problems and wrestle with it."[1177]

Popper gives two reasons why we should understand science as proceeding from problems to problems. Besides the limitations of induction as a negative reason, the first reason is that, "our knowledge is vast"[1178] and the second reason is that, "our ignorance is boundless and overwhelming."[1179] Every instance of knowledge reveals our ignorance of the subject matter in question. The conflict between and our fallibility is important because it leads to the growth of knowledge. Each scientific theory then should be considered as an attempt to solve a problem. Considering science as a body of accepted theories as Bacon and Max Plank claim is " utterly mistaken, and a residue of the dream of authoritarian science.[1180] Thus, Popper summarises the

[1174]Karl Popper, *The Myth of Framework,* p. 96.
[1175]*Idem*.
[1176]*Idem*.
[1177]*Ibid*., pp. 99-100.
[1178]Karl Popper,*The Myth of Framework*., p. 100.
[1179]*Idem.*
[1180]*Ibid*., p. 101.

quality of the openness of science in three words problems – theories – criticism. I believe in these three words the whole procedure of rational science may be summed up."[1181] The openness of science thus saves it from the claims of its death on grounds that it has resolved all its problems for what it was designed. Popper concludes this by affirming that:

> *On the contrary, it is mainly concerned, with criticising it. It regards or should regard, the over throw of even tis most admirable and beautiful theories as a triumph, an advance for we cannot overthrow a good theory without learning an immense amount from it and its failure. As always, we learn from our mistakes.*[1182]

The forth quality of the scientific mind is realism. At the metaphysical level, it defends a mind independent reality. This saves science from the antiscientific forces of the post-modern period because it situates science as an attempt to understand nature. The scientific theories then should not be subjected to systemic forces such as corporate organisations but it should be a midway between the scientist and the reality. At the epistemological level, Popper's realism claims the possibility of the attainment of truth and this is important because it saves science from anarchism.

8.2. THE IMPLICATIONS OF POPPER'S REVALORISATION OF METAPHYSICS

Popper's defence of the importance of metaphysics in science has a great impact on the relationship between philosophy and science. It is a challenge to define new frontiers between science and philosophy. Against scientist naturalism which denies the automou existence of metaphysics and philosophy, we will propose compartibilist naturalism. Such naturalism has the merit of recognising the autonomous existence of science and metaphysics but also defends the view that science and metaphysics influence each other. We will thus examine how science and philosophy influence each other so as to end up with the proposal of an epistemology of interdisciplinarity. Such epistemology condems excessive specialisation in philosophy and demands for an interdisciplinary approach in understanding the real.

8.2.1. Compatibilist Naturalism: The New Frontiers between Science and Philosophy

Popper's revalorisation of metaphysics calls for a re-examination of the relationship between philosophy and science. This is not only because metaphysics, understood as first philosophy plays

[1181] *Ibid*., p. 100.
[1182] *Ibid*., p. 103.

an important role in science but also because he insists that in demarcating between science and metaphysics, "we must not draw the line too sharply. This becomes clear if we remember that most of our scientific theories originate in myths."[1183] Popper's defence of the importance of metaphysics to science is also a great challenge to naturalism, which from the 17th century up to the 21st century has attempted to impose the scientific methods of investigation to philosophy. This does not only challenge philosophy as an autonomous independent discipline but it also displaces it from the central position given by classical epistemologists. In preface to his principles of philosophy, Descartes gives an encyclopaedic connotation to philosophy as he holds that: "Thus, philosophy as a whole is like a tree, of which the roots are metaphysics, the trunk is physics, and the branches emerging from the trunk are all the other branches of knowledge. These branches can be reduced to three principal ones, namely medicine, mechanics and ethics."[1184]

In the modern times, inductive tradition, beginning with Bacon, (1526-1626) natural philosophy became science of the practical and experimental order. Bacon did not only develop a new organism for the inductive appreciation of the world, but he also rejected the scholastic appreciation of the ancient Greek speculative philosophy which blinded them from making an objective and direct reading of the book of nature. John Locke (1632 – 1704) restricted knowledge to two types of experience; sensation and reflection and equally developed salient arguments against the innate ideas. David Hume (1711 – 1776) equally rejected the logical justification of causality and the 18th century. This empirical and inductive tradition in the 19th century took the form of positivism defended by Auguste Comte (1898 – 1857), to whom verification through direct observation was the method par excellence of knowledge.

The inductive method, developed from the 17th to the 19th century caused the separation of science from philosophy and most philosophers adopted the scientific approach as the model for evaluating the legitimacy of philosophical theories. That is why from the 18th century empiricism to the 20th century logical positivism, there was an increasing "praise for science and methods merged with a critique of traditional/scholastic philosophy (generally labelled metaphysics) as based on the improper use of language."[1185] In the first half of the 20th century, the logical positivists and specifically first Wittgenstein, refers to as nonsense and to philosophical problems as problems of the misuse of language. This was the peak of naturalism. Naturalism is, " the view

[1183]Karl Popper, *Conjectures and Refutations*, p. 257.
[1184]Rene Descartes, *Principles of Philosophy* trans. Valentine Rodger and Reese P. Miller, Dordrecht, Kluweit Academic Publishers, 1982, p. xxiv.
[1185]Matteo Morganti, *Combining Science and Metaphysics*, New York, Palgrave Macmillan, 2013, p. 2.

that philosophy must be continuous with the sciences and there is no first 'philosophy'".[1186] Thus, abstract speculative philosophical edifices such as those of Kant and Hegel should be replaced by philosophy which is, "a reflection on our best knowledge of reality, which is not based on armchair speculation but rather, on the experience-based methodology distinctive of the sciences."[1187]

Naturalism in the contemporary philosophy of science goes beyond prescribing the scientific method to philosophy to demanding that science should teach her own philosophy. That is, that philosophy of science should be the affair of scientists and not philosophers. However, Paul Horwich reduces the pluralistic approaches to contemporary naturalism into five theses. The first thesis is anti-super naturalism. This thesis holds that science is restricted to space-time relations and facts. The second thesis is metaphysical naturalism which holds that: "everything that exists is located within the spacio-temporal, causal domain."[1188] The third thesis is epistemological naturalism which holds that acceptable knowledge can only be gotten through the usage of the scientific method. The fourth approach is reductive naturalism states that exists is of the spacio-temporal, temporal order and it is made up of relatively small units of entities. The fifth approach is physicalistic naturalism which holds that the basic units that made up the reality are are physical realities.

The five approaches to naturalism by Paul Horwich, express naturalism as a form of scientism. It claims that every rational and acceptable belief can only arise from the scientific method. This scientist naturalism is defended also by Issoufou Soulé Mouchili Njimom who holds that not only should science be the only legitimate source of wellbeing to man but it should also determine the type of philosophy that is useful in our contemporary world. After acknowledging that physics and hard sciences are well placed to answer the question of the significance or meaning of life, Issoufou Soulé Mouchili Njimom in a scientist naturalist tone asserts that:

> *« On a l'impression que la philosophie, dans sa form classique, pourrait ne plus avoir de pertinence si elle ne tient pas compte des informations que nous livrent les sciences sur le reél. Et comme un peut remarquer aujourd'hui, elle est entrain de réusir, de l'intérieur, à faire sa propre mutations épistemologique*. »[1189]

[1186]*Ibid*., p. 4.
[1187]*Idem.*
[1188]Bana Bashour, Hans. D. Mullar, Alexander Rosenberg and others, *Contemporary Philosophical Naturalism And Its Implication*, New York – London, Routledge, 2014, p. 38.
[1189]Issoufou Soulé Mouchili Njimom, *op.cit*., p. 7. "We have the impression that philosoph in its classical form could not stil have its pertinence if it does not take the information that the sciences give on the real into consideration. And as we can remark today, it is succeeding to make its proper mutations in the interior"; (my translation).

Such scientist naturalism does not only reject any metaphysical influence on science but also attempts to remove all forms of apriori determinations of philosophical reasoning. In this light, Issoufou Soulé Mouchili Njimom still insists that: *« En philosphie, on ne peut plus fonder sa pensée sur des principes apriori affirmé par une raison autosuffisante »*[1190]. Thus, there is neither apriori Knowledge nor is there any first philosophy. Such epistemological approach seems destructive to the autonomy of philosophy. It insists that: "tools we should use answering philosophical problems are the methods and findings of nature sciences-from physics across to biology and increasingly neuroscience. It enables us to rule out answers to philosophical question that are incompatible with scientific findings."[1191]

Such approach implies that philosophy has no content of its own. Questions that are essentially rated as philosophical such as the question of the meaning of life, free will, consciousness, morality will not be worth while rationalising. Before highlighting the limitation of scientisist naturalism, it should be noted that such biased contentment against philosophy is an attempt at the ontological and methodological monism of knowledge using science as the paradigm. Paul K. Moses and David Yandell argue that there is a dilemma of naturalism in an attempt to appreciate the autological and methodological pillars of scientisist naturalism. That is:

> *Core autological naturalism: every real entity either consists of or is some how ontically grounded in the objects countenanced by hypothetically completed empirical sciences (that is, in the objects of natural ontology). Core methodological naturalism: every legitimate method of acquiring knowledge consists of or is completed methods of the empirical sciences (that is, in natural methods).*[1192]

The problem noted in the above thesis is the use of science as standard to Judge metaphysical and epistemological legitimacy. This is ontological and methodological monism then for it recognises empirical science as the only yard-stick to define the tenability of metaphysics and epistemology. This is pure scientism and it is criticised because the two theses. These thesis which include the ontological and the methodological are not hypotheses or theses of any empirical science. Naturalistic claims thus can be studied by philosophy and not science because they are non-empirical categories of science. More over, they cannot even constitute predictive contents of current empirical sciences. The basic theses of naturalism thus are not naturalistic in nature.

[1190]*Idem. "*in philosophy one can no more base his reasoning on apriori principles affirmed by an autosufficient reason" (My Translation*)*

[1191]*M*atteo Morganti, *Combining Science and Metaphysics,* p. 17.

[1192]William Lane Craig, J. P. Moreland, David Yandell and others, *Naturalism, A Critical Analysis*, London – New York, Routledge, 2000, p. 10.

The second limitation of these scientist naturalism is its incompatibility with realism. One of the reasons for the successes of science today as Putman noted is the fact that it is grounded on realism. Realism does not only make claim to the truth but it defends the mind-independent reality which is a necessary condition for truth and objectivity in science. According to Robert C. Koons, "naturalism and realism are incompatible."[1193] This is because ontological naturalism claims that the reality is limited only to space and time and thus we cannot talk of causal influences out of space and time. Given that space-time determination is strictly empirical, realism seems eliminated because of the micro-physical states, the theory of chaos of this reason that Robert C. Koons criticises naturalism by asserting that:

> *Unless science provides us with objective truth about reality, it has no authority to dilate to us the form which our philosophical ontology and metaphysics must take. Science construed as mere instruments for manipulating experience, or merely as an autonomous construction of our society, without reference to our reality, tells us nothing about what kinds of things really exists.*[1194]

In order to appreciate Popper's originality in this debate on naturalism, it is important then to give the essential specificities of science on one hand and philosophy on the other hand, before evaluating Popper's view of the role of philosophy in science and the importance of science in philosophy.The main difference between philosophy and science is that the former is characterised by subjectivism while there is a certain degree of objectivity in scientific knowledge. Karl Jaspers notes that:

> *Whereas sciences in their field have gained compellingly certain universally recognised insights, philosophy, despite thousands of years endeavour has done nothing of the sort. This is undeniable: in philosophy, there is no generally accepted definitive knowledge. Any insight which for cogent reason is recognised by all has ipso facto become scientific knowledge and ceased to be philosophy.*[1195]

There may be a multiplicity of sciences like human sciences, formal sciences and empirical sciences but each scientific domain is always specialised and attempts objective approach to the knowledge of the subject matter. However, the relationship between philosophy and science here, we are implying empirical sciences which is our focus in this thesis. Empirical sciences such as physics in every period and circumstance, agree on knowledge of any factual reality. Such agreement is always a product of an experimental set up. This is never a case in philosophy. When we ask the philosophical question of the basis of the reality, different theoretical approaches like

[1193]William Lane Craig, J. P. Moreland, David Yandell and others, *Naturalism, A Critical Analysis,* p. 49.
[1194]*Idem*.
[1195]Karl Jeaspers: *A Way To Wisdom, Introduction To Philosophy*, trans. Ralph Manhein, New Haren, Yale University Press, 1954, p. 5.

idealism, materialism, realism, nihilism, phenomenology and among others will emerge. The acceptance of any theoretical framework is a matter of personal logical conviction. At the level of the object of study, philosophy deals with the reality as a totality while science is marked by acute specialisation. To defend this point of differentiation, Karl Jaspers asserts that:

> *Whereas science always pertains to particular objects, the knowledge of which is by no means indispensable to all men, philosophy deals with the whole being, which concerns man as man, with a truth which, wherever it is manifested, moves us more deeply than scientific knowledge.*[1196]

Taking empirical sciences, we can have a tradition division into physics that deals with concrete bodies, astronomy that deals with heavenly physical bodies, geology that studies stones, chemistry aspects of matter and biological that studies life from an empirically determined point of view. Even within these empirical sciences, there is still specialisation. For instance, there is geo-chemistry, biotechnology, nuclear textile, forensics, computational chemistry among others, as areas of specialities in chemistry. We can also make the same divisions in other empirical sciences.

Presenting the differences between philosophy and science as above, makes recourse to the classical encyclopaedic view in which philosophy assumed the status of the queen science. However, the problem arises with the independence of sciences and the scientific revolutions and strides of the 19th and 20th centuries. Naturalism has not only declared the assimilation of philosophy by science but some have even declared the death of philosophy.

Most contemporary physicians think that philosophy plays no role in the development of physical theories. This is the same point held by a Nobel Laureate; who affirms that:

> *The value of philosophy to physics seems to me to be something like the value of early nation – states to their people. It is only a small exaggeration to say that until the introduction of the post office, the chief service of the nation – states was to protect their people from nation states. The insights of philosophers have occasionally benefited physics, but generally in a negative fashion – by protecting the preconception of other philosophers.*[1197]

Philosophy plays a role, not in the development of physics but in inhibiting other philosophical frameworks from coming up against the existing one. This argument by Weinberg

[1196] *Idem*.
[1197] Steven Weinberg, *Dreams of a Final Theory*, New York, Pantheon, 1992, p. 166.

has even influenced some scientists to claim that science should develop her own philosophy and epistemology.

Relegating epistemology and philosophy of science to scientists is contested by Mario Bunge who thinks epistemology should be given a new function. He defines epistemology as *« philosophie dans, à partir de, avec et pour la science. »*[1198] It is philosophy of science and philosophy in science because epistemology deals with the philosophical implications of science. It studies categories that are non-scientific such as but determine the development of science such as time, space, matter, laws, causes and hypothesis. Science does not create any of them but they are philosophical presupposition of science. Epistemology can also be described as philosophy from science because science influences the development of some philosophical systems, that falls under epistemology.

Epistemology far from being the study of theories of knowledge, or gnoseology is the science of science then. In other words, it is meta science because the development, structure and functioning of science are highly influenced by philosophy. A re-examination of a new link between philosophy and science thus requires accordance of a new connotation of epistemology. It defends a branch of philosophy which is neither above science nor is it below it. Bunge Mario considering epistemology as meta science thinks his stance is defendable because:

> *« Elle est à la fois dans la racine, dans les fruits et dans le tronc même de l'arbre de la science. Il faut distingues des problèmes scientifiques, mais il n'y a pas de raison pour inventer un abîme qui les sépare : problème scientifiques qui ne soulèves de problèmes philosophiques, ni de problème philosophique que l'on puisse aborder avec une chance de succès sans adopter une attitude scientifique. »*[1199]

Considering epistemology as metascience thus helps to avoid two negative attitudes; notably antiscience and scientist naturalism. Unless we recognise how science influences philosophy and how philosophy enriches science, we will not avoid the attitude where philosophers without scientific formation deny science and the attitude where scientists without philosophical domain advocate for a scientist. Philosophy of science that is strictly in the hands of scientists and independent of epistemology.

[1198] Mario Bunge, *La Science, Sa Methode Et Sa Philosophie*, trad. Adam Herman, Paris, Editions Vigbor, 2001, p. 72. "Philosophy of, in, from, with and for science"; (my translation).

[1199] Mario Bunge, *La Science, Sa Methode et sa Philosophie*, p. 73, "It is at the same time in the roots, in the fruits and in the trunk of the tree of science. It is necessary to distinguish meta scientific problems from scientific problems but there is no reason to invent a depth separating them. They are probably no scientific problems that do not provoke philosophical problems neither are there philosophical problems that we can handle successfully without adopting a scientific attitude"; (my translation).

Popper thinks that such a philosophy of science that is meta-scientific should not be developed within the scope of definition nor should it be developed within the context of delineating the subject matter. A credible philosophy of science, that can better resists the disciplinary nihilism of philosophy developed by absolute naturalists like Wittgenstein of the Tractatus must be developed within the confines of problems. That is, philosophical theories, just like scientific systems should be appreciated in their ability to solve problems. The best distinction between disciplines then should not be at the level of subject matter. Such distinction is not rational. That is, "subject matter, or kinds of things do not, I hold, constitute a basis for distinguishing disciplines. Disciplines are distinguished partly for historical reasons and reasons of administrative convenience."[1200]

Problems to Popper thus transcends disciplinarily. However, Wittgenstein of the Tractatus argued that there are no genuine philosophical problems. This is the contention that Popper rejects because to him, some philosophical problems even have their origin in the sciences. The best approach to philosophy thus consist in solving problems. That is why he affirms that: "I wish to reaffirm my conviction that a philosopher should philosophise: He should try to solve philosophical problems rather than talk about philosophy."[1201]

Understanding philosophy to Popper does not consist in apprehending the essence but in delineating its problem-situation. Most problems in philosophy are extra-philosophical for they have their origin in science. Historically, Popper illustrates his point as he affirms that: "My thesis here is that Plato's central philosophical doctrine, the so-called theory of forms or ideas, cannot be properly understood except in extra-philosophical context. More especially in the context of the critical problem situation in the Greek science."[1202]

The general contention in the history of philosophy is that Plato's theory of forms was a historic reconciliation of the pre-Socratic conflict between Parminedes and Heraclitus on change and Permanence and on Non-Being and Being. Popper rejects this and asserts that Plato's theory of forms was developed because of "the discovery of the irrationality of the square root of two."[1203] In other words, Plato's theory of forms have a scientific origin because it is linked to Pythagoras' mathematics. Pythagoras discovered that qualitative phenomena like mutual harmony can be

[1200]Karl Popper, *Conjectures and Refutations*, p. 67.
[1201]*Ibid*., p. 68.
[1202]Karl Popper, *Conjectures and Refutations*, p. 75.
[1203]*Idem.*

expressed in form of the numerical ratios of the form 1, 2, 2:3, 3:4 and so on. This, with the ratios of type of angles made Plato to talk of the essences or of the real nature of things.

The second historical example Popper gives is the Kantian great heritage in his critique about knowledge. To Popper, it was not essentially the need to reconcile the epistemological conflict between rationalism and empiricism that influenced Kant, as historians of philosophy claim. Popper instead attributes the motivation behind Kant's conception of the critique of pure Reason to the astronomical revolution of Newton. About Kant, Popper asserts that: "His book was written for people who knew something about Newton's stellar dynamics and who had at least some idea of his forerunners – of corpenicus, Tycho Brahe, Kepler and Galileo."[1204]

Newton's idea of gravitational law was accepted with reservations since there were no experimental backings by then. Yet, Kant believed that Newton's innovations was an illustration of the highest level of knowledge. This was at the time that Hume denied the possibility of the logical justification of causality or laws. This scepticism of Hume, "Thus arose the central problem of the critique: 'How is pure natural science possible? By pure natural science-scientia, epistémé- Kant simply meant Newton's theory."[1205] This is acceptable if we link Kant's solution to Hume's scepticism on knowledge of laws and Newton's announcement of the law of gravitation. Kant's solution consists in the transition from realism to idealism or from object-centred knowledge to object-centred knowledge. This is the famous Kantian Copernican revolution, which Popper expresses as: "[…] we are not passive receptors of sense-data, but their active digestors. By digesting and assimilating them, we form and organise them into a cosmos, the universe of nature."[1206]

We can demonstrate another example of the scientific motivation of philosophical theories by considering British empiricism and the technological context of its emergence. Empiricism was not essentially developed to refute rationalism as most historians of philosophy argue but it was motivated by the influence of the industrial revolution and the need to render all knowledge operational and practical. That is why Charles MC Cormick asserts that:

> *The term empiricism refers to both a philosophical approach towards understanding the world and the principles and methods that ground modern scientific practices. The philosophy of empiricism, which was first stated by Aristotle and other classical philosophers, came to friction in the writings of Enlightenment era scholars including*

[1204]*Ibid*., p. 93.
[1205]*Ibid*., p. 94.
[1206]*Karl Popper, Conjectures and Refutations,* p. 95.

David Hume and John Locke. A key philosophical question at that time was whether knowledge should be generated based on experience.[1207]

A sound understanding of empiricism then resides in the problem of the link between knowledge and experience. After demonstrating that there are philosophical problems and that they originate in the sciences, Popper achieves his objective, that is to show the role that science play in the philosophical activity. Besides the role of metaphysics in science, Popper equally proceeds to demonstrate the role of the philosophical activity in the development of science. The thought experiment Popper gives is that of the role the philosophical problem of matter in the development of science. Most of the scientific problems today were initially considered as speculative and philosophical enigmas. Popper in this light asserts that " modern science, at any rate has something important to say to the philosopher about some classical problems of philosophy especially about the old problem of matter."[1208] The view of traditional philosophers like Descartes, Leibnez and Kant influenced and experimental physics of Faraday, Maxwell, Einstein De Broglie and Shrodinger. This can be illustrated with the theory of matter which stems from the pre-Socratics physicalism, specifically in Demeontus' view of a block universe Plato's' distinction of Forms and the physical objects, Aristotle's hylomorphism, Empicurus' atomism, received systematisation in the modern times leading to the scientific view of matter.

Rene Descartes on matter, has a geometric and an essentialist view. Matter or the body to Descartes is a substance, whose body is extension. In his famous wax analogy, Descartes asserts that the essence or true nature of matter is extension, because it is the only idea we have of wax, when the secondary qualities like sweetness, hardness and hardness have disappeared. Just like Parminedes, "Descartes asserts that there is no void and motion to Descartes is a product of action by contact. Thus, the force of push accounts for causation and motion. Thus, from the Cartesian mechanics, "in a plenum, an extended body can move only by pushing other bodies."[1209]

In the same speculative mechanism, Leibnez accepted the Cartesian equation of the body to extension. The difference is that while Descartes used the intuitive qualities of the thought of the essence of the body, while Descartes holds that the equation of the body to matter is irreducible, self-evident, clear and distinct, thus entailing the principle of action by push, Leibniz questioned all of those. To Leibniz: "If a body pushes another along instead of penetrating it, then there can only be because they both resist penetration. So this resistance must be essential to matter or

[1207]Charles MC Cormic, Empiricism available on https://onlinelibrary.wiley.com, consulted on 12/08/2020, at 10:32am.
[1208]Karl Popper, *All Life Is Problem-Solving*, p. 112.
[1209]*Karl Popper, All Life Is Problem-Solving*, p. 113.

body."[1210] The reason for the absence of interpenetration between bodies is not due to the force of push but because of the repulsive force. This repulsive force obstruct into penetration. Leibniz then does not adopt atomism but instead mechanism because matter is simply a field of forces. These forces arise from unextended points which are monads. There is no void too to Leibniz because an empty space will means the absence of repulsive forces. Newton posed the problem of the elasticity and comprehensibility of matter. To Newton, atoms do not matter but small bits of matter and thus, they can neither be compressed nor are they elastic. This implies that they are "[…] absolutely incomprehensible, absolutely hard, absolutely inelastic."[1211] Given that atoms are inelastic, push is not the cause of motion. Forces are thus simply proportionate to acceleration.

The above philosophical speculations on matter were considered as useless metaphysical abstraction and that they had no role to play in physics. This was the view of Ernest Mach. It was rather in 1905 when Einstein tested Newton's theory in his theory of the Brownian motion that the theoreticians of atomic physics like Bohr, Heisenberg, and Pauli, were influenced were influenced to get committed into atomic physics. Thus, the revolutions in macrophysics mechanics in macrophysics, to microphysics with corresponding theoretical frameworks and experimental groundings can be understood as a product of an age old period of intense philosophical speculations on matter.

Another illustrations we can give to add to Popper's view is that of the role of the philosophy of the mind into artificial intelligence and robotics. Artificial intelligence refers to;

> *The science of making machines that can do the kinds of things that humans can do. Topics of research have included speech recognition, visual recognition and the more familiar problem solving and game-playing. Modelling a psychological phenomenon on a computer is a way of showing how the phenomenon on a computer is a way of showing how the phenomenon is possible in a physical world and is also a way of bringing out the complexities involved in apparently simple task.*[1212]

In artificial intelligence, then there is computation of electronic system to mimic human intelligence. This is evident in the internet, the phones, calculators, the dosage of drugs in the health care unity, in the surgical units, auto cars, unusual debit card used in banking among others. The theory of artificial intelligence that led to this technology is the product of an aged old philosophy of the mind. Understanding the conceptual archaeology of cognitive science and

[1210]*Idem*.
[1211]*Ibid*., p. 115.
[1212]Simon Blackburn, *Oxford Dictionary of Philosophy*, p. 25.

intelligence then must make resource to the different episodes of the philosophy of the mind. Alvin I. Goldman is of this point of view as he asserts that:

> *Where as Cartesianism erected barriers to the empirical investigation of the mind and behaviourism imposed narrow restraints on mental theorizing, the functionalist – computation a – list model of the mental states developed by Putman, Fodor, and others provided a friendly conceptual underpinning for cognition.*[1213]

Besides the historical illustrations of the science-philosophy dialectics and their interdependency, it can be argued that the two disciplines influenced each other in the historical development of most of their respective theories. Given the purpose of our reflection here, was to moderate hyper naturalisation of philosophy, there is still the burden of the argument, on showing how philosophy intertwines with science in our everyday scientific practices or the first point that the conditions for the possibility of science cannot be determined by science but an extra-scientific discipline which is epistemology. In other words:

> *Scientific disciplines cannot on their own determine what is the bounding of their domain and what their "proper" objects of investigation, methodological principles and standard evidence. These are normative meta-questions that are continuous with fundamental question within the discipline but which cannot be handled solely within these boundaries and which therefore require an extended, methodological and metaphysical discussion.*[1214]

Questions like; is the scientific object constructed or given? Does the scientific begin with observation hypothesis or problem? Are scientific laws intrinsic in nature or they are imposed on nature by the mind? Are theoretical terms real entities or simply tools of prediction? Is the scientific truth supposed to be objective or subjective? These are crucial questions that surrounds and arise from the scientific practice. The reflection on these question does not only reveal an implicit philosophy in science but it also illustrates how philosophical reflection influence the development of science.

Another argument to show the role of philosophical reflection is at the level of the interpretation of scientific theories. The interpretation of scientific theories such as the quantum theory is strictly philosophical. There are many theoretical and experimental physicists like Albert Einstein (1879 – 1727), Isaac Newton (1642-1727), Niels Bohr (1885 – 1662), Richard Feynman (1918 – 1988), among others, engaged into conceptual interpretations of their theories. These

[1213]Alvin I. Goldman, *Liasons – Philosophy Meets The Cognitive and Social Sciences*, Massachusetts, Massachusetts Institute of Technology Press, 1991, p. 2.
[1214]Camilla Serck Haussen, Frode Kjosavick, *Metametaphysics and The Sciences, Historical and Philosophical Perspectives*, New York – London, Routledge, 2020, pp. 1-2.

interpretations always use concepts and framework which are philosophical and do not constitute hypotheses in their theories. It is in this light that Michael Esfeld asserts that:

> *For any scientific theory needs an interpretation, and it is philosophy qua epistemology of science that assesses the criteria of the interpretation of scientific theories. More over, that dependence stretches to metaphysics in the sense of the mentioned project, for the integration into a coherent and complete view of the world is an important criterion in the interpretation of scientific theories.*[1215]

It is thus plausible that science and philosophy influenced each other. Consequently, there is need to revise naturalism because not all aspects of science influence philosophy and not all aspects of philosophy influence science. There is thus the necessity for a new form of naturalism. However, the plurality of the sciences is a challenge to philosophy thus a call for a new epistemological approach. Given the unifying character of philosophy, we need a synthetic and not an analytical approach in studying and understanding the empirical sciences. Unlike the analytical approach as defended by logical positivism is thus not adequate because philosophy is:

> *The "eye on the whole" which distinguishes the philosophical enterprise. Otherwise, there is little to distinguish the philosopher from the persistent reflexive specialist; the philosopher of history is more concerned to reflect on how his work as a specialist joins up with other intellectual pursuits, then in asking and answering questions within his speciality, he is said, properly to be philosophically minded. And indeed, one can "have one's eye on a whole" without staring at it all the time.*[1216]

The Analytical approach does not lead to new knowledge and to innovations in philosophy. Another disadvantage of the analytical approach to epistemology is that new scientific disciplines arise every day and thus applying analysis in studying science will be a myopic and a narrow-minded epistemological approach. The synthetic approach then is the best epistemological approach faced with the multiplicity of the empirical sciences for the analytical approach will require infinite breakdowns into small scale maps of new orientations of empirical sciences.

After demonstrating the Popperian influence on the new frontiers between and philosophy, their interdependency and the impact of their dialectics on epistemology, there is need to avoid two negative extremes; Naturalistic scientism and philosophic antiscientism. Naturalistic scientism rejects the autonomous existence of philosophy with its problem, content and methods, arguing that if any philosophy is to be recognised, it must reflect the scientific methodology and approach

[1215]Esfeld, *The impact of science on metaphysics*, available on www.philsci-archive.ptt.edu, consulted on 12/08/2020 at 1:25pm.
[1216]Carl G. Hempel, Wilfred Sellars, Michael Scriven and others, *Frontiers of Science and Philosophy*, Pittsburgh, Pittsburgh University Press, 1962, p. 39.

to knowledge. Philosophic antiscientism claims that real philosophy is first philosophy and that science is not an independent field, but simply a branch in the great tree of philosophy. Between the two extremes, naturalist scientism is more dominant because of the revolutionary aspect of science, its technological orientation and the practical role of science in human history and civilisation.With the above, the moderate stand appears to be non-elumative naturalism. It is compatibilist and inclusive. Matteo Morganti, defends such moderate naturalism. He holds that:

> *Naturalism about metaphysics is the best understood as the view that metaphysics preserves its autonomy (we have suggested, as apriori inquiry into the possibility space primarily characterised by dependence relations), but be studied in parallel with science, being put to the test of empirical evidence while at the same time defining the tools for the interpretation of science itself.*[1217]

Metaphysics just as philosophy here constitutes and autonomous discipline that is independent to science. The results of philosophical investigation in their turn help in the development of science. This is a non-eliminativist naturalism because it recognises philosophy and metaphysics as first philosophy. It neither ignores philosophy nor does it ignore science:

> *Rather, it invites one to opt for a form of compatibilism between science and metaphysics, intended as a general stance that take both disciplines seriously and regards them as completing each other in essential respect. In other words, what one may call compatibilist naturalism to a constructive, approach to metaphysics that gives up the idea that to naturalise means to make similar as possible to science and insists instead that metaphysic has to be in close contact as it were with the sciences while preserving its autonomy and independence.*[1218]

The continuity of naturalism is thus maintained but there is no imposition of the scientific method on philosophy. Thus metaphysic as first philosophy holds but science as an autonomous discipline from philosophy is recognised. Matteo Morganti thus concludes that:

> *Since the very demarcation between science and metaphysics, as we have seen in this chapter is not as sharp as often implicitly assumed and in fact, there are many points of contact and continuity between the two, it is indeed advisable to endorse a more flexible view point.*[1219]

The advantage of compatibilist naturalism thus is that it promotes science and metaphysics, making philosophy and science to benefit from each other.

[1217]Matteo Morganti, *Combining Science and Metaphysics*, New York, Palgrave Macmillan, 2013, p. 22.
[1218]Matteo Morganti, *Combining Science and Metaphysics* p. 23.
[1219]*Idem.*

8.2.2. Epistemology of Interdisciplinarity and Limitations of excessive Specialisation in the Pedagogy of Philosophy

Talking about interdisciplinarity in epistemology at first sight seems to be an attempt to destroy the autonomy and the ontology of both philosophy and science. Contemporary philosophers rejects the idea of interdisciplinarity on grounds that it will destroy the specificity of the philosophical discipline. Andrew Barry and Georgina Born asserts that:

> *The idea of discipline opens a nexus of meaning. Disciplines disciplines disciplines. A commitment to a discipline is a way of ensuring that certain disciplinary methods and concepts are used rigorously and indisciplined and undisciplinary objects, methods and concepts are ruled out. By contrast, ideas of interdisciplinarity imply a variety of boundary transgression, in which the disciplinary and disciplining rules trainings and subjectivities given by existing knowledge corpuses are put aside.*[1220]

The question of the method in philosophy and the problem of demarcation in science are effectively posed to define the boundaries of empirical science from non-sciences and to distinguish authentic philosophy from pseudophilosophy. This thus reinforces the idea of disciplinarity because the philosophical methods and the demarcation principles in science, excludes the two disciplines from other disciplines that are not commensurate and compatible with their respective principles and method. However, Karl Popper's rationality of science challenges epistemology to invest in the new concept of interdisciplinarity at the same time inviting philosophy to review the nature of specialisation in its pedagody.

The first motivation for the integration of disciplinarity into epistemology is Popper's defence of the importance of metaphysics in the development of science. This is the main contention that has been developed in this thesis. If metaphysics play a role in science then the disciplinary status of philosophy and science are no more absolutely and mutually exclusive because the two disciplines influence each other. Secondly, Popper does not only demonstrates that psychology plays a role in the origin of scientific hypotheses but he also develops a deductive psychology of learning in his critique of induction and his defence of the conjectural status of knowing. At the level of psychology, Popper affirms that; "The question how it happens that a new idea occurs to a man-whether it is a musical theme, a dramatically conflict, or a scientific theory – maybe of a great interest to psychology."[1221]

[1220]Andrew Barry and Georgina Born, *Interdisciplinarity, Reconfigurations Of The Social and Natural Sciences*, New York, Routledge, 2013, p. 1.
[1221]Karl Popper, *The Logic of Scientific Discovery*, p. 7.

Thus, psychology intervenes at the level of the origin of scientific hypotheses. This follows that empirical science and psychology are not absolutely and mutually exclusive as they influence each other. To reinforce this argument, Popper developed a deductive psychology because after elucidating the limitations of induction, he posits that, living organisms actively learn when their expectations and anticipations are betrayed by experience. We cannot then understand science without making recourse to psychology.

In the third place, Popper argues that theoretical biology and specifically Darwin's theory of evolution may not be falsifiable but it plays the role of the research program. Popper here asserts that:

> *From this point of view, the question of the scientific status of Darwinian theory – becomes an interesting one. I have come to the conclusion that Darwinism is not a testable scientific theory, but a metaphysical research programme – a possible framework for testable scientific theories.*[1222]

Theoretical biology to Popper then plays a role in the development of testable theories of empirical science. In the fourth place, Popper argues that politics play a role in the enhancement of rationality, which is a fundamental disposition of a scientific mind. Rationality to Popper supposes the recognition of human fallibility. This necessitates mutual criticism, which is the apogee of rationalism. Popper on the other hand argues that the manner in which the society is organised has bearing on the quality of rationality. The best political organisation is thus that which promotes mutual criticism and the expression of ideas.

In the fifth argument for the dependence of the interdependency of the sciences is grounded on the view that the most important aspect of knowledge is the identification of the problem situation. There are some problems that can be resolved only by the intervention of many disciplines. On the other hand, there are other problems that a particular discipline import the solution from another. To illustrate this, Popper affirms that:

> *I need hardly mention that a geologist's problem such as assessing the chances of finding deposits of oil or uranium in a certain district has to be solved with the help oftheories and techniques usually classified as mathematical, physical and chemical. It is however less obvious that even a more "basic" science such as atomic physics may have to make use of a geological survey and of abstract and fundamental theories; for example the problem of testing productions about the relative stability or instability of atoms of an event or atomic number.*[1223]

[1222]Karl Popper, *Unended Quest*, p. 37.
[1223]Karl Popper, *Conjectures and Refutations*, p. 67.

Popper here opposes the strict academic classification of disciplines. When such classification is rigorous, it obstructs our objective appreciation of problems. The consideration of problems on the other hand requires the intervention of more than just one discipline. Here, Popper asserts that, "But this does not affect my point that the classification into disciplines is comparatively unimportant, and that we are students not of disciplines but of problems."[1224] If we are students of problems and not disciplines and the resolution of some problems appeals to a cross-border approach, then Popper is implicitly defending inter-disciplinarity as the effective and holistic way of solving problems that are essentially complex.

After examining the motivation for an epistemology of interdisciplinarity using Popper's rationality of science, it is then necessary to expatiate on the notion of interdisciplinarity and then illustrate how epistemology of interdisciplinarity is possible. The first remark to be made is that interdisciplinarity here does not imply the destruction of disciplines with their corresponding ontology and autonomy. Disciplines are homogeneous in their methodologies but our contention in the development of the epistemology of interdisciplinarity is to show that there is no crucial conflict between the homogeneity and closure of disciplines on one hand and interdisciplinarity on the other hand. Andrew Barry and Georgina Born assert that: "On the other hand, interdisciplinary research can involve closure, limiting as well as transforming the possibilities for new forms, methods and sites of research. On the other hand, disciplines themselves are often remarkably heterogeneous or even internally divided"[1225]

This follows that even within disciplines there are hybrid sub-disciplines. Margaret Boden, classifies interdisciplinarity into two types; the synoptic and the reflective. Synoptic interdisciplinarity is when, "a single theoretical perspective is applied to a wide range of previously distinct discipline."[1226] An examples of synoptic interdisciplinarity are clearly seen in cybernetics and evolutionary biology. Evolutionary biology is an integrative theory which is applied to a series of problems on evolution. This synoptic approach, presents interdisciplinarity as a product of the collaboration between different disciplines, to form a synthetic theory that incorporates all the problems of that disciplines.

From the above, interdisciplinarity can be defined as a situation where, "knowledge (methods of knowledge generation) from various disciplines is applied in a collaborative manner

[1224]*Ibid*., p. 67.
[1225]Andrew Barry and Georgina Born, *op.cit.*, p. 7.
[1226]Magaret Boden, "What is interdisciplinarity?" In R. Cunningham ed., *Interdisciplinarity And Organisation Of Knowledge In Europe*, Luxembourg, Office Communities, 1999, pp. 13 – 14.

to one common problem, goal or object of inquiry."[1227] This is collaborative interdisciplinarity which does not prescribe the abolition of disciplinarity but calls for a disciplinary integrative approach to problems. This collaboration can take place in three ways. Firstly, there is shared collaborative interdisciplinarity when disciplines complement each other with little efforts from the specialists or experts. For instance, for physics to study the pressure of rocks it must unavoidably involve geology which studies rocks. Secondly, collaboration can be cooperative, when it involves the intervention of many experts in a problem situation. For instance, in a situation of an epidemy, there is a cooperation between epidemiologists who are experts, public health experts, anthropologist to study the cultural set up to ease the eradication of an epidemy and so on. Thirdly, synoptic collaborative interdisciplinarity can be interpretive. This is interdisciplinarity as the end product of perfect collaboration.

The second approach to interdisciplinarity to Margaret Boden is reflective. There is a reflective relation between disciplines, "[…] if one of the disciplines is the subject matter of the other disciplines."[1228] The example of reflective interdisciplinarity can be seen in the relationship between Darwinism and evolutionary biology. The former is the subject matter of the latter and thus is integrated in the latter.

Margaret Boden uses the interaction between disciplines to develop the synoptic and the reflective types of interdisciplinary. Steve Fuller on the other hand argues that interdisciplinarity can be defined and classified from the very history of knowledge. There are two modes of such approaches. Mode 1 of interdisciplinarity to him can be linked to Kulin's view of the episode of science in crisis. When crisis rock normal science, many explanatory models or paradigms are developed to solve puzzles. This leads to the production of different paradigms and epistemological systems. Steve Fuller thus asserts that model 1 is: "a model of intellectual history whereby increasingly specialised disciplines are seen as the natural process, which is envisaged as a kind of organism that develops functionally differentiated parts."[1229]

The separation between disciplines is not then not arbitrary but a natural product of the history of knowledge. In the second mode of interdisciplinary, Steve Fuller asserts that: "Interdisciplinary enters as mode 1 as q complementary 'demand – driven' process. It attempts to

[1227]Marie I. Kaiser, Marie Kronfeldner, Robert Meunier, "Interdisciplinarity in Philosophy of science" in *Journal For General Philosophy Of Science*, vol. 14, no. 10, Dordrecht, Springer, 2014, pp. 59 – 40, p. 60.
[1228]*Idem.*
[1229]Robert Froodeman, Julie Thompson, Klein Care Mitdiam and others, *Oxford Handbook of Interdisciplinary*, New York, Oxford University Press, 2010, p. 5.

bridge the epistemology gaps that have emerged between the disciplines as a result of increasing specialisations."[1230]

The gaps between disciplines are not thus product of intentional acts but are unavoidable products of mode 1. The gaps arise simply because "disciplinary practitioners pursue the implications of what Kuhn called their paradigms for a given field of inquiry until it creates more problems than it solves."[1231]

The first reason advances by experts in this domain to make a case for interdisciplinarity is based on the notion of complexity. This notion of complexity which arises from the link science to the society basically stems from the fact that the problems of the human society are multiple and complex and thus requires a complex and interdisciplinary approach. That is, interdisciplinarity is motivated by the need to engage into "joint problem solving among science, technology and society."[1232] Jan Schmidt asserts that the problems of the human society do not exist in isolation but they arise in a web. According to him: "The societal problems are so complex and interrelated that a disciplinary approach is usually not feasible. Interdisciplinarity is regarded as tool to tackle these probles."[1233] Monodisciplinarity cannot adequately solve social problems. This is a kind of ontic interdisciplinary motivation because the complexity of problems stem from the complexity of nature. That is, it is "sheer complexity of nature, which draws researchers towards the next important question, moving towards interfaces with other disciplines."[1234] We consider the problem of poverty, an interdisciplinary approach will require the economic perspective for there is need for production, an approach of physics, for there is need for technology, biology and chemistry for the resolution of the problem of poverty equally requires good health.

Moreover, complexity as the driving force of interdisciplinarity is not just ontic but also semantic. The semantic connotation of complexity resides in the fact that "many disciplines (such as literary studies, philosophy, art, history and philosophy) address such key notions simultaneously."[1235] If we take a concept of climate change, we will realise that it is tackled by

[1230]*Idem.*
[1231]*Ibid*., pp. 51-52.
[1232]Jan C. Schmidt, "Towards A Philosophy Of Interdisciplinarity as an Attempt To Provide a Classification and Clarification", in *Poiesis and Praxis*, vol. 5, no. 53, Dordrecht, Springer, 2008, pp. 53-69, p. 53.
[1233]Jan C. Schmidt, *"*Towards A Philosophy Of Interdisciplinarity as an Attempt To Provide a Classification and Clarification", p. 57.
[1234]Committee on facilitating interdisciplinary research, National Academy of Sciences, Facilitating Research, Washington DC, National Academy Press, 2004, p. 253.
[1235]Marie I. Kaiser, Maria Kronfeldner, Robert Meunier, "Interdisciplinarity In Philosophy Of Science*"*, p. 61.

many disciplines. The notion is thus complex and requires an interdisciplinary approach because it cuts across fields such as ecology, environmental ethics, astronomy, among others.

The second motivation of interdisciplinarity is the need to establish the lost unity that existed between the sciences before the advent of disciplinarity. Disciplinarity in knowledge and in the sciences in particular emerged in the nineteenth century, "when it came to be conceived of consisting of relatively discrete and specific bodies of knowledge or 'logies'."[1236] However, there was a general agreement that these disciplines had impacts on one another. The classification between formal, human and natural sciences and hybrid division within the various sciences was based on the delimitations in terms of objects of study, method and principles. However, some disciplinarists in their compartmental endeavours recognised that the boundary between disciplines was simply arbitrary as there is continuous intertendency of different disciplines. Compartementality of discipline was done formally but not absolutely respected in practice. That is why Auguste Comte asserts that:

> *It follows that the mutual dependence of the sciences of dependence resulting from that of the correction […] must determine the arrangement of the system of human knowledge. Before proceeding to investigate this mutual dependence, we have only ascertain the real bounds of the classification proposed.*[1237]

Comte here implies that classification of sciences and disciplines proceed arbitrarily and strictly for the sake of simplicity of studying nature. This boils down to the second reason of interdisciplinarity which is to retrieve the lost unity that disciplines enjoyed before specialisation. It is because of this that Jan. C. Schmidt explicitly relates the emergence of interdisciplinarity to the search to unify the sciences as he affirms that: "interdisciplinarity is not regarded as an end-in-itself, but rather as a means to regain a presupposed unity from the (obvious) plurality of disciplines. Such unification has been a well-established topic and the overall aim of philosophy since ancient Greek."[1238]

This assertion elucidates the point that interdisciplinarity is not a new practice in philosophy. In looking at the reasons why philosophy should have an interdisciplinary hybrid, it is historically plausible that the practice of interdisciplinarity is as old as the history of philosophy. The rupture from 'mythos' to 'logos' by the Pre-Socratic witnessed the adoption of an encyclopaedia approach. This is because the pre-Socratics used both the philosophical scientific approach for they carried

[1236]Robert Frodeman, Julie Thompson, Klein Care Mitcham, *The Oxford Handbook of Interdisciplinarity*, p .8.
[1237]Auguste Comte, *Positive Philosophy*, p. 43.
[1238]Jan. C. Schmidt, *op.cit*., p. 56.

out observations and a mathematical approach for they attempted measurement in its rudimentary stage. This same attitude is conspicuous in the post Socratic philosophy where Plato and Aristotle approach the real from the epistemological, metaphysical, mathematical, physical, psychological and astrological perspectives. Rene Descartes in the modern times captures this interdisciplinarity in the famous metaphor of the tree of philosophy. This was at the same period that Leibniz initiated a project of 'mathesis universalis', to construct logic on the model of a mathematical language that will assure univocity among scientists from different disciplines including philosophers. This universalist tendency is evident in Hegel who argues that the scientific truth is universal and cannot be identified with a particular special science or discipline. Besides this historical ascension of philosophy to interdisciplinarity, the semantic aspects of philosophy also exhibit the propensity of philosophy to practice interdisciplinarity. That is:

> *We can find aspects of approaches in domains which are classified by keywords like "monism and pluralism", "unity of science", "intertheoretic relations", "holism", "unification", "reduction", "rationality", etc. here interdisciplinarity might be understood as an integration instrument in order to relate various patch works of disciplinary knowledge - its basic goal is to obtain a synthesis and to restore what is thought to be lost.*[1239]

One of the most reputed philosopher who defends the integration of interdisciplinarity into philosophy of science is Uskali Mäki. In a syllogistic manner, he presents the urgency of an epistemology of interdisciplinarity in the following argument:

> *Premise 1. It is part of the agenda of philosophy of science that it should be informed about and should produce information about, major features of contemporary science.*
>
> *Premise 2: Interdisciplinarity plays increasing central role in contemporary scientific research and its governance.*
>
> *Conclusion: Philosophy of science should meet the call for Phi D.*[1240]

The epistemology of interdisciplinarity is thus an attempt to actualise epistemology. If philosophy of science is interested in science, then it also take note of any new developments in science. At the age of the interdisciplinarity, philosophy of science should not only tackle the latter but it should also adopt an interdisciplinary approach so as to understand the interdisciplinarity status of science. Uskali Mäki notes that interdisciplinarity does not exclude disciplinarity. Rather, "if disciplines were to fade away as some enthusiasts of interdisciplinarity sometimes would seem

[1239]Jan C. Schmidt, "Towards A Philosophy Of Interdisciplinarity As An Attempt To Provide A Classification And Clarification", p. 56.
[1240]Uskali Mäki, "Philosophy of interdisciplinarity What? Why? How?". in *European Journal For Philosophy Of Science*, vol. 6, no.3, Dordreicht, Springer, pp. 327-342, p. 330.

to wish – the very idea of interdisciplinarity would become inconceivable."[1241] The epistemology of interdisciplinarity should not to be a radical one, which calls for the abolition of disciplines but that which complements disciplinarity. As such, there is a causal dependency of interdisciplinarity on disciplinarity.

Elsewhere, the epistemology is defined as essentially dealing with interdisciplinarity which is divided into two types; the synoptic and the reflective. The synoptic approach is the general perspective when philosophy of science treats problems that involve other disciplines. This is seen in the Darwinian theory of the biological evolution of species which involves both philosophers and sciences. It is synoptic because it:

> *brings together knowledge from diverse disciplines and thereby also constitutes to each of these disciplines; however, it addresses the problems of the respective sciences rather than developing a specific reflective philosophical problem, e.g., concerning the nature of science in general.*[1242]

The synoptic interdisciplinary approach of philosophy of science does not start with pure philosophical problems but with theoretical problems that are common to other disciplines and thus synthesising knowledge. The reflective approach on the other hand deals with problems that strictly arise from science. It deals with problems such as that of the scientific theory hood, the demarcation between science and non-science, the bases of scientific revolution, the nature of scientific explanations, among others. While epistemology from the synoptic perspective intervenes on the content of sciences, at the reflective level, such intervention is excluded.

The synoptic approach to philosophy of science has two obstacles. Firstly, for the philosopher to participate on issues intandem with scientist, he should understand the contents of the sciences in question. Secondly, the synoptic approach can lead to radical naturalism which can lead to the destruction of the autonomy of philosophy. This naturalism in the synoptic to Uskali Mäki can be external or internal. The external approach claims that: "science (e.g. history and sociology) of science should impose evidential constraints on philosophical claim about scientific practice in that philosophical theories are to be informed by or tested against the evidence produced by the scientific study of scientific practices."[1243]

This is the radical naturalist and synoptic interdisciplinarity which is detrimental to the autonomy of philosophy. The most tenable version of synoptic philosophy of science is the internal

[1241] *Ibid.*, p. 332.
[1242] Maria I. Kaiser, Maria Kronfeldner, Robert Meunier, *op.cit*., p. 63.
[1243] Uskali Mäki, *op.cit*., p. 334.

approach. This approach is linked to the compartibilist naturalism defended in this thesis. The internal approach:

> *suggests that relevant parts of science (e.g. cognitive science, evolutionary theory, economics) should provide inputs to the construction of the contents of philosophical account of science, so that there be continuity between the contents of philosophical theories and those of the relevant scientific theories.*[1244]

The internal approach recognises the autonomy of philosophy and assures the collaboration between philosophy and science.

At the reflective level of the epistemology of interdisciplinarity does not involve the philosophical appropriation of the contents of science. It is however tenable because it provides the collaboration between disciplines, complexity in reflective interdisciplinarity, science and not its contents. Reflective disciplines deals with different aspects of science. This is because scientific activities may have ethical, historical, material and conceptual motivations. Thus; "philosophy of science is more focused on the conceptual dimension; anthropology and sociology of science on the historical dimension, ethical on the moral dimensions and history of science on the historical dimension."[1245]

Philosophy of science also collaborates with other disciplines that foster the understanding of scientific knowledge. Some of these disciplines include cognitive sciences, which studies the different scientific processes. Given that scientists and philosophers sometimes converge on certain incepts like causality; "The role of philosophers might even be to generalise the insights or problems of that particular science and apply them in a reflective manner to other fields which there by blurs the bounding between general and particular philosophy of science."[1246]

The pertinence argument is referential from the history of science and the emergence of hybrid sciences. These hybrids have occasioned the philosophies of particular sciences. Uskali Mäki in this light notes that: "so we have, in an institutionalised form, specialised fields such as philosophy of biology, philosophy of chemistry, philosophy of cognitive science, philosophy of economics, philosophy of engineering, etc."[1247]

[1244] *Idem*.
[1245] Marie I. Kaiser, Maria Konfeldner, Robert Meunier, *op.cit.*, p. 64.
[1246] *Ibid*., p. 65.
[1247] Uskali Mäki, *op.cit.*, p. 336.

The study of different sciences and their relationship by the epistemology of interdisciplinarity investigate on the relation between the sciences using two methods of getting information. The first method consists in comparison. Comparative information is "about the similarities and the differences between two or more disciplines or families there, of regardless of what happens (or facts to happen) between them."[1248] This comparative approach can differentiate between sciences like economics and ecology, and between historical and experimental sciences. This comparison has nothing to do with what happens when the two discipline coverage on any object or subject matter.

The second way in which the epistemology of interdisciplinarity should study the different sciences is aimed at procuring contractual information. Unlike the comparative information which reports the disciplinary differences between the various sciences, the contractual information is "about what happened (or fails to happen) when two or more disciplines are brought in contact with one another."[1249] To be able to procure contractual information about disciplines, the epistemology of interdisciplinarity should transcend knowledge provided by special disciplines. The contact between disciplines can only be understood as the product of the transfer of models, methods integration, collaboration of disciplines and the inspiration of one discipline by another. This comparative philosophy of interdisciplinarity is somewhat related to historical epistemology, which deals with the comparative study of different forms of the rationality of sciences, assessing their differences and similarities.

The epistemology of interdisciplinarity is important because it renders philosophy of science to be practical. Given that research today is funded and manipulated, so as to culminate to policy action, the epistemology of interdisciplinarity will be resourceful for research and its application. Given that it reflects on different compartments of human knowledge for comparative and contractual information, the epistemology of interdisciplinarity is of:

> *relevance to scientific practices; relevance to science policy (and research management, research funding, etc), relevance to society (science-society relations as extra-academic trandisciplinarity) in principle, PhiD has the capacity to be of relevance with respect to all these realms of practice.*[1250]

Philosophy of interdisciplinarity should also connote interdisciplinarity. It should "welcome contributions from social, historical, cognitive sciences as well as from other branches of

[1248] *Ibid*., p. 337.
[1249] Uskali Mäki,"Philosophy of interdisciplinarity What? Why? How?", p. 337.
[1250] *Ibid.,* p. 338.

philosophy such as metaphysics, social epistemology and political and moral philosophy."[1251] It should be a sub-branch of philosophy but which is metaphysical. This branch of philosophy will play the role of research resource. This branch will not lost the critical attitude of philosophy due to its synoptic nature. The establishment of such philosophy "must happen without compromise and corruption. It must be combined with both critical self-scrutiny and proved self-defence."[1252]

To train learners to the epistemology of interdisciplinarity, there is need to first expose them to the general methodology and principles of philosophy. This will arm them with good conceptual tools for appreciating discipline on one hand and a critical mind to ensure the comparative study of the sciences. To resist the capitalist pressures of scientific governance and the influence of research finding institutions, Uskali Mäki asserts that: "Philosophy of interdisciplinarity must examine the discipline of philosophy itself by generating relevant comparative information about its peculiar, valuable characteristics – those that must not be sacrificial under the pressure of a new regime of accountability. Philosophy should not be for sale."[1253]

This implies that in the pedagogy of philosophy should not be grounded on absolute and exclusive disciplinarity. The philosophy of interdisciplinarity is actual today but universality reforms have not yet implemented them in their research organigram. The Stand Ford University in the USA for example, centres tis research on major specialisations which are: "1. Logic and semantic; 2. Philosophy of science and history of science; 3. Ethics value judgement, moral and political philosophy; 4. Metaphysics, epistemology, philosophy of mind and philosophy of language; 5. History of philosophy."[1254]

Taking the example of the united and India above, it becomes clear that most universities have not created compartment for interdisciplinary philosophy. However, the Department of Philosophy in the University of Ibadan has met up with the challenge. The Department carries out the pedagogy of philosophy around the following specialisations:

> *Metaphysics, epistemology, logic and ethics,second order areas of the branches of philosophy such as socio-political philosophy, philosophy of education, philosophy of law, aesthetics and comparative philosophy which bears direct relevance on the social*

[1251]*Ibid*., p. 340.
[1252]*Idem*.
[1253]Uskali Mäki,"Philosophy of interdisciplinarity What? Why? How?", p. 341.
[1254]Department of Philosophy Standford University, available on www.htts://philosophy.standford.edu>fac40.Department of philosophy, University of Delhi, available on du.ac.in, consulted on 22/08/2020.

practice within a larger society, all in an attempt to bridge the gap between the town and the gown.[1255]

The University of Ibadan thus refers to the epistemology of interdisciplinarity as comparative philosophy. Thus, creating epistemology of interdisciplinarity as a sub-branch of philosophy will make the latter to be actual and more practical.

8.3 The Logical Surpassement of Popper and the Thesis of Positive Metaphysics

Given that there is an opposition between the necessity of metaphysics in science and the insistence on a generic criterion of demarcation in popper, we are faced with two challenges. The first challenge will be how to correct Popper's criterion of demarcation to suit in the context where metaphysics influences science. Unlike Lakatos who proposed sophisticated falsification, which is justificationist and thus ignores the conjectural character of knowledge and also evaluates scientific theories in a series, we will attempt to defend progressive falsification. In the second challenge, given the limitations of Popper's rationality of science, the heterogeneity of the sciences and the claims of the demise of criterion of demarcation, we will attempt to propose a second criterion of demarcation. Such criterion goes beyond scientists naturalism to demarcate between scientically useful metaphysics, which we qualify as 'positive metaphysics' and scientifically useless metaphysics that we qualify ad 'negative metaphysics'.

8.3.1. Progressive Falsification as Improvement of Lakatos Correction of Popper's Logic of Falsification

Imre Lakatos is considered by many Popperians as having given the best correction of Popper's principle of falsification. Even though Lakatos in his methodology of scientific research, corrects some of the Popper's principle of appraisal in the actual context of the scientific practice, it has some limitations that shall be amended in what we refer to as pragmatic falsification. The aim of our reflection here then is to evoke the motivations of Lakatos, his critique of Popper, the evaluation of the pertinence of his correction of Popper and the basic tenets of our arguments for pragmatic falsification, which will synthesis Popper's and Lakatos' criteria of scientificity.

Lakatos' conception of scientific rationality is a product of Duhem's conventionality, Kuhn's paradigm-based view of scientific revolution and Popper's appraisal principle of

[1255]Department of philosophy, University of Ibadan, available on www.facultyotartsai.org,department, consulted on the 22/08/2020

falsificibility. Even though, a student and an apprentice of Popper, Lakatos just like Pierre Duhem and Thomas Kuhn rejects the negativist aspect of Popper's falsification. Scientist to him do not test theories with the negative intention of rejecting them. That is why he questions:

> *Is, then Popper's falsifiaibility criterion the solution to the problem of demarcating science from pseudo science? No. for Popper's criterion ignores the remarkable tenacity of scientific theories. Scientists have thick skins. They do not abandon a theory merely because facts contradict it.*[1256]

To Popper, a single case observation statement that contradicts a theory warrants the elimination of such theory. However, Lakatos just like the Quine-Duhem thesis argues that scientists in most cases always construct ad hoc hypotheses to reinterpret the theory that produces anomalies. A contradictory experience then is not fatal for the theory but simply an anomaly that can be amended using auxiliary hypotheses. Even when the anomaly becomes recalcitrant to scientific elucidation, it is usually ignored for attention to be reoriented towards other problems.

Considering the rival of Popper's methodology like Kuhn, Lakatos does not find a better alternative. Kuhn in his view of the scientific revolution for instance, asserts that the revolution is kind of religious conversion which occurs after lobbying young scientists. Such conversion to Lakatos renders his methodology to be grounded on irrational bases. That is why Lakatos asserts that: "if Kuhn is right, then there is no explicit demarcation between science and pseudo-science, no distinction between scientific progress and intellectual decay, there is no objective standard of honesty."[1257]

Lakatos objective then is to device a methodology which at the same time corrects the flaws intrinsic in the methods of appraisal, developed by Popper and Kuhn. He is thus in search for the "methodology of scientific research programmes, which solves some of the problems which Popper and Kuhn failed to solve."[1258]

Given that the philosophy of science is either prescriptive or descriptive, while the prescriptive approach attempts to impose standards on science, a process that renders such reflection abstract, the descriptive approach presents science as it is practiced in context. Lakatos opts for the second approach in the philosophy of science. In this approach, Lakatos proceeds in a holistic way as he denies the attempt to give an isolationist approach to the descriptive history of

[1256]Imre Lakatos, *Methodology of Scientific Research Programmes*, Eds. John Worral and Gregory Currie, Cambridge, Cambridge University Press, 1975, pp. 3-4.
[1257]Imre Lakatos, *Methodology of Scientific Research Programme,* p. 4.
[1258]*Idem.*

science. This is grounded on his claim that the history of science should not be reduced to that of independent and isolated hypotheses because scientific achievements can better be represented as research programmes. The character of an isolated hypotheses or theory should not be generalised as the character of science as a whole. For instance, if we use the famous Popper's example of "All swans are white", we can falsify it by the identification of a single black swan. Lakatos however insists that "but this trivial trial and error does not rank as science."[1259]

Considering the history of science, Lakatos affirms that we cannot reduce Newtonian science to his three basic laws of mechanics and his law of gravitation. It is here that Lakatos brings an innovation to Popper's view by referring to the basic laws of Newtonians mechanics as the 'hard core' of the Newtonian programme while Popper advocated for the falsification of the whole theory by means of counter evidence, Lakatos holds that, "this hard core is tenaciously protected from refutation by a vast 'protective belt' of auxiliary hypotheses."[1260] If an anomaly comes up for instance, in case a planetary motion does not match with the conjecture, the Newtonian scientist will not immediately opt for the elimination of the theory as Popper prescribed. To Lakatos, there are two alternatives the Newtonian scientists use to overcome the anomaly. Either they review their hypotheses on atmospheric refraction about the emersion of light in magnetic storms or they check other hypotheses about the programme. If these two alternatives do not explain the anomaly, they can predict a new planet that is unknown and further carry out thorough calculation of its velocity, its position and mass. The scientific attitude to be adopted towards theories should be understood from the descriptive approach of the specialists in a particular science. To historically elucidate this, Lakatos points out that:

> *Newton's theory of gravitation, Einstein's relativity theory, quantum mechanics, Marxism, Freudism, are all research programmes, each with a characteristic hard core stubbornly defended each with its more flexible protective belt and each with its elaborate problem-solving machinery.*[1261]

To make a case for Lakatos' point, Newton's theory did not develop and die instantly. Newtonian scientists continued to develop his theory even when anomalies were pointed in it. Einstein's programme simply subsume Newton's by making bold predictions that Newton's programme ignored. Besides, is no theory in the history of science that was developed anomaly-

[1259] *Idem.*
[1260] Imre Lakatos, *Methodology of Scientific Research Programme,* p. 4.
[1261] *Ibid.*, p. 5.

free. Every scientific theory that is newly conceived is always too old to die and it is in this way that Lakatos holds that,

> *All theories, in this sense, are born refuted and die refuted."*[1262] *For instance, Newton's publication of his principle was in tandem with the realisation of the implicit limitations. For instance, he did not fully explain the lunar motion. The motion of the month was thus a counter-evidence to Newton's theory, the year it was published. Also, when Einstein published his theory of relativity, it was refuted by a physicist; Kaufmann.*[1263]

These are proofs that of falsification through elimination by Popper is applied, the whole science will be eliminated.

From the above, scientists operate not at the level of independent theory but in the combination of theories into a research programme. The striking character of research programmes to Lakatos is their predictive power. The prediction in the Lakatosian sense is all-inclusive and progressive. This is because research programmes "all predict novel facts, facts which had been either indeed contradicted by previous or rival programmes."[1264] For instance, when Newton came up with his theory in 1686 on gravitation, they were two contradictory theories on comets; that is, bright line object that are seen from the earth moving round the sun. The two theories were; the theological view and Kepler's view. According to the theological view comets were adequate signs of Gody anger about the transgressions of man on earth. Kepler's view on the other hand considered comets as simple heavenly bodies that move round the sun. Newton on the other hand, asserted that while some of the comets move in hyperbolas, others move in parabolas while others simply move in ordinary eclipses. This was Newton's prediction of unknown planets.

Einstein's research programme equally carry out risky predictions that Newton's programme undreamt of. His prediction was that: "If one measures the distance between two stars in the night and if one measures the distance between two stars in the day (when they are visible during the eclipse of the sun), the two measurements will be different."[1265]

This was an unprecedented prediction by then. The predictive feature, permits Lakatos to differentiate between the progressive research programme and the degenerating one. He affirms that: "Thus, in a progressive research programme, theory leads to the discovery of hitherto

[1262]*Idem*.
[1263]As the first to discuss Einstein's theory of relativity and insisted that despite its advancement, it was equivalent to Lorenz's theory. He used his experiment to confirm Max Abraham's theory and to reject what he called the Lorenz-Einstein principle of relativity.
[1264]Imre Lakatos, *op.cit*., p. 5.
[1265]Imre Lakatos, *Methodology of Scientific Research Programme, p.5.*

unknown novel facts. In degenerating programmes, however, theories are fabricated only in order to accommodate known facts."[1266]

This is evident in our historical note above, where Newton's programme predicted facts that Kepler did not and where Einstein's programme predicted facts that Newton did not. Scientific predictions should however be differentiated from non-scientific theories that have scientific pretentions like Marxism. Marxism predicted the absolute poverty of the working class, that the most working class, that the most technologically developed counter were to host the first socialist revolutions and that the socialist society will be classless and thus conflict-free. These predictions failed and the Maxists justified their failure using the notion of imperialism. It is thus clear that their explanations or ad hoc hypotheses were mere inventions to serve and save the failed predictions. This is not scientific to Lakatos as, "The Newtonian programme led to novel facts; the Marxian lagged behind the facts and has been running fasts to catch up with them."[1267] Thus verifications, no matter how multiple they are do not constitute the criterion of scientificity. Lakatos agrees with Popper on this, though he does not buy Popper's negativist falsification through elimination. To buttress his point, against verification asserts that:

> *Popper is right that there are millions of them. It is no success for Newtonian theory that stones when dropped, fall towards the earth, no matter how often this I repeated. But so-called refutations are not the hall mark of empirical failure, as Popper has preached, since all programmes grow in a permanent ocean of anomalies.*[1268]

When a theory predict new facts, it is a progressive research programme while theories that lag behind facts is simply are "degenerating research programmes."[1269] We can then talk of scientific revolution, when there is inverse proportional relationship between two research programmes. That is: "If we have two rival research programmes, and one is progressing while the other is degenerating, scientist tend to join progressive programme. This is the rationale of scientific revolutions."[1270]

Unlike Popper who proposed rational criticism of scientific theories Lakatos asserts that a revolution or theoretical change is never an instantaneous thing because research programs can even go on for decades before they become progressive. Thus, he insists that: "Criticism is not a Popperian quick kill; by refutation. Important criticism is always constructive: but is no refutation

[1266]*Idem*.
[1267]*Ibid*., p. 6.
[1268]Imre Lakatos, *Methodology of Scientific Research Programme,* p. 6.
[1269]*Idem.*
[1270]*Idem.*

without a better theory. Kuhn is wrong in thinking that scientific revolutions are sudden-irrational changes in vision."[1271]

This is a pragmatic element of constructive element. In Popper, criticism is theory-driven. That is, the focus of refutation is to eliminate the theory. To Lakatos, it is fact-driven. When we can no more corroborate predicted facts, the theory collapses. By rendering criticism to be fact-based, Lakatos makes scientific methodology to be pragmatic.

Another fault of Popper's methodology evoked by Lakatos is that it is incomparable with the actual institutionalisation of criticism. In some major epochs, social institutions in history seemed to be the source of the principles of demarcating between science and pseudo-science. For instance, in 1616, the Catholic Church banned Copernicus theory referring to it as pseudo-science. In 1820, it was considered scientific on ground that it was proven by available facts. In 1949, the Mendelian genetics to Lakatos, was declared to be pseudo-science by the central committee of the Soviet Communist Party. Even Academician Vivilov who was a proponent of the theory was even killed in the concentration camp, shortly after his death, the theory was declared scientific. Lakatos thus observes that:

> *The new liberal establishment of the west also exercises the right to deny freedom of speech to what it regards as pseudo-science, as we have seen in the case of the debate concerning race and intelligence. All these judgement [1272] were inevitably based on some sort of demarcation criterion. This is why the problem of demarcation between science and pseudo-science is not a pseudo-problem of armchair philosophers: it has grave ethical and political implications.[1273]*

Despite the elucidation of the limitations in Popper's methodology above, Lakatos leans on Popper to develop his sophisticated methodological falsification. In the first place, he praises Popper for asserting that it is not the caution to avoid errors that animates scientists but the need to make bold and risky conjectures that can be corroborated. He holds that, "boldness in conjectures on the one hand and austerity in refutations on the other hand: This is Popper's recipe."[1274] Popper to him is original in avoiding justificationism and probabilification.

In a dialectical manner, Lakatos traces the path to his sophisticated methodological falsification. The first moment of this dialectic is marked by the examination of dogmatic falsification. Lakatos holds that, "dogmatic falsification admits the fallibility of all scientific

[1271] *Idem.*
[1272] Imre Lakatos, *Methodology of Scientific Research Programme,* p. 6.
[1273] *Ibid*., p. 7.
[1274] *Ibid*., p. 8.

theories without qualification, but it retains a sort of infallible basis."[1275] In other word, it is sceptical about theories but certain on their empirical basis: Thus, while theories are fallible, the dogmatic falsificationist ascertain the existence of empirical counterevidence as the only measure of the tenability of any scientific theory. All scientific theories to dogmatic falsification are conjectural. Even though we cannot prove the tenability of theories, we can however disprove the certainty of the theory in question. Dogmatic falsification equates non-falisifiability to metaphysics. That is, unfalsifiable propositions are just metaphysical. To Lakatos, if falsification applied on dogmatism, it leads to its collapse.

The second moment of Lakatos' Development of his methodology is methodological falsification. This to Lakatos is different from dogmatic falsification is that, while methodological falsification as defended by Popper has conventionalist undertones, dogmatic falsification cannot produce general consent among scientist. Lakatos describes Popper's methodological falsification into the following words:

> *Popper's methodological falsificationism is both conventionalist and falsificationist, but he differs from the (conservative) conventionalists in holding that the statements decided by agreement are not (spatio-temporally) singular; and he differs from the dogmatic falsificationist in holding that the truth value of such statement cannot be proved by facts but, in some cases, may be decided by agreement.*[1276]

The conventionalist element is evident in Popper's development of the methodological rules of falsification. Given that we can not test basic statements infinitely, some of them have to be saved from falsification due to agreement. Moreover, conventionalism in Popper is manifest when scientists agree on the degree of observation to licence the acceptance of a theory. A single observation can in some cases be a product of a minor error. It is thus methodologically wrong to refute a theory on the basis of such trivial error. To overcome this, "methodological falsificationists prescribe some safety control. The simplest of such control is to repeat the experiment (it is a matter of convention how many times); thus fortifying the potential falsifier by a 'well-corroborated hypothesis."[1277]

Even though Popper opted for conventional decision at the level of agreeing on the basic statement to be accepted, he did not evoke the argument of the triviality of observation. By raising the latter, Lakatos gives reasons why potential falsifiers can be falsified leading to more

[1275] *Ibid*., p. 12.
[1276] Imre Lakatos, *Methodology of Scientific Research Programme,* p. 22.
[1277] *Ibid*., p. 24.

corroborated theories. Dogmatic falsification can erroneously accept false theories and refute true ones because it does not differentiate between reject and disprove. Methodological falsification introduces empirical basis that is lacking in dogmatic falsification. With this empirical basis, Popper proposes an adequate demarcation between science and non-science. In this way, "a theory is scientific (or acceptable) if it has an 'empirical basis'. This criterion brings out sharply the difference between dogmatic and methodological falsificationism."[1278] What Lakatos learns more from Popper is this combination of criticism and fallibilism.

Lakatos points out the difference between himself and other critiques of Popper. Instead of rejecting methodological falsification, Lakatos proposes to amend it. It is true Lakatos pointed out, that decisions can lead astray but it is better to adopt them than to indulge into irrationality. Otto Neurath had argued that falsification obstructs scientific progress but he did not propose a better alternative. Hempel also argued that falsification is a form of pseudo-rationalism but he fails to provide the basis for tenable rationalism.

After a critical review of Popper's methodology, Lakatos asserted that the latter just like inductivism and methodological falsification collapse when confronted with the tribunal of history. Brendan Larvor expresses Lakatos' view of the three basic pillars of actual scientific methodologies as follows:

> *For "inductivists", proper science means proving theories from observed facts by means of rigorous "logic of induction". For so-called "conventionalists", proper science means constructing the simplest taxonomy of phenomena which saves appearances. The theories produced are "true by convention", because their acceptance is based not only on empirical criteria but also on our preference for simple theories. For "methodological falsificationist", proper science means inventing testable theories and then testing them.*[1279]

Against induction, Lakatos asserts that most theories in history do not proceed inductively, against conventionalism, Lakatos illustrates that most theories are evenly simplier and against methodological falsification of Popper, Lakatos asserts that all theories from their inception have implicit anomalies, thus the application of falsification is equivalent to the destruction of science.

Lakatos attempts to go beyond Popper's methodological falsification to propose sophisticated falsificationism. Unlike Popper's methodological falsification which insists on the negative spirit of refuting and eliminating theories when confronted with observation,

[1278] *Ibid*., p. 25.
[1279] Brendan Larvov, *Lakatos, An Introduction*, London – New York, Routledge, 1998, p. 48.

sophisticated falsification has a positive spirit, for it insists on the empirical character of the theory. That is, to sophisticated falsification, a theory is "acceptable" or "scientific" only if it has corroborated excess empirical content over its predecessor (or rival, that is, only if it leads to the discovery of novel facts."[1280]

For a theory T to be falsified, another theory T' has to be developed which satisfies three conditions. In the place, T' must predict new facts that T did not and thus exceeds T in terms of empirical content. Secondly, T' must also explain the previous achievements of T. as such, theory T' includes theory T. Thirdly, there should be a corroboration of some component of the content of T'.

One of the major innovation in sophisticated falsification is that theories no longer exist in isolation but in series. When we add auxiliary clauses to existing theories, we obtain a new theory. Thus, theories exist in series such as T1, T2, T3 and so on where the proceeding is formed by adding auxiliary clauses to the previous ones or such a series can also proceed from semantic interpretation of the preceding theory into the preceeding one. If the preceeding theory has excess content more than the previous one through the prediction of new facts, there is a theoretical progress or what Lakatos calls, "a theoretical progressive problem shift."[1281] By predicting new facts, there is a theoretical progress from one stage of the series of theories to another and this is usually accompanied by 'empirical progressive shift", which consists in the measure of the corroboration of these new predictions. It is here that Lakatos states the central thesis of his sophisticated falsification which holds that; "we regard a theory in a series 'falsified' when it is superseded by a theory with higher corroborated content."[1282]

It is some what logically narrow to reduce the criterion of scientificity to the character of a single theory. The Lakatosian revolution in falsification is actual because in practice, the falsification of theories takes the form of improvement. When a theory in physics presents anomalies, what scientists do in practice is to reinterpret it using auxiliary hypotheses and if it corroborates the revised theory is considered as a revolution. It is in this line that Lakatos asserts

> *Sophisticated falsification thus shifts the problem of how to appraise theories to the problem of how to appraise series of theories, not an isolated theory, but only a series of*

[1280]Imre Lakatos, *op.cit*., p. 32.
[1281]Imre Lakatos, *Methodology of Scientific Research Programme,* p. 33.
[1282]*Ibid*., p. 34.

theories can be said to be scientific or unscientific: to apply the terms "scientific" to a single theory is a category mistake.[1283]

Arguably, Lakatos takes the step ahead of Popper here. However, this is not too original to Popper given that corroboration to Popper also serves as the measure of the degree of verisimilitude of two competing theories. Lakatos does well to his theories in a series, but the closer look at his series the closer look at his series shows that it is infact the same theories undergoing development. If we make new predictions on an old theory, maintaining the "hard core" of such theory, then the corroboration of these new predictions do not in the strict sense produce a new theory but instead enlarges the connotation of the theory. When Lakatos ignores the role of problem in his sophisticated falsification, it can thus be understood why he does not give much value to the conjectural character of knowledge and this also leaves the logical problem of induction unsolved. Lakatos is pragmatic for asserting that the result of an experiment are not enough to falsify a theory and that we cannot falsify a theory without having produced a new one. With Kuhn, a paradigm enters into crisis before scientific proliferation that anticipates a new paradigm. Popper also defends the thesis of falsifying a theory once it is contradicted by observational statement, even if such theory does not have a better replacement. Lakatos' sophisticated falsification then seems more pragmatic than Popper's. In his pragmatic thesis, Lakatos asserts that: "Contrary to naïve falsificationism no experiments experimental report, observation statement or well-corroborated law-level falsifying hypothesis alone can lead to falsification. There is no falsification before the emergence of a better theory."[1284]

Therefore, in the context of practice, falsification largely depends on the emergence of new better theories than on counterevidence as Popper argued. Even though Lakatos completely reject the role of counter evidence, they however cause the desire to review the theory especially in the absence of a counter example. For instance, if a medication is used on a patient and it causes adverse effect, it is a counter-example, which is a challenge to the medication and thus a call for the review of the medication using ad hoc hypotheses and also a call for the production of a more effective cure to the disease at hand. Lakatos however insists that given that theories exist in a series, the counter-evidence of theory T1 is simply theory T2. He thus asserts that:

Thus the crucial element in falsification is whether a new theory offers any novel, excess information compared, with its predecessors and whether some of this excess, information is corroborated. Justificationists valued "conforming" instances of a theory; naïve falsificationists stress "refuting" instances; for the methodological falsificationists it is

[1283]*Idem.*
[1284]Imre Lakatos, *Methodology of Scientific Research Programme,* p. 35.

the rather rare-corroborating instances of the excess information which are the crucial ones. These receive all the attention.[1285]

To sophisticated falsification then, falsification is not the necessary condition of the growth of the growth of science. This is because in a problem shift, theory T2 can subsume theory one T1. What plays a role in the growth of science is the proliferation of theories. While Popper talks of counter-examples are falsifying instances, Lakatos talks of the proliferation of better theories as the only necessary falsifying instances. The logical originality of Lakatos' sophisticated falsification resides in its syncretical role. This is because it blends several traditions of philosophy. Lakatos in a syncretical tone asserts that: "From the empiricist it has inherited the determination to learning primarily from experience. From the Kantian it has taken the activist approach to the theory of knowledge. From the conventionalist, it has learned the importance of decision in methodology."[1286]

Lakatos does reject the conjectural nature of theories but does not opt for justificationism. To him, induction involves justificationism and it is thus not tenable because it demonstrates how a theory can be confirmed but does not show how a theory can be refuted. However, sophisticated falsification is a dialectic between confirmation and falsification. That is:

For sophisticated falsificationists, learning about a theory is primary learning which new facts it anticipated: indeed, for the sort of Popperian empiricism I advocate, the only relevant evidence is the evidence anticipated by a theory, and imperialness (or scientific) and theoretical progress are inseparably connected.[1287]

A glaring example Lakatos gives in the history of science is in Einstein and Newton theories. Popper asserted that one of the reason that Einstein's theory is better than that of Newton is that Newton's was refuted by counter-examples that Einstein's' theory corroborated. To Lakatos, this is not adequate because the pre-eminence of Einstein's theory is better than Newton's theory and also predicted new facts that Newton did not. For instance,

Forbade events like transmission of light along straight lines near larger mass about which Newton's theory had said nothing but which had been permitted by other well-corroborated scientific theories of the day; moreover, at least some of the unexpected excess Einsteinian content was in fact corroborated.[1288]

[1285]*Ibid*., p. 36.
[1286]*Ibid*., p. 38.
[1287]Imre Lakatos, *Methodology of Scientific Research Programme,* p. 38.
[1288]*Ibid*., p. 39.

Thus, Newton's theory was never falsified but it was simply subsumed by that of Einstein. One of the logical advantages of sophisticated methodological falsification is that it is less conventional compared to naïve; falsification. The interconnection of a series of theories constitutes what Lakatos calls scientific research programmes. The logic of scientific discovery is thus that of scientific programmes. Scientific rationality consists in the evaluation of scientific research programs. This is realised in the examination of the progressive and degenerating problem shift within finite series of scientific problems. The methodological feature of the research programmes are the rules of research. That is, "The programme consists of methodological rules: some tell us what paths of research to avoid (Negative heuristic) and others what paths to pursue (positive heuristic)."[1289] While negative heuristic are rules that forbids the refutation or criticism of the "hard core" of the theory, positive heuristic are rules that direct the scientist to resolve anomalies by criticising the protecting belt" of the research programme. While the hard core consists of the basic axioms of the programme, the protective belt refers to the auxiliary hypotheses that can be altered to solve anomalies arising from the programme. To illustrate how the "hard-core" and "protective belt" interplay in scientific research programmes, Lakatos makes recourse to Newton's scientific research programme. That is; "In Newton's programme, the negative heuristic bids us to direct the modus tollens from Newton's three laws of dynamics and his law of gravitation."[1290] Thus, researchers of Newton's research programme make negative heuristic not to attack the hard-core of the programme.

The resolution of anomalies using positive heuristic is never all-encompassing but it proceeds in a piecemeal manner. Theoreticians put anomalies at random but resolve them orderly. The positive heuristic thus attacks the auxiliary hypotheses and thus; "[…] consists of a particularly articulated hints on how to change, develop the 'refutable variants' of the research – programme how to modify sophisticated programme, the 'refutable protective belt."[1291] For instance, when the observation of the motion of the moon did not match with the Newton's basic laws, it was understood simply as the distortion of the atmospheric situations or as a product of the errors of interpretation. The protective belt defends the hard core and changes according to changes in observation.

Karl Popper distinguished between the psychology and the logic of scientific discovery. While the psychology deals with the question of the invention of theories, the question of logic

[1289]*Ibid*., p. 47.
[1290]Imre Lakatos, *Methodology of Scientific Research Programme*, p. 48.
[1291]*Ibid*., p. 50.

deals with the appraisal of theories. Lakatos replaces this distinction with the distinction between methodology and heuristic of research. As such: "A methodology in this sense is a solution to Popper's demarcation question, that is, a specification of the logical features characteristic of science. A heuristic is a set of problem – solving techniques for scientists in a particular research programme."[1292]

At the level of methodology, a theory is scientific when it is progressive. This is Lakatos demarcation between science and non-science. However, heuristic determines the testing of a programme as they vary from one theory to another. Testability to Popper implies the rejection of theories but this is not the case in Lakatos. That is why a commentator of Lakatos asserts that: "Hence, Lakatos makes more sense than Popper out of the fact that when all the available theories in a some field are deeply flawed, scientist may on their least lousy theory in spite of its shortcomings."[1293]

With these attempts to divert from Popper, Lakatos seem more destructive than corrective as most commenters claim as others hold that Lakatos is practical Popper. That is:

> *Thus Lakatos, by shifting the whole problem of the evaluation of scientific theories from evaluation problem of a single theory to an evaluation of a series of connected theories (so called by Lakatos, "Research programme") suggests a better criterion of "demarcation and falsification than the Popperian one.*[1294]

Though a student of Popper, Lakatos was a contemporary of Popper, Popper acknowledges his role in the production of his works but criticises Lakatos for misunderstanding him. To Lakatos' criticism of Popper for privileging elimination instead of appraisal. Popper asserts that: "It is true that I have used the terms 'elimination' and 'rejection' when discussing 'refutation'. But it is clear from my main discussion that these terms mean when applied to a scientific theory, that is, eliminated as a contender for the truth – that is, refuted but not necessary abandoned."[1295]

Though Popper makes his point firm, this pragmatic note has not had such insistence in main works. There is thus the acknowledgement of the pragmatic element which require a demarcation between the falsification of a theory and the usefulness of such theory. Popper goes ahead to assert that: "that Einstein regarded relativity as false, yet as a better approximation to the truth than

[1292]Brendan Larror, *op.cit.*, p. 53.
[1293]*Ibid*., p. 57.
[1294]Pantelis Nicolapoulous, Kostas, Garr-O Glu, Yorgos Goudaroulis, *Imre Lakatos and Theories of Scientific Change*, London, Kluwer Academic Publishers, 1989, p. 161.
[1295]Paul Arthur Schilpp, *Philosophy Of Karl Popper*, p. 1009.

Newton's gravitational theory. He certainly did not 'abandon' it. But he worked to the end of his in an attempt to improve upon it by way of a further generalisation."[1296]

This is Popper's reply to Lakatos. We can then talk of a Lakatosian Popper and the question that is unanswered is, when is a falsified theory useless? Or when it is abandon? Popper does not give another answer than when it is falsified. This is begging the question. Lakatos' pragmatic answer is that, a theory is abandoned when a better one that is progressive both theoretically and empirically emerges.

Given the pragmatic limitations of Popper and the logical insufficiencies of Lakatos, we can talk of progressive critical falsification. To give its basic tenets, it is important to indicate that Popper talks of science as an independent activity of individual scientists but Lakatos talks of science as a research programme. That is why Popper developed his methodological falsification and Lakatos talked of sophisticated falsification to satisfy their respective domains. In progressive critical falsification, we agree with Popper that knowledge is conjectural. We also accept with Popper that making bold conjectures and testing their corroboration is the motivation of testability in science. However, progressive critical falsification does not agree that scientist in every case test theories with the aim of eliminating them. Scientists want more of successfully tested theories for practice.

Instead of sophisticated falsification of Lakatos that combines a series of theories, we instead talk of progressive units. This is because to as research programmes simply refers to the same theory put in different episodes of its progress. For instance, what Lakatos calls Newton's research programme is simply Newton's theories put in its progressive history. Thus, progressive units seem more suitable to Lakatos' research programmes. However, we adopt theoretical and empirical progress as the cause of scientific revolution as Lakatos asserts. It can be argued with Popper that some theories are falsified using counter-examples. However, it should be noted that we can talk of theoretical and progressive shift or progress only if the two theories have the same problem situation and background knowledge. If not, instead of theoretical and empirical progress from on theory to another, we talk of theoretical and empirical progress from one unit of a progressive shift to another.

[1296] *Idem*.

8.3.2. Positive Metaphysics as a Response to the impertinence of the problem of Demarcation

It is in the quest to give logical groundings for demarcation related problems in practical life that Massimo Pigliucci and Maarten Boudry propose a change from the criterion of demarcation to the criterion of the definition, given the heterogeneity of the various sciences. To them, we cannot demarcate between the whole of science and pseudoscience. Instead of the terminology "demarcation" which somewhat connotes a radical destruction, they propose soft core demarcative approaches such as: "'delimitation', 'delineation' or even just 'distinction', or we may simply redefine the concept of demarcation and accept this as an example of conceptual change."[1297] This soft core demarcation criterion is relative to the different types of experimental sciences. The essence is not to define the conditions for the absolute autonomy of science from non-science but to set rules for their distinction for practical purposes. For instance, we can develop the conditions for the distinction of astronomy which is scientific from astrology which is pseudoscientific. Even though this position seems practical, we will suggest another way to overcome the problem of the demise of the criterion of demarcation which consists in answering the question, what type of metaphysics is important in science? This thus calls for a demarcation between the scientifically useful metaphysics, which will call 'positive metaphysics' and strictly speculative metaphysics that has no direct impact on science, and we thus qualify it as 'negative metaphysics'.

The concept of "positive metaphysics" is not new in philosophy. Henri Bergson in a conference on the 2nd of May 1901 in front of the French Society of Philosophy proposed a project of "positive metaphysics". According to Jean Gayon, Bergsons motivation was the observation that, "there is no absolute frontier between science and philosophy: philosophers should feel free to discuss with scientists, the content of scientific knowledge."[1298] In the same way, Henri Bergson asserts that "I see metaphysics as a science that is in its own empirical progressive, obliged like other positive sciences to present the results of its attentive study of reality as merely provisional."[1299] The positivity of metaphysics to Bergson then is rooted in his claim that the metaphysical reality is not static and as such the results of its studies should be tentative. This metaphysics to him is based on the constant contact of the knowing subject with the reality. As

[1297]Massimo Pigliucci and Maarten Boudry, *op.cit*., p. 41.
[1298] Jean Gayon, "Bergson's Spiritualist Metaphysics and Science", in *Continental Philosophy Of Science*, ed. Gary Gutting, Oxford, Blackwell, 2005, p. 45.
[1299] Henri Bergson, "Psychophysical Parallelism and Positive Metaphysics in Gary Gutting Ed., *Continental Philosophy Of Science*, Oxford, Blackwell Publishing, 2005,p. 3.

such, "it requires that our faculties of observation be so trained that they sometimes surpass themselves."[1300]

To Bergson, philosophy is an attempt to make experience to be deeper. In this way, a commentator of Bergson, holds that in philosophy we seek to deepen our experience of the real. In this way, a commentator of Bergson affirms that: *« la métaphysique positive consiste à confronter, avec les données et les théories scientifiques des conclusions tirées de la réflexion sur l'expérience approfondie, appelée 'intuition'»*.[1301] Bergson's intuitionism undermines Kants restriction of knowledge to space and time, frustrating the attempt to attain absolute knowledge and subjing reason into antinomies. Intuition to him is a form of experience, where we enter into the thing rather than going around it.

While science to Bergson studies the real using the intellect, a true knowledge of the real is intuitive and we can only attain t through metaphysics. Science and metaphysics to him then are two correlative instances of our knowledge of the world. That is why he affirms that "we have on one hand science and mechanical art, which have to do with pure intellect; on the other hand, metaphysics, which calls upon intuition"[1302] True experience of the real then is metaphysical. Bergson in this way insists that "a true empiricism is the one which purposes to keep as close to the original itself as possible, to probe more deeply into its life, and by a kind of spiritual *auscultation*, to feel its soul palpitate; and this true empiricism is the real metaphysics"[1303]

By positive metaphysics then, Bergson is not advocating for a metaphysics that is based on quantitative, measurable, and concrete knowledge but he is instead advocating for a new approach to the study of the real philosophy to him should abandon pure conceptualisation and base reflection on our experience of the reality. His positive metaphysics then is at the level of the attitude to be adopted in studying science and philosophy. He insists that:

> *We need to break out of mathematical frameworks, to take account of the biological, psychological and sociological sciences, and on this broader base construct a metaphysics: that can go higher and higher through the continual, progressive and organized efforts of all philosophers, in the same respect for experience.*

[1300] Ibid, p. 67, pp. 59 – 68, p. 64.
[1301] Matsui Hisashi, La « métaphysique positive » de Bergson et la Pensée Positive en France au 19ème Siècle, in *Tetsugak*, vol. 1. ,The Philosophical Association of Japan, 2017, pp. 58-72, p. 67. "Positive metaphysics consists in confronting data and scientific theories with conclusions drawn from the reflections on profound experience, called 'intuition'"; (my translation).
[1302] Henri Bergson, *The Creative Mind, Trans.*Mabelle L. Andison, 1946 Philosophical Library, New York, p. 92
[1303] *Ibid.*, p.206.

It is thus evident that Bergson's "positive metaphysics" is a call for an integrative study of the reality, where philosophers incorporate the scientific views in their reflections and in which scientists also consider the experiences that undercut the various philosophical views of the real. Our approach is different from that of Bergson, in that we do not only advocate for the interaction between metaphysics and science but we also attempt to develop the content of "positive metaphysics." Our view is based more on the object (content) and practice (methods) of science and metaphysics.

The notion of positive metaphysics is also implicit in the collective publication of three Cameroonian philosophers; Joseph Teguezem, Roger Mondoué, Betrand Nzogang Nguemeu. According to them, the logical positivists' ambition of eliminating metaphysics is impossible because the epistemological value of the latter is incontestable. To them, the metaphysical method is neither solely metaphysical nor solely abstract but simply 'abstro-empirical'. It is abstract when metaphysics goes beyond the physical world to study purely abstract notions and it is empirical when it focusses on the physical world and its objects. By this, they thus have the philosophical intuition of the distinction between 'positive and 'negative metaphysics', and that i why they assert that :

> *« S'agissant de la méthode métaphysique, elle n'est ni abstraite, ni empirique, mais abstracto-empirique. L'abstrait et empirique sont ses deux pôles méthodologiques. Seulement, elle active chaque pôle en fonction du type d'objet qui l'intéresse à un moment précis – par exemple, le pôle abstrait est mis en braule lorsqu'il. S'agit d'examiner les questions relatives à Dieu, à l'âme, à la liberté. Et c'est là où le métaphysicien exerce le talent de raison pure ou de l'intention intellectuelle. Le pôle empirique est implémenté quand il s'agit d'un objet réel »*[1304]

The demarcation between positive and negative metaphysics is not strange in Popper's scientific rationality. Popper lightly highlighted on this when he differentiated between metaphysics as metaphysical research 'programmes' and 'irrefutable metaphysical doctrines'. Metaphysical research programmes can be termed as positive metaphysics because they play a heuristic role in the development of science. For instance, atomism in ancient Greek philosophy

[1304] Joseph Teguezem, Roger Mondoué, Betrand Nzogang Nguemeu, « Rudolf Carnap Et La Mise A Mort De La Métaphysique Dans Le Monde », p.159. "Concerning the metaphysical method, it is neither abstract no ris it empirical, but it is abstro-empirical. The abstract and the empiirical are two methodological poles. Just that, it activates each pole depending on the type of the object that it is interersted in, at a precise moment. For example, the abtract pole, is put into work when it is a question of exammining questions relative to God, the soul, to freedom. And it is there that the metaphysician exercises his talent of pure reason or of the intellectual intuition. The empirical pole is implimented when it cncerns a real object"; (my translation).

that paved the way for the modern atomic theories. Negative metaphysical theories are in irrefutable theories that have no link with the factual world such as nihilism, and idealism.

When we talk of "positive" we, are not implying the positivistic semantic view of logical positivism but we are simply implying "positive" as new epistemic value of scientifically useful metaphysics. Positive is thus a pragmatic value and positive metaphysics is a scientifically pragmatic metaphysics. As for negative metaphysics, we do not imply the scientifically biased and pejorative view of strictly speculative metaphysics by naturalism. Negative metaphysic may be useless to science but it is important for abstraction and equally useful in moral and aesthetics.

Naturalist motivated philosophers instead of asking the question, which metaphysics is useful in science have instead engaged into the biased question, when can metaphysics be considered scientific. This is the error that Emmanual Kant seems to have committed in his criticism and in his *Prolegomena to Any Future Metaphysics*. Kant concluded by using Euclide geometry and mathematics to demonstrate synthetic *apriori;* knowledge as a possible metaphysics. Such position became unfamous with the crisis in mathematics and the discovering of the post-Euclidean geometry. Moreover, he expressed agnosticism towards objects of 'negative metaphysics' like God, the soul and the idea of the origin of the universe.

While negativist metaphysics is not only non-naturalist, but it is purely speculative and has no immediate interaction with experience, positive metaphysics is realist and determines experience and the way science studies objects in experience and the way science interprets its results. We can classify positive metaphysics into analytical metaphysics and metaphysics of modality. Analytical metaphysics deals with the *apriori* Presupposition of scientific research. Katherine Hawley describes analytical metaphysics as follows:

> *Analytic metaphysics is in resurgence; there is renewed and vigorous interest in topics such as time causation, persistence, parthood and possible worlds […] once widely discussed example is the apparent conflict between the special theory of relativity (SIR) and presentism, the view that only what is present exists.*[1305]

Analytical metaphysics thus deals with the categories of scientific objects. Scientific objects can exist in time and place, can exist in part or as a whole and can also exist as a cause or an effect. Besides this ontological dimension, analytical metaphysics engages into reflections that influence the orientation of scientific research. Taking the example of the debate between the special

[1305]Katherine Hawley, "Science as guide to metaphysics" in *Synthese*, vol. 149, no. 2, New York, Springer, 2006, pp. 451-470, p. 451.

relativity theory and the theory of presentism, we realise how tenable our position is. According to relativism, space and time depend on objects and various events. Space and time to relativism do not exist by themselves as they are reduced to mere relation. This is the view that was defended by Leibniz and Newton defended the theory of absolute space and time. This in analytical metaphysical view called substantivalism. It holds that, "space and time exists independently of physical objects and processes and are prior to them."[1306] Newton's view on space and time is thus a form of substantivalism. Einstein's idea on space-time is a form of substantivalism also because he conceives the two as existing in four-dimensional while. Space has three geometric dimensions that are independent of each other. They include length, width and the breath. Science is thus dominated by substantivalism.

Another debate on analytic metaphysics is between presentism and eternalism. This debate concerns the ontological status of the categorisation of time. It seeks to find out if the past, the present and the future are real entities. According to "presentism, only presently existing things are real."[1307] According to eternalism on the other hand, "The past, the present and future are real."[1308] These questions on space and time by analytical philosophers infringe with the practice of science. Scientific investigations involve questions: "Quality, quantity, causality, change and energy? What is the ultimate constitution of bodies, of protons, of electrons and of matter? These are metaphysical questions and scientist do study them."[1309] Thus, analytical metaphysics is useful in science because it deals with the metaphysical presuppositions of science and also reflect on debates that are interwoven with the scientific study of the real in science. It is also a kind of metaphysical realism.

The second type of positive metaphysics is the metaphysics of modality. Mark Sinclair asserts that: "The modal notions are those of possibility and necessity, together with notions of impossibility and contingency, and the metaphysics of modality as commonly understood, concerns the grounds or truth-conditions of statements containing these notions."[1310]

In common life, actuality and possibility can be represented in the following statements. For instance, that there could be more professors of philosophy than they are. The "there could be"

[1306]Matteo Morganti, *Combining Science And Metaphysics*, New York, Palgrave Macmillan, New York, 2013.
[1307]*Ibid*., p. 122.
[1308]Craig Callender, *The Oxford Handbook Of Time*, New York, Oxford University Press, 2011, p. 2.
[1309]Ochulor Chinenye Leo, Apebende Stephen, Atah, Metuondu Iheauacho Chukwuemeka, "The Necessity Of Metaphysics*", in American Journal of Social Sciences and humanities*, vol. 1, no. 2, open access, scholarly resource publishers, 2011, pp. 35-49, p. 39.
[1310]Mark Sinclair, Mogens Loerke, Feuenberger Stephen and others, *The Actual And The Possible, Modality And Metaphysics In Modern Philosophy*, New York, Oxford University Press, 2017, p. 1.

refers to possibility and "they are" refers to actuality. Others include; that we can get to Douala through a number of ways. That a mirror might break if it falls. That though there could be unicorns we have not yet established their existence. Possibility is thus a state of affaire which does not occur anyway but its occurrence is thinkable. In this way, the metaphysics of modality breaks away from traditional metaphysics and studies the actual world as one of the possible worlds. Craig Callender describes this revolution in metaphysics of modality as he holds that:

> *In metaphysical modality, metaphysics has found the subject matter over which it has "exclusive claim". Notice the subtle change of emphasis from earlier metaphysics. Prior meta-investigations were primarily directed at providing reasons for believing that the actual world has particular entities or properties in it, for example God, substantial space, creatures with free will, a moving now. Today, so limited a concern is passé. Metaphysics is after something bigger and more abstract, the structure of metaphysical modality. What it investigates can tell us about the actual world, but only-'individually' – because the actual world is one possible o many worlds.*[1311]

Eventhough Criag Callender talks of a revolution from traditional metaphysics to the metaphysics in terms of the change of the subject matter, it will be consistent to talk of distinction instead between non-naturalist metaphysics and metaphysics of modality. This is because the notion of modality is not so recent as Lebniz developed it extensively in the 18th century. Craig Callender's intension is to naturalise metaphysics, a biased epistemological attitude that we are avoiding.

Scientific hypotheses, presuppositions, axioms are of the possible world, when they are not yet tested. It is difficult to build knowledge in any domain without presuppositions. Thus, the actual world of science can be understood as the as the concretisation of the metaphysically possible world. That is why Edward Jonathan Lowe affirms that: "but given that metaphysics has told us this, experience can then tell us which of various alternative metaphysical possibilities is plausibly true in actuality."[1312]

Experience can only confirm the actualisation of the metaphysical possible through science. Actuality in science is then the interpretation and verification of the possible in metaphysics. Another metaphysical possibility that has been interpreted in the history of science is that of the possibility of two events happening at the same time in the same frame of reference. Einstein provided an answer to the actuality of such possibility. Lowe situates this as he asserts that:

[1311]Craig Callender, Steven French, Juha Saati and others, *The Continuum Companion To The Philosophy Of Science*, London – New York, Continuum International Publishing Group, 2011, p. 40.
[1312]Edward Jonathan Lowe, *The Possibility of Metaphysics*, New York, Oxford University Press, 2001, p. 9.

> *Einstein's theory makes certain fundamental claims about time – for instance, that simultaneity is relative and that the velocity of light cannot be surpassed but that it does indeed concern time, and that in having such concerns, something whose reality is possible, are metaphysical questions which no merely scientific theory of this sort can settle.*[1313]

The defend of the actualisation of the metaphysical possible has led to what David Lewis calls modal realism. On the question why there are many worlds, Lewis provides a strictly theoretical response. He holds that this is possible:

> *Because the hypotheses is serviceable and that is a reason to think that it is true. The familiar analysis of necessity as truth at all possible worlds was only the beginning. In the last two decades, philosophers have offered a great many more analyses that make reference to all possible worlds, or to possible individuals that inhabit possible worlds. I find that record most impressive.*[1314]

What is more impressive is that this metaphysics of monadity is intrinsic in both the philosophies of some logical positivists and Karl Popper. In A. J. Ayers' distinction between practical verifiability and verifiability in principle, he holds that the latter is when we lack the means to observe a matter of fact but it is possible to conceive such experience. He gives his famous example of, "there are mountains on the farther side of the moon."[1315] Ayer thus, to avoid the burden of proof of conclusive verification, Ayer acknowledges the thesis of the possible world. In his theory of types, Russel asserts that existence is the possible. He thus refers to the world as a class of all possible things. The notion of possibility is also evoked by Schlick in his view of verification. According to him, "verifiability means possibility of verification."[1316] It may be argued that he is referring to logical and not metaphysical possibility but given that such possibility is rendered actual through the observation of a state of affairs makes it metaphysical. Schlick's view becomes closest to metaphysics of modality when he insists that: "I call a fact or a process logically possible if it can be described, that is, if the sentence which is supposed to describe it obeys the rules of grammar we have stipulated for our language."[1317]

He later expressed the metaphysics of modality when he asserts that verifiability is not exhaustive and thus the notion of possibility. He restated Ayer's example, "There are 10.000ft

[1313] *Ibid*., p. 13.
[1314] David Lewis, *On The Plurality of Worlds*, Oxford, Clarendon Press, 1986, p. 3.
[1315] Alfred Jules. Ayer, *Language, Truth and Logic*, p. 17.
[1316] Moritz Schlick, "Meaning and Verification", p. 347.
[1317] *Ibid*., p. 349.

mountains on the far side of the moon."[1318] To Schlick, if science improves on her technical setup, a lot of possible propositions will be verified.

Karl Popper equally develops the metaphysics of modality in his book, *The World of Propensities.* Popper'' propensity interpretation of quantum physics presents propensities as real things but which are not yet actualised. He holds that, "propensity, it is assumed, are not mere possibilities but are physical realities. They are as real as forces, or field of forces. And vice versa: Forces are propensities."[1319] It is clear that Popper assumes the realist view here to avoid the traps of indeterminism and instrumentalism. This is because, if these propensities are not yet actualised as he asserts, then it is not logical to give them the status of real existing things. Besides, Popper did not carry out an experiment to demonstrate the reality of propensities. He may interpret them as having independent natures but to affirm that they are physical is seemingly a sweeping scientific claim. Thus, it is logically tenable to interpret these propensities as real entities of a possible world. This is how the metaphysics of modality arises in Popper's philosophy.

From the above development, it can be deduced that the demarcation between "negative" and "positive" metaphysics is an advanced solution to the problem of the demise of metaphysics. "Positive metaphysics" involves both analytical metaphysics and metaphysics of modality which influences the development of science. "Negative metaphysics" on the other hand refers to traditional speculative metaphysics or pure ontology that is not having direct relationship with experience and thus play no role in the development of science. Positive metaphysics goes beyond simple and pure naturalism because it does not engage into a bias naturalism of metaphysics. It is not then essentially antithetical to negative metaphysics because their distinction is at the level of their influence in the development of science. Positive metaphysics therefore, recognises the methodological autonomy of both science and metaphysics but concludes that there is an influence of metaphysics on science at the level of their interventions in the study of the reality.

[1318]Moritz Schlick, *Positivism and Realism*, p. 41.
[1319]Karl Popper, *A World of Propensities*, p. 12.

CHAPTER NINE:

THE SOCIAL, PEDAGOGIC AND THE AFRICAN IMPLICATIONS OF POPPER'S RATIONALITY OF SCIENCE

> *Reason, like science grows by way of mutual criticism, the only reasonable way of 'planning' its growth is to develop those institutions that safeguard the freedom of criticism, that is to say, freedom of thought.*[1320]

9.1. THE ETHICAL AND POLITICAL IMPLICATIONS

At this level, we are going to examine the social implications of popper's scientific rationalism. Given that rational discussion has bearings on intersubjective criticism and tolerance, the ethical challenge then becomes that of examining the contribution of rational discussion to the development of the discursive axiological values of tolerance, freedom and peace. Moreover, rational discussion and tolerance are only possible in an open society. The political implication of the open society then becomes the necessity of liberal democracy. Thus, the question that animates this sub-chapter is, what are the ethical and political implication of popper's scientific rationalism?

9.1.1. Rational Discussion as the Basic of Tolerance, Freedom and Peace

Tolerance, freedom and peace are moral values that guarantee harmonious coexistence. However, it appears somewhat strange to like Popper's philosophy of science to ethics. This is due to two reasons; firstly, Karl Popper has not committed a single text for moral and secondly, "most of Popper's counsel lies in scattered remarks and occasional paragraphs."[1321] Such scepticism towards a moral implication of Popper's scientific rationality will be overcome in the following analysis. Over main contention here then is to demonstrate that the moral values of tolerance, freedom and peace are the axiological products of the social orientation of Karl Popper's rationalism. Such attempts to draw the moral implications of Popper's thoughts also constitutes what Jacques Chatué in the Cartesian tone refers to science as an incontestable arm that directs modernism. To him, science should not be separated or radically opposed to moral as he asserts that:

> « *Le profondeur rationaliste de l'épistémologie l'enrégimente dans une réduction éthique de la science, qui déviant alors participante d'un même effort de soi contre soi, d'une même transcendance des préjugés, d'un même continuum axiologique, dont dérive la*

[1320]Karl Popper, *The Open Society and Its Enemies*, p. 214.
[1321]Alan Musgrave, Zuzana Parusnikovia, Robert S. Cohen, *Rethinking Popper*, p. 329.

grande séparation entre rationnel et irrationnel, dont on doit se démettre pour mieux comprendre la réalité des sciences, pour accéder aux fondement les plus subtiles de la hiérarchie des cultures, et pour mieux justifier la morale et l'Etat. »[1322]

To talk of the social implication of Karl Popper's rationality, it is important to evoke Popper's view of moral realism. By moral realism, we imply we do not only to the character through which, "[…] moral realism aspires protecting the objectivity of ethical judgement"[1323], but we also refer to Popper's defence of the autonomy of ethics from Natural and social sciences such as sociology. This autonomy is asserted in his critical dualism, in which he differentiates between facts and decisions in the context of making norms. Popper asserts that: "so much concerning the dualism facts and decisions, or doctrine of the autonomy of ethics, first advocated by Protagoras and Socrates."[1324] Ethical norms to him are man-made and are normative while sociological laws are factual and descriptive. He differentiate the two explicitly as he asserts that:

By speaking of sociological laws or natural laws of social life, I do not think so much of the broad developmental laws in which historicists, Plato for instance, are interested, although of there are many any such developmental regularities, their formulations would certainly fail under the category of sociological laws, nor do I think so much of the laws of "human nature", i.e. of psychological and socio-psychological regularities of human behaviour.[1325]

Talking of ethics then is not to engage into historicists' view of the way the society is determined to function. Sociological laws are natural and are claimed to determine the social functioning in an involuntary way. For instance, Plato view that the state originates from self-insufficiency and that this conditions the manner in which the society is organised and administered is sociological and not ethical. Unlike closed or determinist like those of Plato and Hegel that opts for naïve monism by making no distinction between natural and normative laws, Popper proposes critical dualism which separates facts from decisions as the prolegomena for the ethical underpinning of an opened society.

Talking about rational discussion at this level is not to examine the role of reasoning in science but we are referring to the social manifestation of reason through dialogue. Popper at this

[1322]Jacques Chatué, *Épistémologie Et Transculturalité, Tom. 2*, Paris, Harmattan, 2009, p. 149. "The rationalist depth of the epistemology recognises the ethical reduction of science, which then becomes participatory in the same efforts of the self against the self, of the same transcendence of prejudices, of the same axiological continuum, where we derive the great separation between the rational and the irrational which which one has to come out of his function to bettr under the reality of the sciences, to better accede the most subtle foundation of the hierarchy of culture to better justify moral and the state"; (my justification).
[1323]Simon Blackburn, *Oxford Dictionary of Philosophy*, *op.cit.* p. 241.
[1324]Karl Popper, *The Open Society and Its Enemies*, Vol. 1, The spell of Plato, London, George Routledge and Sons, Ltd., 1943, p. 55.
[1325]*Ibid.*, p. 56.

level asserts that: "when I speak of reason or rationalism, all I mean is the conviction that we can learn through criticism of our mistakes and errors, especially through criticism by others, and eventually also self-criticism."[1326] What we deduce from this definition of social reason is that rationality attains its climax in language and dialogue. It is this light that Stefano Gattee grounds dialogue as the nerve-centre of Popper's rationality. That is:

> *Dialogue is a value to Popper. He views life as a continuous process of problem-solving: Problems arise with life, and there are problems only when there are values. When violence replaces peaceful debates, reason must give in, and we have to fight to establish the minimal conditions for critical exchange.*[1327]

This implies that criticism is a social responsibility and it also grounds the social theory of reason. This theory contradicts the collectivist theory of historicists philosophers like Hegel. Popper states his social theory of reason as he holds that: "Therefore, in speaking of a 'social' theory of reason (or scientific method), I mean more precisely that the theory is an inter-personal one, and never that it is a collectivist theory."[1328]

In *The Poverty of Historicism*, vol.2, Popper expresses the notion of tolerance as he defines rationalism as, "fundamentally an attitude of admitting that 'I may be wrong, you may be right, and by an effort, we may get nearer to the truth."[1329] In conjectures and Refutations, he expresses it in his view of learning by error as he holds that: "the method of learning by trial and error-learning from our mistakes seems to be fundamentally the same whether it is practiced by lower or higher animals."[1330] In all, life is problem solving, Popper expresses fallibility in his definition of social reason. He thus holds that: "when I speak of reason or rationalism, all I mean is the conviction that we learn through criticism of our mistakes and errors."[1331] Due to this fallibility that disposes every humans, Popper in the same text asserts the credo of tolerance as he holds that: "perhaps I am wrong and you are right; anyway we can both hope that after our discussion we will both see things more clearly than before, just so long as we remember that our drawing closer to the truth is more important than the question of who is right."[1332]

These passages prove that fallibilism is the base of tolerance in Popper's rationality. It condemns every human that authoritatively claims the monopoly and the possession of knowledge

[1326]Karl Popper, *All Life Is Problem-Solving,* p. 84.
[1327]Stefano Gattei, *Karl Popper's Philosophy Of Science*, Rationality Without Foundation, p. 84.
[1328]Karl Popper, *The Poverty of Historicism*, vol. 2, p. 214.
[1329]*Ibid*., p. 213.
[1330]Karl Popper, *Conjectures and Refutations*, p. 216.
[1331]Karl Popper, *All Life Is Problem-Solving*, p. 84.
[1332]*Ibid*., p. 85.

and opinions. Fallibilism begins with the recognition of the finitude of our knowledge and the infinitude of our ignorance. It is in this way that Mondoué Roger and Nguemeta Philippe asserts that: *« Popper insiste sur la nécessité de reconnaître l'infinitude de notre ignorance, afin d'accroître notre connaissance. »*"[1333] The claim to the monopoly and possession of knowledge leads to authoritarianism on the part of the individual in question and also commands dogmatism on the part of his interlocutor. Against these two vices, Popper proposes humanity and modesty. Such humanity is grounded on the injunction on everyone to engage into "gladly allowing others to criticise his ideas and by gladly criticising the ideas of the others."[1334]

Unlike scientific rationalism which consist in criticising scientific theories, the social theory of rationalism underscores critical discussion as a duty and right of every human. Certainly, it is a difficult duty but Popper insists it should be "the 'give and take' attitude fundamental to the criticism of the greatest purely human significance. For the rationalist knows he owes his reason to other people."[1335] This is a call for cooperation between individuals in society. Unlike in science where the rationality of testing theory is exclusively the duty of scientists, Popper in his social theory of reason advocates for the disposition of the rationalist spirit by each and every individual. Every individual that engages into a discussion is a potential source of information and argument. Thus, there is need to practice tolerance. This tolerance is the humanistic aspect of rationality as it leads to the "rational unity of man."[1336] It is not unity in a historicist or deterministic way, but unity in communication, argumentation and the growth of human.

Popper inscribes his social theory of reason in the enlightenment program. That is the program of the liberation of humanity as a whole. Popper in the Kantian tone asserts that, "but when I speak of enlightenment, I think above all of the idea of self-emancipation through knowledge, the idea that Kant and Pestalozzi inspired."[1337] Popper at this level gives a new task to philosophers which is to play the role of the actors of enlightenment. The greatest virtue of being an actor of enlightenment to him is the simplicity of language. An actor of enlightenment, does not persuade, convince or use esoteric language. That is, "he does not even want to convince; all the time he is aware that he may be wrong."[1338] A promoter of enlightenment recognises his

[1333]Roger Mondoué and Philippe Nguemeta, *Vérificationnisme et Falsificationnisme. Wittgenstein Vainqueur de Popper?* , p. 87. « Popper insists on the necessity of (recognizing the infinitude of our ignorance, so as to increase our knowledge » (My Translation)
[1334]Karl Popper, *All Life Is Problem-Solving*, p. 84.
[1335]*Idem*.
[1336]Karl Popper, *op.cit*., p. 213.
[1337]Karl Popper, *All Life Is Problem-Solving*, p. 85.
[1338]*Idem*.

fallibility and thus the epistemic independence of the other, in his search for knowledge. An actor of enlightenment in the Popperian sense is a philosopher in the image of Socrates in the ancient Greek philosopher. Just like Socrates used the technique of the Macietics and the dialectical method of discussion, Popper asserts that the advocate of enlightenment does not claim knowledge and, "he seeks not to convince but to arouse – to challenge others form free opinions."[1339] This promotion of self-emancipation is the basis of Popper's defence of freedom of ideas and opinions. Freedom in this context is the ability to form one's believes and opinions, independently of the others. The "rational unity of man", demands the respect of the free formation of opinion "even when he considers the opinions so formed to be fundamentally wrong."[1340]

The freedom of opinion formation and toleration in the society are the bases of peace. Violence and conflict in most social sectors today is caused by intolerance and the refusal to respect the difference. This is more applicable in the social of religion. There is need for religious toleration which should arise, "from a positive understanding that forced religious unanimity is completely worthless; that only free assumed religious belief can be of any value."[1341] The "rational unity" of humans then demands the respect of honest beliefs and the consideration of the opinions of the others. The respect of the beliefs and opinions of the others culminate to the recognition of human dignity. Popper emphasises on this as he states that, "in the word of Immanuel Kant, the last great philosopher of the enlightenment, it leads to recognition of the value of the human person."[1342] In tolerating the opinions of each other, we realise the collective freedom of thought. Popper gives the golden guide to it, which is, "do not do unto others what you would not have them do unto you."[1343] Such freedom of thought becomes a fundamental right and unlike Spinoza who asserts that it is inalienable, "that tyrants, however much they try can never actually wrest from us"[1344], Popper does not agree with it because freedom needs to be disciplined. That is, everyone has his right to his opinions but no one should claim that his opinions are all right. Spinoza views freedom in terms of the possession of thought while Popper conceives it from the communication of thought. Popper's argument is also supported by his contention that, "for without a free exchange of ideas, there can be no true freedom of thought."[1345] If we proceed in terms of the freedom to thought, it will lead to justificationism and authoritarianism. Thus, no one

[1339]Karl Popper, *All Life Is Problem-Solving,* p. 85.
[1340]*Ibid*., p. 86.
[1341]*Idem*.
[1342]*Idem*.
[1343]*Idem*.
[1344]*Idem*.
[1345]*Idem*.

is the measure of his own thought. That is, "to find out whether our ideas are sound, we need other people to try them on. Critical discussion is the basis of free thought for each individual."[1346]

Freedom of thought also has repercussions in the political context. With the political context of coexistence, it becomes impossible to realise unlimited freedom by each and every individual. This is because "If I am free to do anything I want, I am also free to rob others of their freedom."[1347] This is the famous thesis of the paradox of freedom. Faced with this paradox, Kant proposes the limitation of the freedom of every citizen by the state. Popper finds Kant's solution consistent but it does not state the criteria of determining political freedom as a whole. If we limit the understanding of resolution of the paradox of freedom to Kant, it will lead to political absolutism and tyranny. Popper proposes a more adequate solution as he affirms that: "As state is politically free if its political institutions enable its citizens in practice to change a government without bloodshed when the majority wishes such a change."[1348]

This criterion also helps to different between democracy of politically free states and tyranny of a state where there is no freedom. Popper develops four arguments for a free state. The first argument is rooted in his thesis of optimism. This argument holds that a free or a democratic state does not only assure development but it creates a repression-free society. The second argument is based on activism and creativity because free-states, "give our personal abilities a little more influence on our well-being."[1349] The third argument is based on the realisation of easier life. Popper at this level notes that, "The poverty of a democracy or autocracy, for freedom is better than slavery."[1350] This argument x-rays quality life that free states enjoy. The fourth argument is that of responsibility. That is, once citizens of a state opts for a free or democratic state, such choice should be unwavering. That is, "we choose it because it makes possible the only dignified form of human coexistence, the only form in which we can be fully responsible for ourselves."[1351] Democracy is better than other forms of government but it is not the best because if citizens do not have the freedom to change the rulers without bloodshed, it will lead to tyranny. Thus, rational discussion is the basis of freedom.

Popper contrasts the virtues of rationalism with the vices of the social application of irrationalism. The irrational attitude consist in attacking the person's personality instead of his

[1346]*Karl Popper, All Life Is Problem-Solving,* pp. 86-87.
[1347]Karl Popper, *Ibid.,* p. 89.
[1348]*Idem*.
[1349]*Ibid*., p. 11.
[1350]*Idem*.
[1351]*Ibid*., p. 92.

thought. It is a kind of argumentum ad hominum and thus a fallacious attitude. The irrational attitude is also portrayed when emotions take the place of reason in social interaction and communication. Irrationalism proceeds like this, "that we think with our blood, 'with our national heritage', or 'within our class'"[1352] using blood to think creates favouritism and nepotism, using 'national heritage' to think creates intolerance and obstructs integration of people of different nations and using 'classes' to think creates inequality. To make things more explicit, Popper asserts that: "Thus abandoning reason, they split mankind into friends and foes, into those who stand near and those who stand for, those who speak the untranslatable language of our own emotions and passion and those whose tongue is not our tongue."[1353]

Basing social thinking on preference creates social anti-equalitarianism as there is class dominance of the preference and the exclusion of those who do not make up to the criterion of preference. This is an arguable position given that the criteria of preference such as love can be humanistic, "but I maintain that he who teaches that not reason but love should rule opens the way for those who rule by hate."[1354] Thus, on no occasion should humans allow emotions like love be the basis of social thinking for it creates partiality. Love exist because hatred and conflict are realities. Thus, Popper prefers social reason which is tolerant and creates impartiality. So social institutions should be based on the social theory of reason and not on emotions. Popper is so categorical about this, "but I insist that no emotion, not even love, can replace the rule of institutions controlled by reason."[1355] Popper in this way criticises political ideals based on emotions such as the quest to make people happy. This to him leads to utopianism and romanticism on one hand and on the other hand it leads to the imposition of self-values on others. This to him is pure intolerance. We can help others, Popper holds but their happiness will never depend on us. Popper reduces the role of public policy to the resolution of daily problems of, "pain, suffering, injustice and their prevention, these are the external problems of public policy."[1356]

Love should not interfere in public policy because it triggers hatred and it is discriminatory because it applies only to friends and not enemies. Reason on the other hand demands that, "help your enemies, assist those in distress, even if they hate you because love only your friends."[1357] Love can be applied only to friends but towards enemies, social reason is required. Love should

[1352]Karl Popper, *The Poverty of Historicism*, p. 222.
[1353]*Ibid*., p. 223.
[1354]*Idem*.
[1355]*Idem*.
[1356]*Ibid*., p. 223.
[1357]*Ibid*., p. 224.

thus be private while reason should direct public policy. Impartiality that arises from critical rationalism is equivalent to scientific objectivity. Instead of emotion, Popper challenges people to adopt tolerant in listening to the other's argument. As such, "one does not kill a man when one adopts the attitude of first listening to his arguments."[1358] Consequently, "we have not only to listen to arguments but we have a duty to respond, to answer, where our actions affect others.

The need to moderate freedom also leads to the need to moderate tolerance. According to Andrew Fiala: "Instead of inspiring questions, the intolerant aim to stifle debate; instead of provoking wonder, they mask uncertainty with fanatism. Tolerance results from a modest, self-critical understanding of human limitations."[1359] The tolerant and the intolerant cohabit the same society. The problem then is, that of the attitude to be adopted towards the intolerant. Popper refers to this problem as the paradox of tolerance. Popper expresses the paradox of tolerance as he holds that:

> *Unlimited tolerance must lead to disappearance of tolerance, if we extend unlimited tolerance even to those who are intolerant, if we are not prepared to defend a tolerant society against the onslaught of the intolerant, then the tolerant will be destroyed and tolerance with them.*[1360]

Just like the paradox of freedom that is resolved by proposing the criterion of political freedom, Popper elucidates the paradox of tolerance in which the acceptance and respect of the intolerant is suicidal to tolerance. This is because intolerance proceeds with authoritarianism and violence, attitudes that are not favourable for, "tolerance that is closely allied with other virtues such as modesty, generosity and hospitality."[1361] The first altitude to adopt towards the intolerant should be a moderate one strictly bases on argumentations. That is why he asserts that: "In this formulation, I do not imply for instance that we should always suppress the utterance of intolerance philosophies; as long as we can counter them in check by public opinions, suppression would certainly be most unwise."[1362] In the second mode of counteracting the intolerant, Popper proposes the session of intolerant views if the intolerant refuse all rational argument. Such destructive attitude should be treated alongside other crimes against established norms and laws. Popper thus insists that:

> *We should therefore claim in the name of tolerance, the right not to tolerate the intolerant. We should claim that any movement preaching intolerance places itself outside the law*

[1358]Karl Popper, *The Poverty of Historicism*, p. 224.
[1359]Andrew Fiala, *Tolerance and The Ethical Life*, continuum studies of philosophy, London – New York, 2005, p. 1.
[1360]Karl Popper, *The Open Society and Its Enemies*, Vol.1, 226.
[1361]Andrew Fiala, *op.cit*., p. 1.
[1362]Karl Popper, *op.cit*., p. 226.

and we should consider incitement to intolerance and persecution as criminal exactly as we consider excitement to murder or to kidnapping; or as we should consider incitement to the rival of slave-trade.[1363]

The nature of tolerance and the need to defend tolerance against tolerance is also a call for a relaxation of legal systems and moral code. Most of the legal and moral systems are justificationist in nature. This is the same view held by the specialists of Popper as they hold that: "a non-justificationist code of ethics would be much less rigid once we recognise that it is impossible to avoid all mistakes and that we learn from our own and each other's mistakes, then our automatic condemnation of error will become more discriminatory."[1364]

A demand for a less rigid legal and moral systems is consistent with Popper's view of tolerance but the problem of the feasibility and of the standard of such less rigidity remains unsettled. Popper however attempts a pragmatic solution to this by proposing a social engineering project, which consists in making a social scheme to render all citizens to be rational from the social point of view. He refers to it as: "The political demand for a practical social engineering-piecemeal of course of-in the humanitarian sense, with the demand for the rationalisation of society, for its control by reason and for planning freedom."[1365]

The rationalisation of the society does not only imply the adoption of interpersonal criticism but also the grounding of social institutions on reason. The aim of this rationalisation is not only "to protect the freedom of its citizens"[1366] but also to ensure equalitarianism which Popper considers as, "the demand that birth, family connection or wealth must not influence those who administer the law to citizens."[1367] Elsewhere, he insists that: "All these consideration show, I believe that the link between rationalism and humanitareansim is very close, and certainly much closer than the corresponding entanglement of irrationalism with the anti-equalitareanism and anti-humanitarian attitude."[1368]

9.1.2. The Rational Groundings of the Open Society and Liberal Democracy

Popper's political view notably his distinction of the open and close societies and the defence of liberal democracy are based on the social theory of rationality. This is because:

[1363]Karl Popper, *The Poverty of Historicism,* p. 226.
[1364]Alan Musgrave, Zuzanna Parusni-Kovia, Rober S. Cohen, *op.cit.,* p. 143.
[1365]Karl Popper, *Poverty of Historicism,* vol.2, p. 225.
[1366]Karl Popper, *The Open Society And Its Enemies*, vol. 1, 82.
[1367]*Idem*.
[1368]*Idem*.

> *Popper believed that science is the best kind of knowledge for the same reasons that he believed democracy is our best form of government. They have, to date, both shown themselves better than their competitors […] both science and democracy try to change their leaders through rational discussion.*[1369]

Same like theories in science are tested through criticism, the change of leaders in political power should also be a product of rational discussion. Popper also offers an epistemological argument for a philosophical reflection on politics. He argues that social reason grows just like science and that such growth can be promoted and secured only we "to develop those institutions that safeguard freedom of criticism, that is to say freedom of thought."[1370] If we want to promote rational discussion and its fruits like tolerance and peace, we must in turn build a society on rational basis.

The first moment in Popper's development of an open society is in his critique of determinism and historicism as theories of social evolution. According to determinism, the past, present and future are already fixed and we cannot influence or change them. This view that is held by thinkers like Laplace to Popper obstruct human freedom and thus cannot assure man's active construction of his social context. Karl Popper proposes indeterminism according to which: "The past is that region which can in principle be known and the future is that region which, although influenced by the present is always open: it is not only unknown but in principle not fully knowable."[1371] What makes us think for instance that the sun will rise tomorrow from the West is because there is no counter-example yet. In the propensity interpretation of quantum physics, Popper presents our universe as an opened and not a fixed one. He asserts that: "the future is open: it is objectively open. Only the past is fixed; it has gone. The present can be described as a continuing process of the actualisation of propensities – or more metaphysically of the freezing one crystallised of propensities."[1372]

World then is a fixed and precise clock but a network of propensities, such that the ones today can influence the future occasionally but they cannot determine the future in a causal way. An indeterminate picture of the world has serious political repercussions. Popper asserts that, "the aim is a picture of the world in which there is room for biological phenomena, for human freedom and for human reason."[1373] If the future is not open and undetermined, then the creative role of

[1369]Ian Jarvie and Sandra Palong, *Popper's Open Society After Fifty Years – The Continuum Relevance of Karl Popper*, London-New York, Routledge, 1999, p. 43.
[1370]Karl Popper, *The Open Society and Its Enemies*, vol. 1, p. 214.
[1371]Karl Popper's poscripts, quoted by Stephano Gattei, in Carl Popper's philosophy of science, p. 56.
[1372]Karl Popper, *A World of Propensity*, p. 18.
[1373]Karl Popper, *Quantum Theory and The Schism In Physics*, p. 160.

rational discussion and the assertion of human freedom will be an illusion and it will then become difficult to talk of the political outlook of the political outlook of the society. This is because the latter is strictly axiological and cannot be implemented in the context where man is not free, rationally creative and thus morally responsible.

The second theory Popper criticises as a condition for an open society is historicism. Historicism, sociologically tries to impose laws at the basis of the evolution of history. They claim that history has a fixed pattern and thus they can predict the universe. The key figures are Plato, Marx and Hegel. Such predictions are possible in theoretical physics but Popper offers a triadic argument to reject the ascription of predictive power to theoretical history.

The first argument against historicism is an evolutionary one. It holds that, "human history is constantly influenced by the growth of human knowledge."[1374] If history is influenced by human knowledge, then we expect the growth of knowledge to influence the growth of history. Human knowledge is conjectural thus we can also argue that history is conjectural and if human knowledge grows incessantly, then history also grows exponentially. If the conjectural evolutionally character of knowledge are granted together with the impact of human knowledge on history then we can argue with Popper that the future of the human history and the society is open. Theoretical historians are thus not justified in their historicist view of human history.

The second argument against historicism is a logical one. Popper in this argument asserts that: "we cannot predict by rational or scientific methods, the future of the growth of our knowledge."[1375] Testing scientific predictions in the modus tolens techniques, either falsifies or corroborate the theory. Even when the theory passes the test, Popper asserts it should be considered as tentative truth. The fallibilist nature of our predictive power and the falsificationist method of testing theories makes it difficult for us to predict with certainty how our future growth of knowledge shall be. Given that the growth of our knowledge influences history and we cannot ascertain ourselves of the future of the growth of our knowledge, then we are not logically liscenced to predict the future of our society.

The third argument is conclusive of the first two. It holds that existing scientists cannot predict the future of its own states of knowledge. If they do this, "they can attain their results only after the prediction has turned into a retrodiction."[1376] Reflecting on the view of theoretical

[1374]Karl Popper, *The Poverty of Historicism*, p. ix.
[1375]*Idem*.
[1376]Karl Popper, *The Poverty of Historicism*, p. xi.

historians and evolutionary biologists that it is the task of the social sciences to lay bare the law of evolution of society in order to foretell its future"[1377], Popper observes that they confuse between laws and trends or patterns. All laws of nature to him are hypotheses but not all hypotheses are laws. For instance, Darwin's view of evolution holds that: "of certain similarities between various species and genera by the assumption of the common ancestry of relate forms. This hypothesis is not a universal law of nature such as hereditary, segregation and mutation."[1378]

The second moment in Popper's rational groundings of politics is in his notion of the open society. This is a consequent of his critique of determinism and historicism. It is worth noting that Popper intends to transcend utopic political theory, to propose a more pragmatic one. The first clement of distinction between the open and close societies is in their respective grounding on individualism and collectivism. He thus asserts that: "In what follows, the magical or tribal or collectivist society will also be closed society, and the society in which individual, are confronted with personal decisions, the open society."[1379]

The good example of theories of the closed society are the theories of Plato, Hegel and Marx. Plato for instance develops utopic political philosophy, which he hopes to propose the prerequisites for the collective happiness of the citizens. Such happiness to him can be achieved only through justice which is in turn, "based upon the same belief that the society is by 'nature' divided into classes or castes."[1380] Justice is realised when each and every member of the three classes performs his natural function. That is, "the ruler must find happiness in ruling, the warrior in warring, and, we may infer, the slave in slavery."[1381] This is a collectivist and a totalitarian view because it does not only exclude individuals from self-development but it also reduces happiness only to the collective. Karl Marx in the same way asserts that the history of man is that of class-confliction of the economic class they belong to. In Hegel's political absolutism, rationalism, freedom and morality is exclusively incarnated by the state and that individuals can only be rational, free and moral, if they conform to the state.

Karl Popper's insistence on individualism distances himself from most enlightenment narratives. Most of the proponents of enlightenment attempt to define conditions for the collective well beings of humanity. His individualism should not be understood as a kind of subjectivism but

[1377]Karl Popper,*Ibid.,* pp. 105-106.
[1378]*Ibid*., p. 106.
[1379]Karl Popper, *The Open Society and Its Enemies*, vol.1, p. 152.
[1380]*Ibid*., p. 149.
[1381]*Idem*.

as the bases for moral autonomy defended by Kant. It can thus be understood why it is argued that: "his insistence on individualism, ontological, political and methodological was not just pathological. It was bases on a Kantian sense of the rational autonomy of each individual, qua individual."[1382]

Secondly, in an open society members can struggle to take the places of others. It is a kind of class struggle. However, Popper bases the closed society to the organic view of the state. Such biological theory of the state to Popper not assure internal change, reforms and progress. As for the biological view of the closed society Popper notes that: "the call or tissues of an organism which are sometimes said to correspond to the members of the state, may perhaps compete for food; but there is no inherent tendency on the part of the legs to become the brain, or of other members of the body to become the body."[1383]

The closed society does not witness fundamental changes of the institutions. The institutions and classes of such societies are "Sacrosanct-taboos"[1384] and any attempt put such organic theory of the state into practice will unavoidably lead to "veiled form of propaganda for a return to tribalism."[1385] Closed societies value tribes to individuals. The danger her is that it deprives man from his creative role of self-determination and the creation of his own history and political configuration. Popper thus holds that the open societies open the forum for the development of the spirit for the development of the spirit of self-assertiveness and individual initiative. He historically patronises Socrates for being a great proponent of the open society with his putative 'man know thyself' aphorism. Socrates challenges individuals to develop knowledge of themselves paving the way for individualism.

Besides his methodological individualism, Popper develops another pillar of the open society which is enligle-rationalism and optimism. This is developed in his thesis of the rational unity of man developed in the moral interpretation of Popper's rationality above. While the closed society is bound by race, class, religion, among others, open societies exhibit the spirit of tolerance and inter-personal criticism. This follows that collectivist identification in groupings like xenophobia, racism, tribalism, nationalism, among others are not bases for social cooperation in the open society.

[1382]Philip Catton and Graham Mac Donald, *Karl Popper; Critical Appraisal*, p. 189.
[1383]Karl Popper, *op.cit*., p. 53.
[1384]*Idem*.
[1385]*Idem*.

The third pillar of the open society is impartiality. It can be connoted as, "any view may be worth-hearing, whatever its provenance."[1386] In the fourth place, Popper links the open society to his humanism. Popper had fresh memories of the First World War. Having witnessed the sufferings of humanity in the First World War and in the socialist revolutions that took place after the war, Popper opts for a peaceful and non-violent exercise of public affairs. He rejects the attempts by utopian thinkers and idealists to sacrifice the lives and well-being of individuals for the survival of the collective society project. In Popper's view of social change, he opts for reformation and not radical revolution. We can thus make a link between Popper's humanism and Kant's categorical imperative, that man should be treated as an end in himself and not a means to preserve political absolutism.

The fifth element of Popper's open society is the consideration of fallibility in social construction and management. That is,

> *"for Popper believes that the unfettered use of reason is bound to produce truth or absence from error. He is in no sense an epistemological optimist; he is, infact, a fallibilist, one who believes that we can never rule out the possibility of error-even in the best regulated and conducted of inquiries.*[1387]

Unlike the close society who claim to have knowledge to define social ideals for each and every individual, Popper grounds the open society on fallibilism. No one is omniscient and infallible and consequently, rational discussion and tolerance are the only techniques to be adopted for a humane social cooperation.

The third moment of the rational basis of Popper's political view is his defence of liberal democracy. There are two motivations of Poppers choice of democracy. The positive and the negative. Positively, democracy is not chosen by Popper for itself but because it is the most conducive for the establishment and promotion of the open society and its values. Negatively, liberals democracy is meant to overcome the ills of radical socialism and capitalism. Describing the situation, Popper's commentator holds that:

> *His experience in Vienna had convinced him that the dangers of socialism were far more threatening than the problems it was out to solve. But he was also aware of the dangers*

[1386]Philip Cattong and Graham Mac Donald, *op.cit*., p. 191.
[1387]*Idem*.

in unrestrained capitalism-dangers he had learned about, along with the rest of Europe, from of the nine-tenth century.[1388]

Popper was not much interested in politics. However, his rejection of Marxism in 1919 compounded by Hitler's rise to power and the right and left wings movements in the 1920's and 1930's, motivated Popper to reflect on politics. He intends to propose a form of social organisation that can promote the open society on one hand and the development of science on the other hand. In one of Popper's Archive note, he explicitly states his reason as he asserts that:

And it seems to me especially important to realise that, as a rule, democracy will work fairly well in a society which values freedom and tolerance, but not in a society which does not understand these values. Democracy, that is, the majority vote, may help to preserve freedoms, but it can never create freedom if the individual citizens does not care for it.[1389]

The choice of democracy as asserted is not based on the nature of democracy, for Popper is not interested in the essentialist question of definition but on is role.

The plurality of political regimes and their essences does not interest Popper. It is not the question of the best form of government or that of the foundation of political power that should determine the taxonomy of political regimes. Popper proposes the taxonomy that differentiates only between two types of political regimes. The criterion is that of the possibility of the citizen to attain a pacific change of leaders. Using this criterion, he classifies political regimes into two; notably; "those in which it is possible to get rid of a government without bloodshed and those in which it is not possible"[1390] the regime in which citizens can change power peacefully to Popper is democracy and those in which it is difficult to realise pacific power change is dictatorship. Thus, it is not the political framework and its theoretical ideals as advocates of utopic regimes asserts that is important for, "all that counts is whether the government can be removed without bloodshed."[1391] Such pacific change is only possible through elections.

Popper articulates a great revolution on the philosophical questioning of the state and governance. Unlike justificationist and essentialist question of the foundation of political regimes, Popper possess a pragmatic and teleological question of the role of political regime in assuring the freedom of citizens and the pacific change of power. Popper thus insists that:

[1388]Ian Jarvie and Sandra Pralong, *op.cit.*, p. 44.
[1389]Karl Popper, Archive 6, File 6, quoted in Ian Jarvie and Sandra Pralong*, Popper's Open Society After Fifty Years*, p. 45.
[1390]Karl Popper, *All Life Is Problem-Solving*, p. 94.
[1391]*Idem*.

It is therefore wrong to put stress and even later have done on the question: 'who should rule? The people (the proletariat) or even the best? (the good) workers or the (evil) capitalists? The majority? The party of the left, the party of the right? Or the party of the centre? All these questions are wrongly posed. For it does not matter who rules if it is possible to get rid of the government without bloodshed.[1392]

This implies that the choice of democracy is not a matter of necessity but an occasional one for it is chosen as a means to an end and not as an end in itself. The constitution of the democracy defended by Popper is based on rationality for it is at the product of fruitful discussions. It should not then be changed so lightly. Popper thus notes that "constitutions should not be changed lightly, but it is good to discuss them critically, if only so that we remain aware of their importance."[1393]

Karl Popper preceeds to differentiate between two types of democracies; representational and democracy of proportionality. Popper identifies representational democracy to the one practical in the United Kingdom and the United States of America. It is representational. For instance, "In Britain each constituency sends as its representative to parliament the person who has gained the highest number of votes."[1394] Such representation has nothing to do with party identify and thus representation for the collective interest is more important than partisan politics. As such, "if a representative thinks it is in his constituency's (or perhaps the nation's) interest for him to vote against his party, or even to break from it, he has an obligation to do so." An example at hand is Winston Churchill who changed his party twice.

The second type of democracy is that which is practiced in Stern European states and also in the African emerging democracies. It is grounded on partisan representation. In the democracy of proportionality, it is difficult to vote against one's political party for it is party representation and not the representation of local constituencies that matter. Such democracies to Popper, "are not people's governments but party governments – that is, party leader's government.[1395] Popper then notes that multipartism is a danger for the unity of the citizens and the efficiency of power. Thus, proportional representation to him does not assure the well-being of people. Popper identifies this difficulty as he reiterates that, "the more parties there are, the more difficult it is to form a government."[1396] Consequently, instead of a many party state, Popper proposes a dual party state. Since the criterion of the acceptable form of democracy is its guarantee for the easy removal of government when necessary, multipartism is then an obstacle to such humanist political

[1392]Karl Popper, *All Life Is Problem-Solving*, p. 94.
[1393]*Idem*.
[1394]*Idem*.
[1395]*Ibid*., p. 95.
[1396]Karl Popper, *All Life Is Problem-Solving*, p. 95.

formula. This obstruction of government removal stems most importantly from the scepticism of the people towards one of the many parties to gain absolute majority. Even when larger parties loose legitimacy, there will always be a possibility of its illegitimate ruler to form a coalition with another minor party and continue ruling against the consent of people.

Given the negative repercussion of multipartism on the change of power, Popper proposes a two-party democratic system. He insists that: "a form of election that makes a two party system, possible seems to me to be the best form of democracy" for it always lead to self-criticism by the parties."[1397] A two-party system election is thus the most rational for it is the great moment for the defeated party to carryout internal reforms that are most people-centred. Such defeat is synonymous to the erroneous moment in epistemology. Same like fallible epistemic subjects, defeated party members always learn from their mistakes. Popper in this light emphases that; "under such a system, then, parties are from time to time forced to learn from their mistakes or to go under."[1398]

With the inconveniences of the democracy of proportionate representation, Popper proposes representational democracy as practised in Great Britain and in the United States of America. The democracy of propositional representation that is based on the Sovereignty theory of the state is "morally defective and unsustainable. It has been superseded by the theory of dismissal."[1399] The two-party representational democracy does not kill plurality that should go with the open society. This is because when one party wins, the other one will play the role of an effective opposition. Thus, Popper resolves the apparent contradiction between the reduction to the two-party system and the exigency for an open society by arguing that:

> *In reply, I should say that it is the function of the political party either to form a government or, in opposition, to keep a critical watch on the work of the government. One of the things to be critically watched is the government's toleration of various opinions, ideologies and religious (in so far as these are themselves tolerant for ideologies that preach intolerance lose their claim to be tolerated.*[1400]

Thus, with the two-party system, it is easier for parties not only to carry out self-recriticism but to also ensure the realisation of toleration that is necessary for the realisation of different virtues of the open society. The two-party democracy of representation should also protect the state and the individual from all forms of public opinions. Popper identifies two types of public opinions to

[1397] *Ibid*., 96.
[1398] *Ibid*., p. 97.
[1399] *Idem*..
[1400] *Idem*.

be moderated by the state. The first type is the institutionalised form of public opinions and they include: "The press (including letters to the Editor); political parties, societies like the mont pèlerin society, universities; book publishing, broadcasting; theatre; cinema, television."[1401]

They are institutionalised because they are formerly allowed to function in the state. They therefore have a certain degree of authority and need to be moderated because they do not only influence the behaviour of citizens but they can also obstruct the freedom of thought of individuals. The second form of opinions are non-institutionalised. This refers to: "what people say in railway carriages and other public places about the latest news or about foreigners, or about 'coloured men'; or what they say about another across the dinner table."[1402] This institutionalised public opinions, which can become institutionalised represent what Popper calls "the myth of univocal voices"[1403] such myth claims that the voice of the people carries final authority. It is expressed in the terms of enlightenment romanticism such as 'the popular will', the 'volonté generale', 'the spirit of the people.' Popper calls for the control of public opinions because they have but irresponsible form of power and thus are dangerous for a liberal democracy. To overcome the challenges of toleration, Popper sets the bases for an adequate liberal democracy.

The first basis of liberal democracy is the ambivalent role of the state. That is, "the state is a necessary evil: it powers are not to be multiplied beyond what is necessary."[1404] This is synonymous to Ockham's Razor which forbids the multiplication of entities more than the necessary. To ensure justice in the state and curb the excesses of power, Popper does not think that such adventure must be product of a particular theory of the origin of the state. He insists that: "In order to show the necessity of the state, I do not appeal to Hobbe's homo-hominis-Lupus view of man. On the contrary, its necessity can be shown even if we assume that homo homini felis or even that homo homini angelus."[1405]

Instead of proceeding that man is a wolf of another as Hobbes' zoological anthropology of the state of nature holds, we can also asserts that man is a gentle and angelic being to another. Either of these two cannot still erase the disparity between the weak and the strong in the society.

Given that the state is a permanent danger, Popper cautiously brings in his individualism of the open society where in it is not democracy as the collective regime that is necessary but

[1401]Karl Popper, *Conjectures and Refutations*, p. 353.
[1402]*Idem*.
[1403]*Ibid*., p. 348.
[1404]*Ibid*., p. 350.
[1405]*Idem*.

democratic citizens. Democracy provides just a framework for citizens to give the organisation and the coherency that it deserves. Popper insists that: "Democracy as such cannot confer any benefit upon the citizens and it should not be expected to do so. In fact, democracy can do nothing-only citizens of the democracy can act (including, of course, those citizens who compose the government."[1406] Popper's defence of liberal democracy is not based on the majority-rule principle. The majority is not infallible thus the argument for the adoption of comparing with others, "evil ones of which we know."[1407] The liberal tradition then is the less evil ones and thus should ground social institutions. This is because, "institutions are always ambivalent in the sense that, in the absence of a strong tradition, they also may serve the opposite purpose to the intended."[1408] The opposite purpose here is totalitereanian and tyranny. For instance, if the opposition that is supposed to check the excesses of power joins the majority to abuse power, then it becomes an institution serving the opposite purpose. The appropriate liberal tradition to be adopted to Popper should take the form of modest traditions and the traditional denotation to justice, such as in the common law that is applied in Britain and also an impartial judge to evaluate equity in the society. Liberalism to Popper is a form of reformation and not a devotional theory, that is: "The principles of liberalism may be described as principles of assessing and if necessary modifying or changing existing institutions, rather than replacing existing institutions."[1409]

The replacement of the institutions is either a concession to utopic society or a call for revolution which brings in violence. Reformation is thus the best way of managing public institutions such replacement is a product of critical discussions. Liberalists then do not advocate for a perfect society but "hope for the mutual fertilisation of opinions and the consequent growth of ideas."[1410] Such mutual fertilisation of views is possible through intersubjective criticisms and evaluation of institutions. Popper corroborate with this as he insists that: "But the traditions of rational discussion creates, in the political field, the tradition of the government by discussion, and with it the habit of discussion, and with it the habit of listening to one another's point of view; the growth of the sense of justice; and the readiness of compromise."[1411]

When Popper asserts that liberal democracy proceeds with adjustment and readjustment of institutions and not though a revolution, the problem of the appropriate technique of such piece

[1406]Karl Popper, *All Life Is Problem-Solving,* p. 350.
[1407]*Ibid*., p. 351.
[1408]*Idem*.
[1409]*Idem*.
[1410]*Ibid*., p. 352.
[1411]Karl Popper, *All Life Is Problem-Solving,* p. 352.

meal resolution of problem is posed. Decision makes use the trial and error method to solve political problems. Adjustment is a form of trail and readjustment is a kind of error-elimination. This partial and gradual resolution of problems is referred to as piecemeal engineering. Popper states the motivation of piecemeal engineering as: "the use of the term 'social engineering' may now be defended by pointing out that the engineer must use the technological knowledge in these hypotheses which inform him of the limitations of his own initiative as well as of institutions and to reconstruct those already existing."[1412]

Institutions are just like instruments or technological tools to be used to solve social problems. However, the fallibility of human knowledge and the imperfection of the knowledge of these institutions make decision makers to proceed reformation and not radical change. Some of these institutions are businesses of all forms, insurance company, school or educational system, the police force, the church, the court of law among others. It is difficult to plan and program the evolution of these social institutions given their complexity and the fallibility of our knowledge. Thus, utopic socialism and historicist sociologist of programmed and ideal societies. Popper emphasises on this as the asserts that: "the piecemeal technologists or engineering recognises that only a minority of social institutions are consciously designed while the vast majority have 'grown' as undersigned results of human actions."[1413]

These institutions are not only heuristic for the resolution of social problems but they can be reoriented to be used for other services. This does not mean that social engineers should avoid ideals. Ideals do exist but the social engineer does not need them in resolving problems. That is, "he does not believe in the method of re-designing it as a whole. Whatever his ends, he tries to achieve them by small adjustments and re-adjustments which can be continually improved upon."[1414] The utopian or holistic engineering on the other hand strives at "remodelling the 'whole society' in accordance with a definite plan or blue print but they can be reoriented to be. It aims at seizing the key positions and at extending the power of the state until the state becomes nearly identical with society."[1415]

The holistic engineering are thus utopic theories that cannot be effectively practices. However, in piecemeal engineering, the step by step, gradual and partial method of solving problems permits the decision maker to evaluate the consequences of his politics so as to curb

[1412]Karl Popper, *The Poverty of Historicism*, pp. 64-65.
[1413]*Ibid*., p. 65.
[1414]*Ibid*., p. 66.
[1415]Karl Popper, *The Poverty of Historicism*, p. 66.

down its negative effects and aspects. It is also a remedy for the accumulation power. The piecemeal engineering corresponds to the open society while the holistic engineering corresponds to the closed society. As such, Popper holds that: "While the piecemeal engineer can attack his problem with an open mind as to the scope of the reform, the holistic cannot do this; for he has decided beforehand that a complete reconstruction is possible and necessary."[1416]

9.2. THE PEDAGOGIC IMPLICATIONS OF POPPER'S RATIONALITY

The importance of Popper's scientific rationality cannot be overemphasised. Not only does popper intervenes in defining the psychology of learning but he also develops the thesis of conjectural learning. Thus, to examine popper's contribution to the development of pedagogy, we shall proceed in two ways. In the first place, we shall examine the role that error plays in knowledge acquisition in what is known as the pedagogy of error. Secondly, the need to make pedagogic more pragmatic has led to the competency based approach of teaching. Thus, we shall examine the role of popper's rationality to the development of the competency based pedagogic approach**.**

9.2.1. The Pedagogy of Error as the New Responsibility of Teachers

In the behaviour approach to education, error is considered as an obstacle to knowledge acquisition. According to the behaviourist view, "learning can be developed by means of establishing a connection between the stimulus and behaviour and that behaviour can be changed through reinforcement."[1417] According to the behaviourists the human brain is blank during birth and can be developed by his passive contact with the environment. This view is closely related to the empiricist view that the human mind at birth is blank and needs to be filled with knowledge from experience. Through constant conditioning, the behaviourist claims that expected behaviour is maintained. This is the view of Pavlor, Skinner, Watson, Thorndike, Tolman, among other. In a classroom context then, the students passively fill their brains and person alites from teachers, who use reinforcement to impose their teaching expectations on students.

The behaviourist approach to learning has given a pejorative connotation to error. In normal life, it is common to get expression like "error is human", "all men are fallible" but this does not apply same to the behaviourist approach to learning, where error is considered as an obstacle to

[1416]*Ibid.,* p. 69.
[1417]Hasan Bancali, Zeki Kaya, Selcuk Akdemir and others, *Learning and Teaching; Theories, Approaches and Models*, 1st ed., Ankara, Cözüm, 2016, p. 19.

knowledge. The hatred for error is seen in the grading of students and their corresponding motivations. It is also seen in parents' expression of discontentment when children fail exams and also evident in the diligence that teachers take to prepare and deliver lessons so as to avoid error. Error then is a weakness and a sign of incompetence or at the level of both teachers and students.

From Latin, error is a mistake; "delusion", "deceptions" and also to "wander about". It is also called "erratum" which means a "lapse", a "fault" or a "blunder". Karl Popper's critique of the behaviourist approach is expressed in his critique of induction and also in his critique of the bucket theory of knowledge. Popper distinguishes himself from the classical empiricists and behaviourists on learning. He insists that: "It differs from them radically in the assessment of the role which repetition plays in the process of learning and also in the assessment of the role which observation plays in the acquisition of experience."[1418]

His critique of the logical, pragmatic and psychological problems of induction, developed in part two of this work, is conclusive that induction has no logical grounding. This apples same to behaviourism that adapts repetition in its conduction of conditioning. The inductive approach is evident in what he calls the common sense theory of the bucket-mind. According to this theory, all our knowledge originate from the senses. This method of knowing that aims at certitude instead create confusion, given that children cannot decode the experiences of their environment without some innate disposition. Popper criticises Gestalt's view of learning where knowledge comprise of entities and wholes of things that are similar. That is:

> *The primary goal of the Gestalt theory is to encourage the brain to view not just the whole, but also the parts that make up that whole. For example, when someone is looking at a tree, is he just staring at this tree, or does he also see the leaves, the branches, and the trunk? The whole and the sum of its parts are two entirely different things and learning can be achieved if learners are available to cognitively process how parts can make up this whole.*[1419]

In his laws of organisation, Gestalt stipulates that grouping should proceed by four factors which are, proxity, similarity, closure and simplicity. The role of teachers is to motivate students to identify the relation of the elements that constitute the whole. Error in such context is interpreted as the student's intellectual importance to identify the relationship between entities that make up

[1418]Karl Popper, *Realism and The Aim of Science*, p. 39.
[1419]Christopher Pappas, Instructural Design models and theories: Gestalt Theory, available on www.elearningindustry.com; consulted on the 24-09-2020, at 5pm.

the whole. Popper points at the aversion for error in the common-sense theory of knowledge as he holds that:

> *D'après la théorie de sens commun, toute erreur, toute connaissance erronée, provident d'une mauvaise digestion intellectuelle qui altère ces éléments d'information ultimes ou « donnés » en les interprétant mal, ou en les associant à tort avec d'autres éléments les sources, d'erreur sont nos ajouts subjectifs aux éléments d'information purs ou donnés, lesquels à leur tour ne sont pas seulement exempte d'erreurs, mais sont les critères de toute vérité, si bien qu'il serait complétement dépourvu de pertinence de simplement se demander si peut-être ils sont faux.*[1420]

This knowledge that is exempted of error, makes the curriculum to be fixed and the leaners to be passive in the pedagogic activity. This theory thus denies the existence of objective error, claiming that a perfect mind cannot commit errors. In the behaviourist style that proceeds by habit formation, Popper criticises it for the growth of knowledge. That is, "Here, we do not look for any new solution of a problem, but try to become familiar with a solution previously discovered by trial and error."[1421] The example of such pedagogic mechanical repetition is "of learningto play a certain passage on the piano, and that of learning to avoid a fall when riding a bicycle."[1422] Such learning is not to solve any new problem but to acclimatise one's self with already discovered knowledge. Such repetition to Popper makes learning to be boring. That is, "repetition as such cannot attract our attention; rather, it tends to make our expectations unconscious."[1423]

Learning by trial and error elimination constitute the basis of Popper's critical rationalism. It is motivated by his theory of fallibilism which holds that every human is dispose to make errors and on his conjectural view of knowledge. Popper defines the importance of learning by error as he holds that:

> *Learning by trial and error, or by conjecture and refutation, is relevant to the growth of our knowledge; it alone is "learning" in the sense of acquiring new information: of discovering new facts and new problems, practical as well as theoretical, and new solutions to our problems, old as well as new.*[1424]

[1420] Karl Popper, La connaissance objective, pp. 72-73, "According to the theory of common-sense, every error, every erroneous knowledge arise from the bad intellectual digestion which alters these elements of ultimate information or "data" by wrongly interpreting them or wrongly associating them with other elements; The sources of error are our subjective addition to the elements of pure and given information which in their turn are not exempted from error but are the criteria of every truth, which even through it is simply a lack of pertinence to ask if they are false"; (my translation).
[1421] Karl Popper, *op.cit*., p. 42.
[1422] *Idem*.
[1423] *Ibid*., p. 43.
[1424] Karl Popper, *Realism and The Aim of Science*, p. 40.

The dogmatism and pedagogic fixism of inductive methods of learning are avoided as there is a considerable degree of the discovery of not only new skills but also new and alternative ways of thinking. It is not the mechanical and conditional repetition that advances our knowledge, "but something entirely different: our repeated and varied attempts to solve a problem which, unsolved, continues to irritate us."[1425] It is thus creative learning, where the learner himself creates solving problems of different facets. Unlike the inductive ways of learning where repetition is possible even when it fails, Popper holds that the only repeated attempt in learning through error is that which tentatively is successful. It is in this light that Roger Mondoué and Philippe Nguemeta captions the pedagogic connotation of Popper's theory of trial and error as they hold that that:

> *« La méthode par essais et erreurs est instructive, dans la mesure où nous tirons des enseignements de nos erreurs. Ainsi perçue, l'approche progressive de la vérité est heuristique et permet de combattre le dogmatisme et la stagnation de la connaissance. »*[1426]

Trial and error learning does not exclude experience and observation. It is grounded also on systematic observation. Unlike inductive observation, systematic observation, "starts from a problem which we try to solve, or from conjectures which we try to test."[1427] Systematic observation proceed either from a problem or from a hypothesis. That is, in an attempt to carry out any experiment, there is always the criterion of evaluation, which precedes such experiment. Even when there are chanced observations, they do not proceed illogically and accidentally because such observations are unconscious. In the trial and error learning, "skills are linked to conscious or unconscious expectation; and the element of error, within the trial and error method becomes manifest always in the disappointment of some expectation or others."[1428]

Besides systematic observation, Popper also grants the accordance of the positive value to experience as a set of problems. This is in the common usage of "experience" is the best teacher. Given this, "experience should not be taken as the ultimate 'source of knowledge', but rather as a system of fallible expectations or anticipations which each of us arrives at by trial and error."[1429] With the criticism of inductive learning and its techniques, as dogmatic and authoritative, Popper

[1425]*Idem.*
[1426]Roger Mondoué and Philippe Nguemeta, *Vérificationnisme Et Falsificationnisme, Wittgenstein Vainquer De Popper*, p.89. "The trial and error method is instructive, in so far as we learn from our errors. Conceived as such, the progressive approach of the truth is heuristic and enhances the fight againsts dogmatism and stagnation of knowledge"; (my translation).
[1427]Karl Popper, *op.cit*., p. 40.
[1428]*Ibid*., p. 42.
[1429]Karl Popper, *Realism and The Aim of Science*, pp. 46-47.

proposes three values that constitute the students' deontological ethics. In learning from error, Popper proposes that:

> *It is obvious that no such formula should be imposed upon the students. If they object, they would thereby show a most welcome interest and they should be asked to offer an alternative approach or give reasons for objecting. The main purpose would be to draw their attention to the significance of the issues and so to keep the attention.*[1430]

As such, students should participate in drawing the contents of teaching. Popper's learning through error is grounded on his reversal of the order of the Hippocratic Oath. For learning through error to be possible, he proposes the virtue of professional responsibility. It stipulates that: "the first duty of every serious student is to further the growth of knowledge in the search for the truth or to search for better approximations to the truth of course, every student is fallible, as are even greatest masters, everybody is bound to make mistakes."[1431]

Thus, the responsibility of students which consists in the search for the truth is accompanied by the profession of fallibility. Error identification then is not an instance of epistemic imperfection but it is an epistemic motivation for the constant search of knowledge. It is this unended search for knowledge that characterises our human epistemic perfectibility. It is not only the fallibility of man that grounds learning by error, but also the inverse relationship between knowledge and ignorance. That is, while knowledge is finite, ignorance is infinite on the other hand. It is this regard that Popper asserts that: "at the same time, we must constantly remind ourselves (especially in connection with the application of science) of the finitude and fallibility of our knowledge, and of the infinity of our ignorance."[1432]

The second educational virtue of teachers in the pedagogy by error, is that of loyalty. While teachers are supposed to exercise generosity, in turn are supposed to be loyal. This loyalty consists in their unwavering readiness to help students develop knowledge and satisfy their intellectual curiosity. As such, Popper insists that:

> *He also owes loyalty to all his teachers who freely and generously share their knowledge and enthusiasm with him. At the same time, he has a duty to be critical towards others including his teachers and colleagues, and especially towards himself and most important, he has a duty to beware of intellectual arrogance, and try not to succumb to intellectual fashions.*[1433]

[1430]Karl Popper, *The Myth of Frame-Work*, p. 122.
[1431]*Ibid*., p. 123.
[1432]*Idem*.
[1433]Karl Popper, *The Myth of Frame-Work*, p. 123.

The third virtue of pedagogy by error is overriding loyalty. This has to do with the pragmatic ends of the acquisition of knowledge by learners. That is: "This he owes neither to his teachers nor to his colleagues, but to mankind – just as the physician owes his overriding loyalty to his patients, the students must constantly be aware of the fact that every kind may affect the lives of many people."[1434]

This demands students to exercise an attitude of caution towards their knowledge and its finality. That is, the knowledge developed by students, can either have negative or positive impact on humanity. The teacher's role is not to impose knowledge to students and students are not passive receivers. The main task of the teacher is to "initiate the student into a traditional and to explain to him the new great problems which arise through the growth of knowledge and which in their turn inspire and motivate all further knowledge."[1435]

Pedagogy by error is thus constituted by a problem-solving curriculum. Given that problems constitute the basis of world 3, it can then be argued that the role of the teacher is to initiate students to the study of world 3 objects. Stephanie Chitpin creates this analogy as she states that:

> *For example, classrooms can be seen as physical places (world 1), where teachers identify problems, think about them and develop tentative solutions to overcome them. These activities are cognitive processes that take place in world 2. The interpretations of ideas or solutions that come out of these activities reside in world 3.*[1436]

In the pedagogy of error, solutions are not then definite and exhaustive but they are tentative and can be tested and readjusted. Such testing of solutions is through the process of error elimination. At this level, Stephanie Chitpin designs fours roles to a teacher in the pedagogy by error. She stipulates that:

> *1. Analysing student progress in relation to the identified goals; (2) Formulating tentative solutions based on identified outcomes to bring about the changes; (3) Devising a plan for implementing the tentative assessment strategies; and (4) Assessing the impact of using the assessment strategies.*[1437]

Stephanie Chitpin from here identifies three aspects of Popper's pedagogy by error; his defence of fallibilism, his outright adoption of criticism and his epistemological preference of verisimilitude over the idea of truth. Firstly, "fallibilism views human beings and their scientific

[1434] *Ibid.,* p. 123.
[1435] *Ibid*., p. 124.
[1436] Stephanie Chitpin, *Popper's Approach To Education, A Cornerstone of Teaching and Learning*, New York, Routledge, 2016, p. 13.
[1437] *Idem*.

knowledge as inherently fallible and subject to error."[1438] We cannot justify our theories and knowledge as true and more to that, our predictive powers are not only limited but they cannot predict the growth of knowledge. To avoid scepticism and relativism, Popper insists that we can learn from our mistakes. The second element that Chitpin points out is Popper's criticism. We criticise deductively, that is, by either transmitting truth from the premises to conclusion or by retransmitting falsity from conclusion to premise. To Popper, we may not be able to justify our knowledge or theories but we can justify our preference for them. Knowledge or a theory is preferred over another when it survives testing more than other competing theories. The third pillar of Popper's pedagogy of error developed by Chitpin is the preference of verisimilitude over the idea of truth. Since we can never know when we attain the truth, Popper proclaims optimism in his view that by searching and eliminating our mistakes, we can get closer to the truth. Popper's schema of conjectural knowledge, "P1→TT – EE → P2" can also be applied in the classroom context. Chitpin notes that:

> *When teachers use a journal, which Bridgman (1951) calls a "paper and pencil operation", they must first ask: "what was the problem?" and to eliminate the error, they reflect on the activity with a pencil and paper. Though teachers start from dealing with an understanding problem (P1), they proceed from there to a proposition or tentative theory (TT1) and later to a method of implementing the changes designed to eliminate errors (EE1). This method of error elimination leads to a new problem.*[1439]

We can still proceed to problem 3. This can be done by getting students assess their peers in an objective way. Such approach is possible at the introduction of the lesson, through the following processes; by considering "(2) their cognitive level ability, (3) allowance for assignment based on students' needs and (4) differentiated evaluation of students."[1440] Popper's theory of learning by error has influenced what is known today as the pedagogy of error. Just like Chitpin asserts above, such approach is grounded on differentiated system of evaluation, called formative assessment. The major objective of formative evaluation is to: "[…] describe the role evaluation plays in curriculum improvement and contrasted it; with summative evaluation which is used to determine whether the chosen curriculum gives credit for the expenses."[1441]

While formative evaluation is continuous assessment of the feedback summative evaluation is end of course which is characterised by a change of level or awarding of grades. While summative evaluation has a conventionalist tag, summative evaluation, considers students and

[1438]Stephanie Chitpin, *Popper's Approach To Education, A Cornerstone of Teaching and Learning* p. 14.
[1439]*Ibid.,* p. 24.
[1440]*Ibid.,* p. 25.
[1441]*Idem.*

learners in their individual cognitive, social and psychomotor specificity. The latter is thus used as a measure of students' development of skills and as the instrument to evaluate which teaching method is proper for students' development of knowledge, skills and competencies. Some educationist thus opine that:

> *We use the general term assessment to refer to those activities undertaken by teachers – and by their students in assessing themselves – that provide information to be used as feedback to modify teaching and learning activities, such assessment becomes formative assessment when the evidence is actually used to adopt the teaching to meet student needs.*[1442]

The problems that constitute the learning by error pedagogy are not only cognitive as Popper asserts but are also problems of the real life situation of the learner. The resolution of such problems is never definite and thus formative evaluation renders a teacher to be a guide to the learner's continuous attempts to solve his vital problems in the error-elimination approach.

William D. and Thompson M., identify five major strategies of formative evaluation. They include "(1) Clarifying and sharing learning intensions and criteria for success."[1443] That is, students should be informed of the objectives, the competencies involved and the criterion of evaluation of each teaching unit. The second strategy is, "engineering effective classroom discussions, questions, and learning tasks that elicit evidence learning."[1444] This implies that the teacher is not more the only source of resources as it is the case with the inductive methods of learning that are criticised by Karl Popper. The teacher should develop the critical minds in learners by creating avenues for them to engage in to thorough self-criticism and intersubjective-criticism. The third strategy consists in "providing feedback that moves learners forward."[1445] Such feedback is not only meant to alter the teaching methodology but to also help learners to approximate the truth. The fourth strategy is grounded on, "activating students as instructional resources for one another."[1446] In other words, the leaners are no longer blank as insinuated by the inductive methods of teaching but has built-in competence, the most important being the disposition to criticise one another. The fifth strategy consists in "activating students to be as

[1442]Black Paul. and William Dylan, "Inside the Black Box: Raising standards through classroom assessment", in *Phi Delta Kappan*, vol.2, no. 5, Kappan classic, London, Forgotten Books publishers, 1998, pp. 139-148, p. 140.
[1443]D. William and Thompson M., "Integrating assessment with instruction: What will take it work?" In C.A. Dwyer ed., of, *The Future Of Assessment: Shaping Teaching And Learning*. *op.cit*., p. 64.
[1444]*Idem.*
[1445]*Idem.*
[1446]*Idem.*

owners of their own learning."[1447] This is tenable in the Popperian approach given that learning consists in the falsification of our expectations and anticipations through the trial and error method.

In formative evaluation, the question or tasks designed by the teachers invite learners to engage into error-elimination methodology of resolving them. The answer of the students are their tentative theories which are contradicted by the teacher's model. The rigorous correction of these responses, make students to learn from their mistakes. It is thus a dialectical pedagogic approach where the teacher through questioning stimulate the trial and error-elimination disposition in leaners. Learners do not only provide answers but they play a central role in the construction of knowledge.

The error-elimination approach to pedagogy has far-reaching positive impact on the teaching-learning process. Firstly, it renders pedagogy to be pragmatic due to the consideration of contextuality of the problems that surrounds the leaner's environment. Secondly, it makes students to be active participants in the production of knowledge. Given that students have innate mechanisms of learning, the teacher only guide and stimulate their ceaseless tentative solution of problems arising from their context of learning. Thirdly, it is an innovative and dynamic pedagogic approach. This is because, far from being based on conventional and authoritative prisms of inductive learning, the pedagogy of error, is an open platform where both the leaners and the teachers develop knowledge. There is therefore inter-subjective criticism and tolerance among students on one hand and between students and teachers on the other hand.

9.2.2. Popper's Rational Bases for the Competency Pedagogic Approach

In his autobiographical notes,[1448] Karl Popper makes recourse to his early scholarly years. In 1918, he was 16 of age and studied in the University of Vienna. He worked in Alfred Adler's child guidance clinic and was qualified to teach in primary school. Though he later contested the scientificity of Alfred Adler's individual psychology, his philosophical method and his isolated[1449] assertions on education were products of his research on children's thinking. His interest in pedagogy is also expressed in his appreciation of his first teacher as he honours him by asserting that: "Emma Goldberger, who taught me the three R's. They are, I think, the only essentials a child

[1447]D. William and Thompson M., *"*Integrating assessment with instruction: What will take it work?*"*. p. 64.
[1448]Karl Popper, *Unended Quest*, p.4.
[1449]It should be noted that Popper did not write explicitly on education.

has to be taught; and some children do not even need to be taught to learn these. Everything else is atmosphere, and learning through reading and thinking."[1450]

Still in his autobiographical note, Popper announces his future project of a school grounded on a competency based pedagogic approach. He thus announces his great pedagogic project as:

> *If I thought of a future, I dreamt of one day founding a school in which young people could learn without boredom, and would be stimulated to pose problems and discuss them; a school in which no unwanted answers to unasked questions would be listened to; in which one did not study for the sake of passing exams.*[1451]

Popper was reprimanding the boredom of an excessively teacher-centered pedagogic of the Austrian teacher who made teaching boring to them, in most subjects. The above pedagogic dream of Popper can be interpreted as the prediction of the competency based pedagogic approach that is en vogue in the contemporary global politics of education.

Besides Popper's biographical notes and his recommendation for a more student-centered pedagogy, his scientific rationality contains fundamental elements which ground the competency pedagogic approach. To examine this, it is necessary to evoke the meaning and motivation of the competency based pedagogic approach. The competency based pedagogy is grounded on the view that: "Teaching aims for new goals which are not related to the content to be conveyed but to the capacity for action achieved by the student. The latter must be able to perform task by mobilising all resources."[1452]

The objective based approach is gradually been replaced by the competency approach because of the following reasons. Firstly, the competency based pedagogy is highly motivated by the capitalist factor. This consists in the desire to match the knowledge acquired by learners with the economic opportunities that exist. It is not then education for knowledge, but education for skills and competencies. As such:

> *The integration of the expectation of the business world into training is one of the main features of the competency-based approach. However, developing a study plan based on the skills required by the labour market remains a delicate task, because it must both take*

[1450]Karl Popper, *op.cit,* p.7.
[1451]Karl Popper, *Unended Quest*, p. 31.
[1452]Ait Haddouchane Zineb, Bakkalisou;ia, Ajana Soud, and others, "The Application Of The Competency –Based Approach To Assess The Training And Employment Adequacy Problem," in *International Journal Of Education*, vol. 5, no.1, 2017, pp. 1-18, p. 4.

into account the expectations of the business world and implement goals that can be considered and evaluated.[1453]

With the competency based approach then, emphasis is placed on technical, social and interpersonal skills and how they can be mobilised with knowledge to solve real life problems. These real life problems are resolved by performing specific tasks designed by the teacher or the educator. Unlike the traditional method that was content-based, curriculum-based and trained specialists with excellent mastery of knowledge, the competency approach goes: "Beyond the traditional way of delivered school institutions, sustains an educational approach focused on competencies, as a result of the integrative leaving learning experiences, bounding skills, abilities and knowledge in combinations used for efficient task performing."[1454]

It is thus a meta-cognitive approach which carries knowledge outside the classroom. The teacher in this new approach is not the master but a guide as he regulates emotions, shifts the pedagogic ground from knowing to doing both within and without the classroom. The educator, to meet up with the competency-based challenges, should be a:

Designer of effective learning opportunities; having effective communication skills, using the maximum potential of learning opportunities; thinking in alternatives; acting objective and content-based curriculum to a skill-based approach. In the objective-based approach, the mind of the leaners is viewed as an empty bucket to be filled with knowledge by the teachers. The competency based pedagogic approach considers a child as pregnant with previous knowledge on any pedagogic unit that is developed in class. Popper had developed this view in his conjectural view of knowledge. To Popper, knowledge begins when an organism's expectations and anticipations are failed by experience. This leads to a problem. That is: "This first stage in our model is the problem. The problem arises when some kind of disturbances take place – a disturbance either of innate expectations or of expectations that have been discovered or learned through trial and error."[1455]

Thus, the mind of leaners is not blank and thus the content of teaching should reflect the interest of leaners. The first thing the educator is supposed to do then is to motivate leaners by provoking the problem-solving solving spirit. Popper insists on this reinforcement as he holds that:

So what you should do is to do your best to stimulate the interest of the child. Don't overwhelm the child with answers to questions the child hasn't asked. As a general

[1453]Ait Haddouchane Zineb, Bakkalisou;ia, Ajana Soud, and others, "The Application Of The Competency –Based Approach To Assess The Training And Employment Adequacy Problem," p. 1.
[1454]Nadia Laura Serdencuic, "5th International Conference EDU-World 2012 – Education Facing Contemporary World Issues, Competency-Based Education-Implications On Teachers' Training," *in Procedea-social and Behavioural Sciences*, vol. 76, Amsterdam, Elsevir, 2013, pp.754-758, p. 755.
[1455]Karl Popper, *All Life Is Problem-Solving*, p. 4.

principle, don't teach the children answers to questions, they haven't asked! It won't work if he hasn't asked himself the question.[1456]

The art of problem identification and question by learners to Popper is a product of the evolution of the mind. At the early stage of education, the teacher has to adopt a dogmatic attitude. This dogmatic posture of the teacher is not conventionally established but it depends on the evolution of the leaner's mind. The evolution of the mind is intandem with the evolution of language from the inferior to superior functions. Popper in this light holds that: "Thus I propose that we look upon the human mind, essentially, as the producer of human language, for which our basic aptitudes are inborn and as the producer of these theories of critical arguments, and many other things, such as mistakes, myths, stories, witticisms, tools and works of arts."[1457]

The psychological development of the child then is essentially independent of the role of the teacher. Thus, the teacher's pedagogic method depends on this evolution and he thus is not supposed to impose any apriori method of teaching. If the child's critical attitude is not yet developed then, the teacher is supposed to use a dogmatic method. Elsewhere, Popper asserts that: "Thus we can say that a child is partly a product of his achievement. […] just as the child's mastery and consciousness of his material environment is extended by his newly acquired ability to speak, so is his consciousness of himself."[1458]

The observation of the evolution of the child then is a fundamental role of the teacher. The child's ability to questioning largely depends on two variables. Popper asserts that: "Any critical attitude assumes a certain evolution of the child. And one of the interesting task of the teacher is to find how far this particular child is capable of being taught. In other words, the answers depend on variables. The variable maturity of the child and the variable interest of the child."[1459]

Just like the competency based approach puts the child's interest at the centre of the pedagogic activity, Popper adds that a leaner can only express such interest at the evolution of his mind. It is the stimulation of this interest that distinguishes between good and bad teachers. He then insists that: "Embittered teachers embitter their children. We must make a way for these people to get out. Then in their place will come young teachers who have some talent, some ability to build a relationship with the children."[1460]

[1456]Richard Bailey, *op.cit*., pp. 186-187.
[1457]Karl Popper, *Unended Quest*, p. 221.
[1458]Karl Popper and John Eccles, *The Self and Brain*, p. 49.
[1459]Richard Bailey, *op.cit*., p. 187.
[1460]Richard Bailey, *op.cit.*, p. 187.

In the pre-critical stage of learning in the competency based approach, leaners are simply exposed to learning situations and to units of knowledge and in the critical stage, they are bound to adopt the deductive psychology propounded by Popper. That is:

> *The development of inferential thought processes take place in two stages: in the first, pupils are placed in learning conditions that lead them to make comparisons in order to classify, sort, etc. this is followed by a second stage which the learning conditions are designed to guide the learners' activity towards formulating theories and drawing conclusions from experiments conducted in classroom.*[1461]

Integration activity is the essential feature of the competency based learning. It unfolds at three levels, notably: "(1) a diagnostic assessment of acquired learning, followed by initial remediations; (2) the current year's learning, systematic learning and integration activities and (3) evaluation and remediation."[1462]

The theoretical foundation of diagnostic evaluation in the competency learning is Popper's theory of the innateness of the mechanics that anticipate knowledge; that is, expectations and anticipations. Diagnostic evaluation usually takes place at the start of the academic year. Teachers are expected here to evaluate the leaners' competencies of the previous year. While those who have not acquired the expected competences are remediated, those who prove the disposition of such competencies are consolidated.

In Cameroon, two types of learning are carried out in current academic year. 4/5 of the learning time is dedicated to specific activities. These activities are:

> *Related to the knowledge, know-how and life-skills of a current year, giving priority to the knowledge, know-how and life-skills that are absolutely essential for the acquisition of the required competency, on the assumption that the rest of the content can be systematically learned only when all of the pupils have reached a minimum standard in the required competency.*[1463]

The second type of learning that takes 1/5 of the time is the integration activity. At this level, learner have the opportunity to integrate the acquired content in a situation of problem. Just like Karl Popper asserts that learning is problem-laden, the educator or the teacher creates a problem situation that covers the topics of the specific learning activities.

[1461]Jean Calvin Bipoupout, "Curriculum Change And Competency-Based Approaches: A World-Wide Perspective, The Contribution Of The Competency-Based Approach To Education For All In Cameroon" in *Prospects*, vol. XXXVII, no. 20, New York, Springer, 2007. pp. 205-221, pp. 209-210.
[1462]*Idem*.
[1463]*Idem*.

There are two ways to carry out an integration activity. They are: "(a) at first progressively, that is in a process of partial integration that takes place throughout the current year's teaching/learning activities; (b) later, towards the end of the process, with the help of a more significant integration module."[1464]

Progressive integration is piecemeal and proceeds with the progress of teaching. It can also occur when the units of teaching have been exhausted. After the integration activity, feedback is determined through evaluation for remediation. This is because after evaluation, there is a diagnosis of difficulties which constitute the content of remediation for the next class.

Moreover, Popper's critical rationalism is the basis of the most critical method of teaching in the competency based approach of teaching. This critical method consists in debates and discussion. According to Richard I. Arends, "discussion improves student's thinking and helps them construct their own understanding of the academic content."[1465] With the application of critical discussion in the competency-based learning, there is a transition from knowledge acquisition to knowledge constitution. Secondly, classroom discussion, "gives students public opportunities to talk about and play with their own ideas and provides motivation to engage in discourse beyond the classroom."[1466] Thus, discussion in classrooms makes students to develop the sense of self-dependency in the development of ideas. In the third place, classroom discussions develop the argumentative function of language. That is:

> *Discussion is used by teachers to help students learn important communication skills and thinking processes. Because discussions are public, they provide a means of ideas and information being taught. Discussions thus provide social settings in which teaching can help students analyse their thinking processes and learn important communication skills such as stating ideas clearly, listening to others, responding to others in appropriate ways and good questions.*[1467]

Moreover, critical discussion is the best method of class management. It promotes collective participation of students in the pedagogic activity leaving no room for distraction. To plan for classroom discussion, three pre-requisites are considered. Firstly, the purpose is well defined and secondly, the previous knowledge and communication skills of students are also considered. In the

[1464]Jean Calvin Bipoupout, *"Curriculum Change And Competency-Based Approaches: A World-Wide Perspective, The Contribution Of The Competency-Based Approach To Education For All In Cameroon"*, p. 210.
[1465]Richard I. Arends, *Learning To Teach*, New York, McGraw Hills Companies INC., 2007, p. 413.
[1466]*Idem*.
[1467]*Idem*.

third place, the approach to be given to discussion is defined. There are three possible approaches of classroom discussions which are recitations, inquiry discussion or the sharing-based discussion.

One of the central approaches in the competency based learning is problem-based learning. Popper is emphatic on the fact that problems constitute the bases of learning. Problems arise when previous knowledge of learners is contradicted with contrary learning situation. In other words: "The essence of problem-based learning consists of presenting students with authentic and meaningful problem situations that can serve a springboards for investigations and inquiry."[1468]

Far from structuring lessons around fixed and established academic principles, "problem-solving learning organises instruction around questions and problems that are both socially important and personally meaningful to students."[1469] This approach gives the student, the wide theoretical horizon. This is because "the actual problem under investigation is chosen because its solution requires to delve into many subjects."[1470] Thus, the problem-solving learn creates an interdisciplinary spirit in the learners. Popper, cognisant of this, asserts that, "we are not students of some subject matter but students of problems. And problems may cut right across the borders of any subject matter or discipline."[1471]

9.3. POPPER'S SCIENTIFIC RATIONALISM AND AFRICA

Questioning the importance of popper's scientific rationalism to Africa is not only to meet up with the exigencies of contextualisation but it is more because some African thinkers still continue to defend theoretical frameworks that obstructs the development of science in Africa and the emergence of the African continent. We will thus interpret Popper's thesis for an open society as a challenge to the proponents of excessive Africanism. Such extreme African thinkers make claims of the identity of particularism, asserting that Africans have certain cultural heritages to be preserve from criticism. Such attitude constitutes the psychology of closed society. We will then examine two groups of African thinkers; those who defend the close society and those who defend the close society. In the second moment, we will move from the premise of poppers thesis of the role of myth and metaphysical research programs in science and call for a rupture from an Afrocentric and spiritual-based cosmology to a rational-based and physical cosmology.

[1468]Richard I. Arends, *Learning To Teach,* p. 380.
[1469]*Ibid*., p. 381.
[1470]*Idem*.
[1471]Karl Popper, *Conjectures and Refutations*, p. 67.

9.3.1. Popper's Open society as The Challenge to Excessive Africanism.

The monumental challenge that Africa faces today is that of development. Despite the idealist approach to development by African writers like Edward Willmot Blyden and the advocates of Negritude like Leopold Sedar Senghor and Franz Fanon who conceptually celebrate the spiritual superiority of Africa, the global paradigm of development seem to be more of material than spiritual. Edward Willmot Blyden asserts that African spiritual dominance as he holds that: "If service rendered to humanity is service rendered to God, then the Negro and his country have been during the ages, in spite of untoward influences, tending upward to the Divine."[1472] He cites great men of Christian religion that sought refuge in Africa like Abraham, the visit of the sons of Jacob and Moses. He observes that while the West condemned Jesus, an African offered the man to help him called Simon, the Cyrenian. With these examples, Blyden presents Africa as a cradle of spiritual excellence.

The spirituality of the African continent is also expressed by Aime Cesaire who asserts the ontological and anthropological continuity of the living and the death in Africa. He asserts that: "Look at the tadpoles of my prodigious ancestry hatched inside me! Those who invented neither gunpowder nor compass those who tame neither stream nor electricity those who explored neither sea nor sky but those who know the humblest corners of the country of suffering."[1473]

Cesaire is categorical that the Negro Africa is distant from science, technology and astronomy but she is a continent of spiritual and moral excellence. In the same line of reflection, Senghor asserts that: *« L'émotion est nègre, comme la raison est hellène. »*[1474] These idealists of Africanism, project Africa as a paradigm of spiritual development. However, such orientation of African development into spirituality has only made the African culture to be weak, faced with the global stakes of development that are excessively material. The material development that is essentially technoscientific, is grounded on the promotion of rationalism and the scientific spirit. To Karl Popper, the development of science and the scientific spirit is only possible in open-societies.

The African anthropological context is grounded mostly on closed societies. This is due to the communal and tribal definition of the African personality and culture. Closed societies to

[1472]Edward W. Blyden, *Christianity Islam and The Negro Race*, (1888), Black Classic Press, 1994, p. 49.
[1473]Aime Cesaire, *Return To My Native Land*, (1956) trans. Anna Bostook, John Berger, Baltimore, Penguin Books, 1969, p. 72.
[1474] Leopold Sedar Senghor, « Ce Que L'homme Noir Apporte », in *l'Homme de Couleur*, Paris, Eds. Cardinale Verdier and others., 1939, pp. 291-313, p. 295, "emotion is negro as reason is Hellenic".

Popper are "based upon the collective tribal tradition, institutions leave no room personal responsibility."[1475] In African ethnology and communalism, the individual is subsumed in the collective spirit. Given that the African culture in its collectivity can assert with Popper that: "In what follows, the magical or tribal or collective society will also be called the closed society, and the society in which individuals are confronted with personal decisions, the open society."[1476] Personal decisions in open societies prompt members to be in constant dynamism and competition to overtake others. Such personal strive also culminates into class-struggle. This is not the case with the closed societies given that, "its institutions including its castes, are Socrasant taboos."[1477] Popper notes that civilisation in the West was occasioned by the rupture from closed to open societies. In Greece for instance, the wealthy landed proprietors were opposed, putting an end to tribalism and the formation of auxiliary states.

It can be argued with Popper that the fundamental tenet of the open society is not only political but cultural. Criticism, rational discussion and the scientific spirit can only be realised in rationalist civilisation. Considering the case of the Greek civilisation, Popper notes that:

> *But what of the original Greek miracle – the rise of Greek poetry, art, philosophy, and science the real origin of Western civilisation? I assert that the Greek miracle, so far as it can be explained, was also largely due to culture clash. It seems to me that this is indeed one of the lessons which Herodotus wants to teach us in History.*[1478]

This implies that the pre-philosophical culture of Greece was not marked by univocity, homogeneity and unanimity. There were internal conflicts between individuals and external conflict between the fundamentals of the Greek culture and other non-Greek cultures like the Eastern and the African. The internal conflict is evident in the pre-Socratic critique of the mythical system of poets like Hommer and Hesoid. It was this cultural clash that orchestrated the Greek civilisation in philosophy, language, arts and science. As such, Popper reiterates that: "Culture clash played an important role in the rise of Greek science – of mathematics and astronomy – and one can even specify the way in which some of the various clashes bore fruits."[1479]

Popper is against excessive cultural relativism and cultural fixism. He criticises them as he insists that: "Cultural relativism and doctrine of the closed framework are serious obstacles to the

[1475]Karl Popper, *The Open Society and Its Enemies*, vol. 1, p. 152.
[1476]*Idem.*
[1477]*Ibid*., p. 153.
[1478]Karl Popper, *The Myth Of Framework*, p. 39.
[1479]Karl Popper, *The Myth Of Framework*, p. 40.

readiness to learn from others. They are obstacles to the method of accepting some institutions, modifying others, and rejecting what is bad."[1480]

It is no doubt that cultural experiences and basis are relative and even historical. However, Popper is not denying this fact but he is against the institution of the categories of cultural difference as absolute frameworks of identity. It is the clash between the various aspects that constitute the difference between different cultures that these cultures learn from one another, restructuring her basic forms and thus progressing. Cultural forms do not then constitute ontological identities for they are subject to change, reformation and restructuring.

Contextualising Popper's view of the closed society in the African context of socialisation and thought, nationalist philosophical theories are frameworks of the close society. Tempel's claim that there is a philosophy proper to the Africans is based on his assertion of a unique ontology for Africans. After observing the Bantus of the Shaba Baluba that even the converted have the habit of going back to their roots or old ways. Tempels thus claims that such consistency is not by chance but must be based on: "a body of logical system, a complete positive philosophy of the universe, of man, and of the things that surround him, of existence of life and of the life beyond."[1481] Such affirmation of a philosophy grounded on an ontology of the difference is defended also by Meinrab Henga. Hebga in the Tempelsian tone asserts that, « *Dis-moi comment tu conçois le composé humain et je te dirai ta position sur les phénomènes paranormaux. »*[1482]

Even though Tempels is criticised for claiming that the Africans are unconscious of their philosophy and by addressing the West and not the African, who are subject of his Bantu philosophy, our interest is in Tempels' institution of what can be referred to as the African way of life. This way of life that is defined by a communal ontology, creates the avenue for ethno-philosophers who claim the cultural specificity of Africa. It is this cultural specificity that grounds the wise ethnophilosophical literature.

The ethno-philosophical trend of African thought system creates a certain cultural fixism rendering cultures to connote close societies. Most ethno-philosophers like John Mbiti, Alexis Kagame and Basil Fouda claim that there is an African culture that is specific in essence. The

[1480] *Ibid.*, p. 46.
[1481] Placide Tempels quoted by D. S. Masolo, *African Philosophy In Search Of Identity*, London, Indiana University Press, 1994, p. 46.
[1482] Meinrab Hebga, La Rationalité d'un Discours Africain sur les Phénomènes Paranormaux, Paris, l'Harmattan , p.7. "Tell me how you conceive the human composition and i will state your position on the paranormal phenomena"; (my translation)

specificity of such culture to them is in the timeless unity of the ancestors, the living and the still to be born. This collectivism they claim is not only reflected in cultural forms but in their manner of thinking. Bert Hamminga in this manner of reflection holds that: "As an African, when I am born, some ancestor has been born into my mother. I will carry his name. I am not this ancestor himself. It is not reincarnations. I am the vital power this ancestor is willing to invest in me."[1483]

The African traditional societies are thus characterised by the valorisation of the group at the expense of the individual. In this regard, Ifeenyi A. Menkiti "group solidarity is most cited as a key, perhaps the defining, features of African traditional societies."[1484] The same point of view is shared by John Mbiti, who expresses the collectivity of the African person as, "I am because we are."[1485] This is a typical picture of the closed society, where there is an extended notion of person. Ifeanyi A Menkiti asserts that in this extended conception of identity, there is no equality for history and time creates the ontological difference between the personhood of youth and that of the adults. He asserts that, "Time's movement was generally from the present to the past, so that the more of the past one has, the more standing a person also has."[1486] Time thus determines the moral, historical and ontological dimension of personhood. As such, Ifeanyi cites the Igbo African proverb, "what an old man sees sitting down, a young man cannot see standing up."[1487]

Kwame Antony Appiah differentiates between close and open cultures in the African context. To him, "The cognitive world of traditional cultures 'closed' and that of the modern cultures 'open'."[1488] In the traditional knowledge to him, there are never alternatives to established theories. In scientifically developed cultures of the other hand such alternatives exist. Just like Popper's thesis of cultural clash, he asserts that, "modern science began in Europe just when her peoples were beginning to be exposed to the hitherto unknown cultures of the orient, Africa and the America."[1489] The emergence of the scientific culture in the West to Anthony Appiah was due to the recognition of contrary cultural forms and the clash between these forms. For instance, the emergence of cosmology, moral relativism and scepticism in ancient Greece was influenced by the representation in other parts of the world like the East and Africa. Such awareness is found in

[1483]Bert Hamminga, Kwame Anthony Appia, and others, *Knowledge Cultures, Comparative Western And African Epistemology*, New York, Rodopodi, 2005, p. 57.
[1484]Afeanyi A. Menkiti, "On the Normative conception of a person" in Kwasi Wiredu ed., *A Companion to African Philosophy*, Oxford, Blackwell Publishing, 2004, p. 324.
[1485]John Mbiti, *African Religions and Philosophy*, New York, Doubleday, 1970, p. 141.
[1486]Ifeanyi A. Menkiti, *op.cit.*, p. 325.
[1487] *Ibid.*, p. 325.
[1488]Kwame Anthony Appiah, "African Studies and The Concept Of Knowledge" in Bert Hamminga ed., *Knowledge, Comparative Western And African Epistemology*, New York, Rodopi, 2005, pp. 23-56, p.42.
[1489]Kwame Anthony Appiah, "African Studies and The Concept Of Knowledge", p. 42.

the early historians like Herodotus. In his narration of the Persian wars, he records the plethora of religions and customs that constituted the Persian Empire. In this way, Appiah asserts that:

> *It is in other words, the availability of alternative theories of morals and nature that gives rise to the systematic investigation of nature, to the growth of speculation and to the development of the crucial element that distinguishes the open society – namely, organises challenges to the prevailing theory.*[1490]

If such existing alternative of cultures and cultural forms are to be acknowledged in Africa, to establish open societies, then we must get rid of ethnological particularism expressed in collectivist tags such as, "we do it because the ancestors did it."[1491] If Western Renaissance that laid to the foundation of rationality, humanism and science arose as a rejection of authority and irrationalism, Appiah thinks that such critical attitude should be adopted by the African culture in search for openness. The claim that African culture has its uniqueness which must be reflected in their philosophy and science is typical of the close society. Marcien Towa refers to such claims as the "cult of the difference." The worship of the African difference that is claimed to be erected on her past, history and ontology is an obstacle to the rational and scientific emergence of Africa. Marcien Towa calls for a revolution from this particularism or excessive Africanism to humanism as he holds that:

> *« Le culte de la différence s'arrête au passé et manque l'humanité, celle qui ut et celle qui serait encore possible. La révolution n'abolit pas et ne peut pas abolir le passé, mais seulement la dictature du passé. Par elle le passé est mis à notre disposition au lieu que nous soyons à la disposition du passé […] le fait que tels résultats furent obtenus dans le passé ne leur confère ni autorité ni supériorité automatique sur ceux que nous obtenons maintenant ou pourrions obtenir dans l'avenir par une praxis également libre, créatrice. »*[1492]

The cultural revolution by Towa is not a negation of the self either is it the ethnological Westernisation of Africa. Same like the ancestors were creators of their history and culture, we have to also be at the climax of our own epoch through the free creation of our own cultural forms. Instead of using the past to judge and evaluate the present as ethno-philosophers, nationalist

[1490] *Idem.*
[1491] *Idem.*
[1492] Marcien Towa, *Essai Sur La Problémtique Philosophique Dans l'Afrique Actuelle*, Yaoundé, Edition CLE, 1971, p. 48. "The cult of the difference ends in the past and lacks humanity, that which was and that which is still possible. The revolution does not abolish and cannot abolish the past. Through it the past is put at our disposition instead of us being put at the disposition of the past "The fact that such results were obtained in the past does not give them either automatic authority or superiority on those we could obtain in the future though a praxis that is equally free, creative"; (my translation).

philosophers and Africanist claim, the present to Towa is supposed to constitute the measure of the past.

Ebénezer Njoh Mouellé distinguishes between open and close African cultures using an excellent man on one hand and a mediocre individual on the other hand as products of the respective societies. Drawing inspiration from Bergson's distinction between open and close societies as Njoh Mouellé affirms that:

> « *Le milieu dont nous parlons a toutes les caractéristiques de la 'société close' de Bergson. C'est un milieu fermé sur lui-même ou qui aurait tendance à rester fermé sur lui-même, égoïstement. A cela clôture d'une culture que Bergson précisément définit comme un 'système d'habitude'. L'idée de système elle-même ne fait qu'abonder dans le sens de la clôture et de la fermeture. C'est un système de problèmes définitivement et intégralement résolus. »*[1493]

Men that constitute the close society are victims of mediocrity to Njoh Mouellé. A mediocre man mediocre man Mouellé is man of situation and by situation, he implies the mass. However, belonging to a mass or a culture is not a sufficient condition to be considered mediocre. That is why he clarifies this by asserting that: *« l'appartenance à un milieu ne conduit pas nécessairement à la médiocrité. C'est l'inaptitude à prendre du recul par rapport au milieu. »*[1494] A mediocre then does not only belong to a collectivity but he also develops a conformist attitude which deprives him of all forms of criticism and auto-definition on the other hand, the open society is that of excellence where freedom, creativity and individuality are affirmed. He analogically refers to an excellent man as he who goes above the pressure of the crowd and servitude to assert his freedom. In a prescriptive tone, Njoh Mouellé asserts that, *« Il faut que le développement œuvre à substituer à la médiocrité l'excellence. »*[1495] True development in Africa then requires a rupture from mediocrity to excellence or from close to open cultures. He captures this in his formula *« le maximum d'être homme suppose la liberté et l'initiative créatrice, tracts que nous avons*

[1493] Ebenézer Njoh Mouellé, *De La Médiocrité A L'excellence, Essais Sur La Signification Du Développement*, Yaoundé, Edition CLE, 2011, p. 51. "The milieu that we are talking about has the characteristics of the 'closed society' of Bergson, it is a milieu closed on itself and which always has the tendency of being close egoistically. As such, closure or the closeness of culture should be seen as Bergson precisely defines as a 'system of habits'. The idea of system itself only abound in the sense of closeness or closure. It is a system of problems definitely and integrally resolved"; (my translation).
[1494] *Ibid*., p. 50. "Belonging to a milieu does not necessarily lead to mediocrity. It is the inaptitude of taking a step back in relation to a milieu"; (my translation).
[1495] *Ibid*., p. 152. "Development should substitute mediocrity with excellence." (my translation).

précisément déniés à l'homme médiocre, homme conventionnel et anonyme de la société close. »[1496]

The theoretical attitude of Africanisation is seeming a sterile posture of thinking African development. When Africanism becomes a protective ideology, of singling out the African culture, promoting and preserving it from criticism as evident in nationalist movements like Negritude, it creates a closed society that is resistant to development. It is in this light that Njoh Mouellé decries excessive Africanism as he holds that:

> *« La liberté de critiquer les choses africaines semble ne point exister. Le travail ainsi fait par nos 'africanistes' demeure alors un travail fait pour les autres et non pour notre propre intérêt […]. Quand des Africains étudiant leurs propres systèmes en viennent à conclure que l'Afrique avait déjà seul à posséder, qu'est-ce à dire ? »*[1497]

The Africanists engage into anthropological fixism where cultural forms are treasures to be immunised from criticism. As Mouellé asserts above, the Africanist tendency of preserving the African culture from criticism blends the identification of other intraracial problems that do not arise from the African culture or the African racial category. As such:

> *"Race" disables us because it proposes as basis for common action, i.e. illusion that black (and white and yellow) people are fundamentally allied by nature and, thus, without effort; it leaves us unprepared, therefore, to handle the "intracial" conflict that arise from the very different situations of blacks (and white and yellow) people in different parts of the economy of the world.*[1498]

The accordance of a unique essence to all Africans thwart the ability to solve other conflicts within Africa that do not have racial motivations. It is no doubt that Africa initiated civilisation as in the Egyptian miracle and it is also clear that Africa has witnessed the same tragic historical problems of slave trade, racism and colonisation but it will be suicidal to take such historical reasons as grounds for a unique identity for Africa. Appiah rejects this grounding of identity on history as he asserts that:

[1496]Ebenézer Njoh Mouellé, *De La Médiocrité A L'excellence*, p. 153. "The maximum of being a man supposes freedom and creative initiative, tracts that we precisely denied in the mediocre man, conventional man and anonymous of the close society"; (my translation).

[1497] Ebénézer Njoh Mouellé, *Considérations Actuelles Sur l'Afrique*, Questions posées par H. Mono-Ndjana, Yaoundé, Editions Clé, 2000, p. 124. "The freedom to criticise African things no longer seems to exist. The work done by our 'africanists' remains the work done for others and not for our proper interest […]. When Africans study their proper systems by coming to a conclusion that Africa already had what the West thought she was the only one to possess, what does that mean?"; (My translation).

[1498]Kwame Anthony Appiah, *In My Father's House, Africa In Philosophy Of Culture,* New York, Oxford University Press, 1992, p. 176.

> *And the Egyptians like all who have chosen to root Africans modern identity in an imaginary history – require us to see the past as the moment of wholeness and unity; tie us to the values and beliefs of the past; and thus divert us from the problems of the present and the hopes of the future.*[1499]

Race, history and metaphysics to Appia do not constitute the bases of veritable identity. The African present and future can also be highly determined by the political, the economic and the ecological realities. The African identity is thus dynamic. To Appiah, the close African society is the tribal while the open is economical. Thus, "being African is, for its bearers, one among other salient modes of being, all of which have to be constantly fought for and rethought."[1500] To him, the necessary revolution requires the transition from the tribal to the economic bases of African anthropology.

Paulin Houtondji on his part presents the Africanist claim of Western acculturation of Africa as a false problem. To him, the reality today is that of cultural interpenetration in which cultures no longer exist in their pure state. Africans to Houtondji who advocate for Africanisms fail to grasp the complexity of cultural interpenetration by continuing to give a cultural tag to it. To him, cultural homogeneity does not exist for every culture carries its own pluralism. He ignores the communalist view of the African culture and asserts that: "That culture is always active and creative; it is a contradiction debate between people chained in the same destiny and anxious to make the best out of it. What we must understand is that never in any society does every one agree with everyone else."[1501]

Unanimity in culture to him is thus a myth which in no way translate the reality of African culture. Pluralism then is not a product of Westernisation for it is as old as African history. Thus, "It is an internal pluralism, born of perpetual confrontations and occasional conflicts between Africans themselves."[1502] Far from agreeing with the Africanist appolegic view that pluralism is caused by colonisation, Houtondji refuted such, insisting that colonisation instead reduced the pluralistic nature of the African culture. It reduced the internal oppositions and ideological conflicts. It instead left "Africans with an artificial choice, between cultural alienation (which is

[1499]Kwame Anthony Appiah, *In My Father's House*, p. 176.
[1500]*Ibid.*, p. 177.
[1501]Paulin J. Houtondji, *African Philosophy, Myth and Reality*, (1976), trans. Henri Evans, Bloomington, Indiana University Press, 1983, p. 165.
[1502]*Idem*.

supposedly connected with political betrayal) and cultural nationalism (the obverse) of political nationalism and often a pathetic substitute)."[1503]

For African renaissance to be attained through the elimination of all these artificial polarisation. This elimination is aimed at not only promoting internal pluralism but to make African cultures open to other cultures as cultural alienation and cultural nationalism are not adequate alternative in the appreciation of culture. Houtondji thus insists that "African culture must return to itself, to its internal pluralism and to its essential openness."[1504] This internal pluralism, to a Cameroonian philosopher, Lucien Ayissi must be accompanied by the rationalisation of governance and living together, to avoid the crisis of identities. He thus asserts that: *« Rationaliser la gouvernance c'est corriger, au moyen d'une pédagogie citoyenne, les mœurs des individus ou des communautés. »*[1505] Ayissi Lucien does not only purport critical rationalism as the logic of modern African governance but he also debunks the weak nature of an essentially African identity faced with modernism that is marked by creativity, innovation and openness. That is why he affrims that : *« Mais une chose est de s'affirmer différent, une autre de préserver son identité danse une mode de plus en plus ouvert du fait de la mondialisation. »*[1506] Thus, it is not enough to affirm a uniquely African identity but the challenge is how to defend it, faced with globalisation.

Unlike other African thinkers who hold that openness is the ideal that African cultures should aim at, Houtondji holds that African cultures have always been open through tis pluralism and that the problem is with the conceptualisation or theorisations of this fact. While others will think that openness is acculturalisation, Houtondji stipulates that, "this will not be a process either of westernisation or of acculturation; it will simply be creative freedom, enriching the African tradition itself as an open system of options."[1507]

With the open conception of African culture, Houtondji poses the bases for an open world civilisation or culture. He is against the static conception of world civilisation as the synthesis of the heterogeneity of regional cultures. He instead proceeds from the observation of the internal

[1503]Paulin J. Houtondji, *African Philosophy, Myth and Reality,* p. 166.
[1504]*Idem*.
[1505]Lucien Ayissi, *Rationalité Prédatrice Et La Crise De l'Etat De Droit*, Paris, L'Harmattan, 2011, p.199. "*to rationalise governace is to correct by means of a citiaenship pedagogy of customs of individuals and the community*" (my translation)
[1506] Lcien Ayissi, Crise et Superstition, Paris, L'Harmattan, paris, 2022, p.240.
[1507]Paulin J. Houtondji, *op.cit*., p 167.

contradictions in regional cultures to project universal civilisation as simply the universalisation of these conflicts and contradictions. In this light, Houtondji states that:

> *On the other hand, if we acknowledge the internal dynamism of these cultures and accept that they exist as cultures only in the form of contradictory debates taking place in particular societies, in specific geographical areas, then the reality of world civilisation will be conceived no longer as a system of universally accepted values but rather as an extension of a debate to a world scale which will give rise to new ideological, artistic and scientific conflicts that straddle various societies.*[1508]

Houtondji cites Nkrumah as a good theoretician of this universal civilisation. To Nkrumah, the fight against colonisation is not a conflictual polarisation of the West and Africa but a universal reflection of class struggle at the level of regional cultures. Class conflict has no barriers and thus the fight against colonisation should not be perceived as essentially a conflict between Africa and Europe. This is evident in Nkrumah's definition of consciencism as he holds that:

> *The emancipation of the African continent is the emancipation of man. This requires two aims. First, the recognition of the egalitarianism of human society and second, the logic of mobilisation of all resources towards the attainment of that restitution. The philosophy that must stand behind this social revolution is that which I have referred to as consciencism; consciencism is the map in the intellectual terms of the dispositions of forces which will enable African society to digest the Western and Islamic and Euro-Christian elements in Africaand develop them in such a way that fit into African personality.*[1509]

There are two important ideas that Nkrumah raises above. Firstly, the global nature of the form of emancipation. He asserts that the emancipation of Africa is that of mankind and secondly, the universal, open and dynamic connotation he accords to the African personality. The latter is attained through the incorporation of positive cultural values not only of Africa but of non-African cultures that can enhance cultural and anthropological revitalisation. This then poses the question of what type of philosophy is needed in the consideration of African cultures as open cultures.

An open society in the African cultural set-up from the above thinkers of dynamic Africa should be grounded on a philosophical approach that promotes criticisms, pluralism and tolerance. Karl Popper's hypothesis of human fallibilism should constitute the epistemic bases of such philosophy. Consequently, there are two philosophies in African that in the Popperian sense revolt against rationality; notably ethno-philosophy and cultural nationalism expressed in Africanist

[1508]Paulin J. Houtondji, *African Philosophy, Myth and Reality*, pp. 166-167.
[1509]Kwame Nkrumah, *Consciencism: Philosophy and Ideology for Decolonisation*, London, PANAF, 1970, pp. 75-76.

tendencies such as Negritude. Against Negritude and her claim of the African hegemony of philosophy as the reason for her existence, Towa asserts that:

> *« Déterrer une philosophie, n'est pas encore philosophie […]. La philosophie ne commence qu'avec la décision de soumettre l'héritage philosophique et culturel à une critique sans complaisance. Pour le philosophe aucune donnée, aucune idée si vénérable soit-elle, n'est recevable avant d'être passée au crible de la pensée critique. »*[1510]

The philosophy that is favorable for an open society to Towa is that which is grounded on critical thought. Ethno-philosophy as defended by Tempels and his fellows is a collective philosophy that is found in cultural forms. It is a lived philosophy and not a critical one. Its collectivity obstructs the emergence of critical thought. Towa in the same light reiterates that: *« la philosophie es peut-être la seul discipline qui a le courage et la force de soumettre ouvertement absolu à la discussion, de le prendre comme l'objet de débats publics. »*[1511] This critical discussion to Popper should not be exclusively for philosophers but everyone in the open society should develop this interpersonal criticism.

The second philosophical trend in Africa that obstructs an open-society is nationalistic and Africanist philosophical movement like Negritude. If an African culture has to be dynamic, open and creative, then national philosophical theories like negritude are sterile. Negritude insists on the uniqueness of Africa, using particularism to define the African identity and culture. Negritude insists on the race as the basis of African identity. This is a kind of fixism which obstructs criticism of African values slowing the revolution from a close to an open society.

If an open society for Africa requires a critical philosophy, Houtondji asserts that the universities have a role to play in realising this. He notices that African universities approach this problem by proposing conceptual decolonisation and Africanisation. This to Houtondji is good because it liquidates Western concepts from African discourses but he notes that such approach leads to particularism. He thus holds that:

But Africanisation often takes the form of a rapid particularism, which is extremely dangerous for our scientific culture. The "Human sciences" are the most vulnerable for all disciplines to this danger. We no longer study sociology but "African sociology" or even "ethnology". No

[1510] Marcien Towa, *op.cit.*, p. 30. "To off-root philosophy is not philosophise. […] Philosophy begins only with the decision to submit the philosophical and cultural heritage to a critique without complaisance. To the philosopher, no data, idea no matter how venerable it is should be received without passing it through the sieve of critical thought"; (my translation).

[1511] Marcien Towa, *Essai Sur La Problémtique Philosophique Dans l'Afrique Actuelle*, p. 31. "Philosophy is maybe the only discipline which has the courage and the force to openly submit the absolute into discussion, taking it as an object of public debate"; (my translation).

longer history, but African history, instead of geography, African geography, instead of linguistics, African linguistics.[1512]

This particularism leads to theoretical imprisonment. African cultures to him are supposed to live and not to be objects of special scientific studies. The open society to him requires that these cultures should be lived, transformed and not to be object of passive studies that have no pragmatic undertones. This to him should apply same to languages which are supposed to be vehicles and not objects of scientific studies. Houtondji thus asserts that:

> *Instead of using French or English to discuss the structures of Yoruba or Fon, we would better use Yoruba or Fon to discuss the structures of French or English or more generally to use African languages in advanced work in various sciences: Mathematics, physics, chemistry, biology, history, linguistics, etc.*[1513]

This is a great pedagogic revolution that Houtondji initiates. Instead of using Western languages to study African languages and to proceed to claim that such language and cultural forms and structures reveal philosophy, African universities have to use their cultural languages as medium to study Western languages and the science as a whole. Finally, he calls for a transcendence of the restrictions established by anthropologies as he proposes that: "We must rouse the internal pluralism of our original culture, beneath which has the false plurality of cultures, if we must now take sides within that culture while putting to good use all the information acquired through contact with other traditions."[1514]

In his view of the role of contemporary African Philosophy, Ayissi Lucien insists on the phenomenology of philosophical pre-occupations. Againsts fixism which open the doors for irrationality like in the case of paranormal phenomena, he affirms that, *« Il s'agit précisément pour nous d'entreprendre de repenser le sens du philosopher en réference aux défis de l'heure. Le philosophe est certainement le fils de son espace -temps* »[1515] This means that epistemology by Africans should be purified from elements that do not permit the evolution and progress of knowlegde.

Even though the content of the views of African thinkers of the open and close society is somewhat different from Popper's at the level of their bases, they have the same ambition. This

[1512]Paulin Houtondji , *op.cit*., p. 168.
[1513]*Idem*.
[1514]*P*aulin J. Houtondji, *African Philosophy, Myth and Reality*, p. 169.
[1515] Lucien Ayissi, *Philosopher Aujourd'hui cést Philosopher Autrement*, paris, L'Harmattan, 2021, p.14. « it is a question for us to undertake the rethinking of the meaning of philosophy by refering to the challenges of our times. A philosopher is certainly product of his space-time »

ambition is to set the social bases for critical discussion and the promotion of science. The result of all these is to initiate development in Africa. Africa today requires the development of the scientific spirit if she should record exceeding material development. However, such development will only be possible after the critique of culture and the initiation of a revolution from close to open cultures.

9.3.2. The Rationalist Pre-eminence of Physical Cosmology over Spiritualist Afrocentric Cosmology

In his preface to the 1959 edition of the logic of Scientific Discovery, Popper affirms that cosmology is the prototype of science. He states that:

> *I however believe that there is at least one philosophical problem in which all thinking men are interested. It is the problem of cosmology: the problem of understanding the world including ourselves, and our knowledge, as part of the world. All science is cosmology. I believe, and for me the interest of philosophy, no less than science, lies solely in the contributions which it has made to it. For me, at any rate, both philosophy and science would lose all their attraction if they were to give up that pursuit.*[1516]

Popper's view is that every form of empirical sciences tackles an aspect of the physical cosmos. Popper's contention can be understood by evoking the different subject matters of prominent empirical sciences. Biology studies the living organism that inhabit the universe, geology studies rocks and inorganic aspects, astronomy studies heaven bodies, physics studies quantities and chemistry deals with the chemical constitution of the physical universe.

In the second moment of his cosmological considerations, Popper considers physical cosmology or speculative physics as scientific research programme. That is, they may not be scientifically testable but they are "anticipations of testable physical theories."[1517] Such theories should "incorporate, together the general views of the structures of the world and at the same time, from general views of the problem situation in physical cosmology."[1518] Popper cites some of these theories such as Parmineds' block universe, atomism, the geometrisation developed by Pythagoras, Plato and Euchide, Aristotle's essentialism and potentialism, Renaissance speculative astronomy, the clock theory of the world animated by Hobbes, Descartes and Hobbes, and the dynamism of Newton and Lubniz. These theories were not directly tested but they created the problem-situations for the development of testable scientific theories. Consequently, physical cosmology to Popper is

[1516]Karl Popper, *The Logic of Scientific Discovery*, p. xviii.
[1517]Karl Popper, *Quantum Theory and The Schism In Physics*, p. 165.
[1518]*Idem.*

the appropriate approach to the universe, which can enhance the development of the scientific mind. However, what is referred to as Africa cosmology presents a spiritualist cosmological outlook that is at the service of afrocentric tendencies. Our focus in this reflection then is to argue that such spiritualist cosmology at the service of afrocentrism is an obstacle to the development of an adequate scientific view of the universe. Hence, the reflection will end with the proposal of physical cosmology as the paradigm for Africa that is in the quest for scientific and technological progress.

The spiritualist conception of the cosmos in Africa can be traced back to Placide Tempels' view of the Bantu ontology. According to him, the nexus of the African view of life and the universe is the idea of the vital force. D. A. Masolo in his interpretation of Tempels holds that "The Bantu talks in terms of either gaining reinforcing, losing, or diminishing this force. For the Bantu, all, all beings of the universe possess their vital force: human, animal, vegetable, or inanimate."[1519]

Even in animate beings in the universe to Tempels then have the vital force. Even though Henri Bergson makes a similar claim in his view of the élan vital as opposed to inert matter, Bergson's theory is based on a dualism that is absent in Tempels. To Tempels, distinction between matter and force is absent in Africa. Tempels spiritualist Afrocentric cosmology influenced a good number of African thinkers such as John Mbiti: To John Mbiti, "The point is that the African, the whole existence is a religious phenomenon; man is deeply religious being living in a religious universe."[1520] African religiosity to Mbiti then encompasses every aspects of his existence and also constitutes the essence of his ontology. This way, he captures this ontological religiosity as he asserts that, "Africans have their own ontology but it is a religious ontology, and to understand their religions, we must penetrate their anthropology."[1521]

The religious cosmos to Mbiti have four different categories of beings who exist in their fixed positions. They include:

> *1. God as the ultimate explanation of the genesis as sustenance of both man and all things. 2. Spirits beings made up of super human beings and the spirits of men who died a long time ago. 3. Man including human beings who are alive as those about to be born. 4.*

[1519]D. A. Masolo, *African Philosophy In Search of Identity*, p. 48.
[1520]John Mbiti, *African Religions and Philosophy*, p. 19.
[1521]*Ibid*., p. 20.

Animals and plants or the remainder of biological life. 5. Phenomena and objects without biological life.[1522]

The originator of man to Mbiti is God, the spirits account for the destiny of man, the centre is man who uses animals, plants and the environment as means of existence and he also engages into a mystical relationship with beings in this universe. These being are ontologically hierarchical and "one mode of existence presupposes all the others."[1523] Thus, unlike physical cosmology that is restricted to the physical aspects of the universe that are scientifically accessible, Mbiti evokes the dualism in the spiritualist cosmology as he holds that, "in many African societies it is believed that the universe is divisible into two. These are the visible and the invisible parts or the heavens (or sky) and the earth."[1524]

Besides the five categories of beings in the universe, Mbiti notes that there is a force emanating from God, which encompasses the whole universe. Such force can be exploited, tapped, manipulated and used by some being to influence others. Given that man is the centre of this universe, Mbiti holds that the former, "awakens the universe, he speaks to it, he listens to it, he tries to create harmony with the universe."[1525] Some humans to him are endowed with the ability to tap the vital force in the universe. Such include, "medicine-men, witches, priests and rain-makers, some for good and others for ill of their communities."[1526]

The pertinence of this mystical connotation of the traditional African cosmology is questioned by the camerronian philosopher, Oumarou Mazadou. To him, the mystical connotation of the African cosmos is:

Endemic and congenial trait of what could be described as a natural benign docility generally brought about by years of blind submission and unquestioning compliance to the mystique of higher authority that reigns surreptitiously yet effectively in all black African societies in varying degrees.[1527]

With this religious view of the universe, the physical universe is viewed simply as a manifestation of the invisible forces that animates the invisible realm. Thus, it is a kind of metaphysical causality which excludes the possibility of scientific predictions. John Mbiti even argues that in the African conception of time, the future has no ontological weight. He asserts that,

[1522]John Mbiti, *African Religions and Philosophy,* p. 20.
[1523]*Idem*.
[1524] *Ibid.,* p. 32.
[1525]John Mbiti, *Introduction To African Religion,* p. 32.
[1526]John Mbiti, *op.cit*., p. 21.
[1527] Oumarou Mazadou, "Kamit and The Will To Power", in *International Journal Of Philosophy And Theology*, American Research Institute for Policy Development, vol. 4, no. 2, 2016, pp. 55-65, p. 61.

"for them, time is simply a composition of events which have occurred, those which are taking place now and those which are immediately to occur."[1528] Thus, what has not yet occurred is not time and it can then be argued that scientific prediction cannot effectively holds in such a religious cosmos. Scientific theories to Popper are bold conjectures and prediction of thing to occur. Such conjectures can only hold in the context where there are future expectations. Even though Popper holds that the future cannot be determined with certainly, he nevertheless argues that scientific theories can always make predictions that can either be tentatively corroborated or falsified. John Mbiti's conception of the cosmos and time excludes such approach as he insists that: "The future is virtually absent because events which lie in it have not taken place, they have not yet been realised and cannot therefore constitute time."[1529]

Talking about causality, the proponents of Afrocentric religious cosmology insists that causality in the African cosmology is specific and unique. Ozunma G. O asserts that:

> *The issue and problem of causality is viewed from a this-worldly standpoint within the ambit of western metaphysics. In fact, causality is seen as a physical order reality which is perceptible and can be rationalised. On the other hand, African metaphysical notion of causality is agentive. Ancient African viewed causality from the other-worldly perspective. The traditionally African understanding of causality is religious, supernatural, spiritual, mystical and mythical.*[1530]

Claiming that causality is physical in western cosmology, Ozumba asserts that it is mystical in the African context. This Afrocentric spiritualist cosmology is also defended Anyanwu K. C. To him,

> *Contrary to the Sartrean (Western) notion that man is the creative drive or force behind his freedom, in the African view, whatever force he (man) acquires is given to him by a superior being who already possesses this force […]. Hence, it can be said that African conception (of causality) is essentially religious.*[1531]

The Africans become aware of such causality through spiritual intuition. This intuition to Apologun Sylvester S. S. is attained from the consultation of the supernatural. While the cosmos in physical cosmology is inert or lifeless, "to the Africans it is alive energised the spirit."[1532] In the

[1528]Oumarou Mazadou, "Kamit and The Will To Power", p. 61.
[1529]*Ibid*., pp. 22-23.
[1530] Geoffery Ozumba. "African Traditional Metaphysics" in *Quolibert*, vol. 6, no. 2, Chicago, Evanston, IL: Scott David Foutz, 2001, pp. 2-20, p. 12.
[1531]Anyanwu, L. C., *The African Experience In the American Market Place*, New York, Exposition University Press, 1982, p. 49.
[1532]Apologun Syslvester s. S., "Causality and African metaphysics: A meeting point" in *International Journal Of History And Philosophical Research*, vol. 8, no.2, New York, Routledge, 2020, pp. 11-18, p. 14.

same way, Apologun Sylvester S. S. holds that the agent behind the cosmos is not any cause that is accessible to science. The cause to him is mystical as he affirms that:

> *For traditional Africans, force is not communicated or reduced primarily by some form of physical causality, because force does not belong to the physical order. It is metaphysical. It is therefore not accessible to scientific verification. It belongs to the order of invisible entities which cannot be known but believed in.*[1533]

The fact that the supernatural world to the Afrocentric spiritualist cosmologist are and the physical are in a comprehensive dualism does not mean that causes in the physical matter. Apart from the fact that there is ontological dependency of the physical cosmos on the supernatural, Nyamiti P. A. notes that; "the connection between the cause (supernatural) and the effect is immediate; secondary causes are either not admitted or considered negligible."[1534]

It is in the ambit of this metaphysical determinism that John Mbiti distinguishes between the four orders in the African cosmos. They include; the orders of law, the moral, the religious and the mystical. Even though he claims his cosmology is anthropocentric and he also attempts to put man at the centre, Mbiti holds that "Man is not the master in the universe; he is only the centre, the friend, the beneficiary, the user, for that reason, he has to live in harmony with the universe obeying the laws of natural, moral, and mystical orders."[1535]

The anthropomorphism that constitutes the religions and Afrocentric cosmology is an obstacle to the development the scientific mind in Africa. The first limitation of this Afrocentric is the inability to differentiate between the subject and the object of knowledge. The view that man's essence is determined by an invisible world and given the view that the universe is organic, makes man an intrinsic aspect of the nature. Thus, it is difficult for him to objectively act on the universe. Mbiti for instance holds that man is a friend of nature and thus cannot engage into the natural manipulation and exploitation of nature. This man-universe symbiosis excludes the possibility of developing a techno-scientific rationality.

Another limitation of the Afrocentric spiritualist cosmology is the obstruction of a realist framework of science. Realism holds that the mind-independent reality is knowable. However, the knowing subject is the spiritualist cosmology is an aspect of the universe, excluding the possibility

[1533]Apologun Syslvester S., "Causality and African metaphysics: A meeting point", p .14.
[1534] Nyamiti P. A., *A Contemporary History of African Philosophy*, Owerri, Amarche Publication, 1999, p. 65.
[1535]John Mbiti, *Introduction To African Religion*, p. 39.

of scientific realism. According to Chiedoze Okoro, the fact that Africa is historically a traditionalist society:

> *Does not imply that Africans are incapable of abstract thinking. It simply means that the traditional Africans, paid little attention to the mental orientation […]. If we grant that a sound theoretical foundation informs practice and leads to rapid sustainable scientific and technological development, why couldn't African develop such intellectual orientation.*[1536]

The change of approach to Chiedoze Okoro is urgent if African cosmology intends to set the basis for a veritable scientific spirit. Unlike Mbiti who claims that man is inactive, the development of physical cosmology demands that man should become an active participant in search for causes. Thus, causes are not supernatural but should be natural or physical. It is in this light that Kwame Gyeke insists that:

> *The view of the critical importance of causality to the development of science of nature, a culture that was obsessed with supernatural or mystical causal explanations wold hardly develop the scientific attitude in the users of that culture, and would consequently, not attain knowledge of external world that can empirically be ascertained by others including future generation.*[1537]

Besides the affirmative Afrocentric religious cosmology, there is an apologetic Afrocentric approach. While the former attempts to prove the specificity of Afrocentric cosmology, the latter establishes the link between the history of science and ancient Egypt. In fact, apologetic Afrocentric cosmology aims at showing that Africa has also greatly contributed to the development of science. The prominent figure of this apologetic Afrocentric cosmology is Cheikh Anta Diop.

In his writings, on Egyptology, Cheikh Anta Diop attempts to illustrate the African paternalism of the sciences. About mathematics and geometry, he reports that: "An Egyptian priest told Diodorus of Sicdy that all the so-called discoveries that made Greek scholars famous were things that had been taught to them in Egypt and which they called their own, once more they went back to their country."[1538] He also cites Socrates in the Phaedrus (274 C) for asserting that the god Thoth invented arithmetics, calculation, geometry and astronomy. Moreover, citing Herodotus,

[1536]Chiedoze Okoro, "Causality And Science: Toward A Deconstruction Of African Theory Of Forces", in *Journal Of Integrative Humanism*, vol. 64, no. 2, Cape coast, Apublication of the department of classics and philosophy, 2014, pp. 65-73, p. 65.
[1537]Kwame Gyeke, "Philosophy And Technology In The Post-Colonial", in *Post-Colonial African Philosophy*: *A Critical Reader*, Cambridge, Blackwell Publishers, 1997, pp. 24-44, p. 28.
[1538]Cheikh Anta Diop, *Civilisation Or Barbarism*, An *Authentic Anthropology*, Trans.yaa-lengi Meema Ngemi, New York, Lawrence Hill Book, 1991, p. 251.

Cheikh Anta Diop reports that, "the Egyptians are the exclusive inventors of geometry, which they taught the Greeks. Democritus boasted that he equally the Egyptians in geometry."[1539]

Concerning the domain of astrology, Cheikh Anta Diop asserts that the Egyptians were the first to invent the calendar having 365 days in a year, divided into three seasons of four months each and each month divided into three weeks of ten days each having 24 hours. He makes this when attempts to show the link between ancient Egypt and chemistry. Chemistry to him has an African origin as he says: "The root of the word chemistry is of Egyptian origin, as is already known; it comes from kemit = 'black', alluding to the long cooking process and the distillations that were customary in Egyptian "laboratories", in order to extract this or that desired product."[1540] About cosmology, Cheikh Anta Diop equally cites the text of the pyramid (2600 B.C.) because this is the epoch "when even the Greeks did not exist in history yet, and when the Chinese and the Hindu philosophies were meaningless."[1541] He thus mention four cosmological systems of the Egyptians, notably, the Hermopolitan, the Heliopolitan, the Memphite system and the Thedan system. According to the Egyptians, the universe was not created out of nothing for there "has always existed an uncreated matter, without a beginning or the end."[1542] This original matter which he qualifies as the indeterminate is likened to Anaximander's apeiron. This first matter that the Greeks referred to as the "nons" by the ancient Egyptians. This nun in the Egyptian cosmology was raised to the status of divinity.

The first uncreated matter is also likened to the matter at the start of the theory of the process of evolution. To buttress this point, Cheikh Anta Diop asserts that the "primitive matter also contained the law of transformation, the principle of the evolution of matter through time, equally considered as a divinity: khepera."[1543] When this first matter becomes the law of change, it then actualises the essences of things. With continuous actualisation, the external matter attains the state of consciousness. Cheikh Anta Diop thus reiterates that, "the first consciousness thus emerges from the primordial nun; it is God, ka, the demiurge (Plato) who is growing to complete creation."[1544] With this material uncreated substance, Cheikh Anta Diop qualifies Egyptian cosmology as a form of materialism. It is constructive to assert and illustrate that Egyptians contributed to the emergence of physical cosmology, but it becomes apologetic and Afrocentric to

[1539]Cheikh Anta Diop, *Civilisation Or Barbarism,* p. 257.
[1540]*Ibid*., p. 285.
[1541]*Ibid*., p. 310.
[1542]*Idem.*
[1543]*Idem*.
[1544]*Ibid*., p. 311.

insist on the Egyptian paternity of Western thought on cosmology. Given that the broad literature for cosmology in Africa today is religious, it will be developed physical cosmology rather than evoking the old aged Egyptian mythical contribution to the emergence of science. Cheikh Anta Diop engages into this Afrocentric apologetic cosmological status, when he asserts that:

> *This materialistic components of Egyptian thought will prevail among the Greek and Latin Atomists: Democritus, Epicurus, and Lucretius but in the appearance of the demiurge, Ra, Egyptian cosmology takes a new direction with the introduction of an idealist component: Ra achieves creation through the word.*[1545]

This word in the idealist aspect of the Egyptian cosmology refers to the word in Islam and Judeo-Christian religion. Heraclitus called it the logos while Hegel referred to it as the spirit. Cheikh Anta Diop does well to illustrate the role of ancient Egypt in the development of science but a look at the religiosity that undergrounds African cosmology today is a reason for the change of approach. The most appropriate approach is to "deafricanise" the cosmological conception by African thinkers. Though our social relation with the universe may not be the same like elsewhere, the universe should be considered by everyone as an object of science. Thus, it can be rationally understood, explained and predicted. Given that science does not carry racial, ethnological or continental colours, the new discourses in the cosmos by African philosophers is supposed to be free from subjectivist and ethnological inclinations. This is the most adequate way to make African cosmology to be rational, experimental and a veritable springboard for the development of science and the consequent development of Africa.

[1545]Cheikh anta Diop, *Civilisation Or Barbarism,* p. 11.

PARTIAL CONCLUSION

The last part of the work is dedicated to the critical evaluation of Popper's logic of science. It can be noted that there are claims of logical inconsistencies notably in the apparent opposition between falsification and the defence of realism on one hand and also between falsification and conventionalism. In the same way, with the difficulty in defining an exact methodology of demarcation, Hilary Putnam's thesis of auxiliary hypotheses and the Duhem-Quine thesis prefer rectificative falsification to Popper's rigorous falsification. Moreover, with the crisis of the demarcation criterion, Thomas Kuhn and Paul Feyerabend prefer antifoundational approach. However, despite the limitations, highlighted, Popper's logic of scientificity preserves its originality and actuality. The negativist connotation of the criterion of falsifiability immunises science against anti-science and irrationalism. It also creates the avenue for scientific dynamism and favours the growth of knowledge. The revalorisation of metaphysics creates new frontiers between science and metaphysics, offering the necessity for interdisciplinarity as the new challenge in the pedagogy of epistemology. In our quest to solve the problem of the pertinence of the criterion f demarcation in a context where metaphysics is important in science, we went beyond the Lakosian correction of Popper to propose progressive falsifiability. Against the demise of the problem of the actuality of the demarcation criterion, we propose the thesis of "positive metaphysics" and also defined the grounds for the new approach to the problem, which consists not in the demarcation between science and metaphysics only but in demarcation between scientifically useful metaphysics, which we call "positive metaphysics" and scientifically useless metaphysics that we designate as "negative metaphysics". The thesis of positive metaphysics can best be illustrated using analytical metaphysics and metaphysics of monadology. Our thesis require then a distinction between the question of scientificity and the question of demarcation. The criterion of scientificity is narrow and pertains to every rationality of science but the question of the demarcation is broad and should extend beyond the confines of science, to also examine how non-science like metaphysics influences science. It can also be deduced from above that Popper's philosophy of science has outstanding implications on man's relationship with the other, his relationship with the society and also can be positively used for the cultural and cognitive revival of Africa.

GENERAL CONCLUSION

The nerve-centre of our examination has been on the role of metaphysics in scientific rationality in the context of the quest to specify science by logical positivism. This research work thus is inline with epistemology and philosophy of science, specifically in the domain of applied, normative and prescriptive epistemology. There are two contradictory rationalities of science examined above. They are, the logical positivist semantic paradigm in which meaningfulness is the character of a scientific theory on one hand and on the other hand, there is popper's fallibilist criterion. While metaphysics plays a negative role in the logical positivists semantic paradigm, it plays a positive role in popper's rationality of science. That is why our topic is focused on metaphysics even though there are other examples of nonsciences.

This topic raises the problem of the pertinence of popper's rationality of science. Karl Popper who proceeds the logical positivists notes that their criterion of scientificity is limited in excluding metaphysics from science. As examined above, Popper argues that if we apply the criterion of meaningfulness of logical positivism, then it will lead to two excesses. Firstly, it will lead to the elimination of all scientific theories because science makes use of universal statements whose meaning cannot be established inductively. Secondly, such criterion will not work because there are many meaningful metaphysical theories that are not empirical. If Popper's scientific rationality demonstrates the importance of metaphysics in science, then the great cognitive challenge becomes that of the pertinence and even the necessity of the criterion of demarcation. Thus, it has been the question of reflecting whether we still need to give attention to the problem of the criterion of demarcation between science and metaphysics, given the weaknesses of the criteria of the logical positivists on one hand and Popper's insistence on the importance of metaphysics in science.

To examine the problem of the pertinence of the criterion of demarcation in the context of the metaphysical motivations of science, we delimited our work in the framework of the opposition of Karl Popper's falsificationism to logical positivism. This opposition is specifically that of the two antithetical conceptions of the role of metaphysics in their respective paradigms of scientificity. While the logical positivist paradigm of scientificity which is the semantic in nature accords the negative role to metaphysics, Popper's criterion of scientific theoryhood which is that of falsifiability gives a positive role to metaphysics in the development of science and scientific theories.

The antimetaphysical tendencies of logical positivism did not arise ex nihilo because it has a definite conceptual archaeology. In fact, logical positivism in the first place were influenced by

the Humean critique of the metaphysical principle of causality and by Kant's trial of metaphysics as a discipline that makes scientific pretention. To Hume, there is no metaphysical necessity between the cause and the effect as the rationalists metaphysicians claim. What is referred to as causality in traditional metaphysics to him is simply psychological and not logical or rational. It is the habit of seeing two events occur concomitantly that the first to occur is referred to as the cause while the second is called the effect. In his critique of the faculty of understanding, Kant limits cognition to time and space and considers the attempt by cognition to know things in themselves or to go beyond space and time as logically illicit. If one tries to apply reason out of space and time, Kant demonstrates that he will entangle himself in irresolvable antinomies. Speculative metaphysics to him then plays no role in the developmen of synthetic apriori knowledge.

Besides the critique of metaphysics by Hume and Kant, there is also the grounding of knowledge on the experantial bases by John Locke and Auguste Comte, leading to an implicit elimination of metaphysics from epistemological context. In Locke's empiricism, knowledge is only attainable through experience and he expresses an agnostic attitude towards the knowledge of substance. Innate ideas to him are not real and thus cannot be integrated into a system of acceptable knowledge. If knowledge can only be attained through experience and innate ideas do not arise from experience, then they are not real. To Auguste Comte, the mature stage of the development of the scientific mind is the positive stage while the metaphysics and science are mutually exclusive. The true scientific spirit to Comte is the positive spirit which is concrete, real and experimental. Given that logical positivism is the linguistic orientation of classical or epistemological empiricism, the analyticy of logical positivism was influenced by Leibniz's linguistic analysis and Ernst Mach's psycho-physical analysis. While Ernst Mach rejects the distinction between the subject and object of knowledge, reducing the real to sensation, Leibniz on the other hand Leibniz's distinction between truth or reason and truths of facts ground the putative analytic and synthetic distinction in logical positivism. Thus, the logical positivist semantic criterion of scientificity and their anti-metaphysical tendencies were influenced by classical positivism, empiricism and analytical philosophers.

In chapter two of part on of reflection, we examined the logical positivists semantic criterion of scientificity. We talk of the semantic criterion of scientificity because to logical positivism, a scientific theory comprises a system of meaningful statements. It is when the conditions under which the meaning of a statement can be defined, that such statements attain the status of scientificity. In the first moment of the semantic criterion of scientificity, meaning is guaranteed by the principle of verification. This correspondence theory of meaning is based on logical

atomism defended by Wittgenstein and Betrand Russell. Logical atomism asserts that there are linguistic and factual residues where every analysis ends. These atomic facts are unanalysable aspects of the world are the referential points of basic or atomic statements that constitute scientific theories. Whether we make recourse to Wittgenstein's atomic facts or to Russell's acquaintances, they all translate the final states of the world which serves as reference for the accordance of meaning to basic statements in science. With logical atomism, the structure of scientific language is viewed as a reflection of the structure of the world. This is the point of departure of the principle of verification where in the logic of science consist in analysing statements of scientific theories to assure the symmetry between the structure of language and the structure of the world. In the picture theory of Wittgenstein, a scientific theory is the mirror of the factual world. While Wittgenstein and Russell defend actual verification, Moritz Schlick and Alfred Jules Ayer, differentiates between actual verification and verification in principle. Despite the differences in the degrees of their conceptions of verification. They all agree that the scientific status of a statement is the method of its verification, which consists in confronting systems of statements with the factual world.

The second moment of the logical positivist theory of meaning is the physicalist meaning defended by Rudolf Carnap and Otto Neurath. In fact, the physicalist theory of meaning is the product of the critique of the failure to establish the adequate principle of correspondence between language and the world. Wittgenstein for instance talks of elucidations to express how the structure of language reflects the structure of the world. Thus, the difficulty the verificationists have is to show how language actually reflect the world. Rejecting such correspondence as metaphysical, Carnap and Neurath propose a language-centred approach in which a universal physicalist language is constructed, where statements can be translated to one another. The possibility of science to Carnap is not necessarily making recourse to extra-linguistic frameworks but in rational reconstruction in which objects are classes, properties, relations, things extensions and intensions. Carnap's construction consist in reduction of statements to one another. The basic of such reconstruction are protocol statements from which every other statement is verified and confirmed. Otto Neurath's approach is the coherency method of testing meaning. He sets the bases for the creation of a unified science which is physicalist in nature because of the need to eliminate metaphysics and the desire to assure the interdisciplinarity between the various departmental sciences. When the statements of science are constructed in a coherent whole, it is possible to test the scientificity of new statements by confronting them with the whole body of statements. Incompatibility in this comparison either calls for a change in the system of statements or in the

elimination of new statements. Statements in rational reconstruction then are not compared with the world but with other statements.

The third moment in the logical positivist semantic paradigm is the probability theory of meaning defended by Hans Peichenbach. He criticises the verificationist and physicalist account of meaning for the mix up direct and indirect sentences. While a direct sentence refers to an observable fact, probability is applied more in indirect statements. The probability of indirect statement to him depends on their relationship with direct statements. The direct and indirect statements respectively refer to fact and their predictions. To Reichenbach, a physical fact cannot be verified because statements that denote them always have predictions which cannot be verified. The probability theory of meaning is then applied to all statements of observation given the uncertainty involved in their predictive nature. In his probabilitist approach to the problem of induction, Reichenbach makes concessions to the instrumentalist function of scientific theories. The role of scientific theories in his instrumentalism is to predict. To realise such ambitions, inductive inferences to Reichenbach should be given probabilitist treatment.

In chapter three of the logical positivist semantic paradigm, we examined their attempt to reject and exclude metaphysics from scientific enterprise. In the first place, Carnap Ayer and Schlick consider metaphysics as having an emotive origin. To them, the metaphysical attitude originates from man's attempt to express his feelings and emotions. To Carnap, the metaphysical impulse arises from man's attempt to express his attitude towards life. To Schlick, the metaphysical attitude of going into the transcendent world, has psychological and not rational motivations. Metaphysical expressions to him are simply the human expression of his feelings. This is the same view, held by Ayer who identifies metaphysians to poets. With the need to express his feelings, the logical positivists assert that man attempts to go beyond the physical to the transcendent world. By metaphysics then, the logical positivists refer to the human attitude towards the transcendent world. Such transcendent systems to Carnap include the subjective idealism of Fichte, the objective idealism of Schelling, the absolute idealism of Hegel, the spiritualism of Bergson, the phenomenology of Heidegger, amongst others. Thus, Carnap, Ayer and Schlick refer to metaphysics as the transcendent. This follows that the metaphysical attitude has an emotive and not a scientific and a rational origin. The elimination of such metaphysical expressions from language to them is through logical analysis as developed in the three approaches to meaning defined in the previous chapter.

The second moment of the logical positivist definition of metaphysics is in the critique of realism and the reality of the external world. Even though Wittgenstein asserts that objects constitute the substance of the world in his logical atomism, what is knowable are not objects in themselves but the state-of-affairs which arise because of the relationship between those objects. Even though Moritz Schlick rejects the identification of existence as a property and defends empirical realism in which the external world is nothing other than the physical world, such realist argument is weak for it does not strongly express the metaphysical groundings on which strong realist claim are grounded. Betrand Russell criticises empirical realism and introduces neutral monism in which he dismisses the realist disjunction of the mental and physical events. Carnap on his part proposes rational reconstruction which is a form of pluralism. To Carnap, the debate between realism and idealism is not of the domain of science, scientists to him do not disagree on the existence of the physical world, they instead disagree on the results obtained from studying this world. Thus, the realist/idealist debate is understood by Rudolf Carnap as a nonsensical debate in scientific rationality.

The logical positivists develop two techniques of analysis to refute metaphysics; the verificationist approach and the logical syntax approach. Wittgenstein, Ayer and Schlick propose the analysis of language by comparing its structure with the structure of the world; via verification. The second technique of analysis consist in the logical syntax approach. It was announced by Wittgenstein and developed by Rudolf Carnap. The logical syntax approach consists in investigating the words used, respect the rules of the grammar of such language. To Carnap, the way in which words are put into sentences determine the meaningful or meaningless nature. Thus, metaphysical nonsense to him can be eliminated by eliminating words and expressions that violate the grammar of science. While Wittgenstein holds that the rule of meaning applies to a sentence as a whole, Carnap asserts that the role of meaning applies to words which in turn determine the meaning of the sentence.

With the rejection of metaphysics from the scientific enterprise, logical positivism proceeds with the project of the naturalisation of philosophy. By naturalisation of metaphysics, we imply the attempts by logical positivists to render philosophy to be scientific in method. It is the art of putting philosophy not only at the service of science but also within the methodological exigencies of science. To logical positivism, there are no genuine philosophical problems and thus they assert that philosophy should be reduced to the logic of science. By logic of science, they imply that philosophy should become a tool for the analysis of scientific language so as to guard it against the intrusion of metaphysical nonsense. While Wittgenstain holds that as the logic of science

philosophy cannot be expressed, Carnap refers to the logic of science as meta-logic and thus should not be assertive about the world. That is why they prefer mathematics and logic to philosophy in the development of empirical sciences. Mathematics and logic to them do not make concessions to the physical world. The logical and mathematical rules are tautological and thus say nothing about the world, unlike philosophy that claim to make a discourse on the empirical world, there by producing pseudo-statements.

In the second part of the work dedicated to Karl Popper's scientific rationalism and the valorisation of metaphysics, we examined the basic tenets of Popper's critique of logical positivism, his criterion of scientificity, his defence of the importance of metaphysics in science and the crisis of the demarcation problem. In questioning the conceptual origin of Popper's evolutionary epistemology, it was revealed that while Konrad's notion of imprinting influences the conjectural nature of knowledge to Popper, Charles Darwin's theory of evolution influenced the method of testing by trial and error. Popper rejects the logical positivist meaning criterion of scientificity because of the following reasons. Firstly, Popper refers to the intention behind logical positivist meaning criterion as biased because metaphysics has never claimed to be empirical science. Secondly, the elimination of meaningless statements to Popper is the eliminatioin of science as a whole. This is because natural laws which grounds are statements of general nature and their elimination entails the elimination of science. Thirdly, Popper identifies the logical impertinence of the meaning criterion by pointing out the impossibility of complete conclusive exhaustive verification. Verificationism just like inductionism does not have a rule and thus cannot be justified. Moreover, Popper points out the semantic inconsistencies that are involved in the logical positivist conceptions of nomalism and naturalism in their definition of meaning.

Karl Popper proposes falsifiability as the principle of scientificity and the criterion of demarcating between science and metaphysics. A good scientific theory is that which make bold predictions that can be tested deductively. Scientific theories are not confirmations but prohibitions of certain things to be hypotheses which of the universal character and they either prohibit state of affairs or the produce a class of basic statement that describe them and another class that contradicts them. If the class of potential falsifiers that describes a theory are rejected, then it is falsified. Therefore, Popper considers refutability to be the criterion of scientificity. Popper applies this criterion not, only to the distinction of science from metaphysics but also in the distinction of science from pseudo-scientific theories like Marx's theory of history, Fred's theory of psychoanalysis and Adler's theory of individual psychology.

Positing falsifiability as the criterion of scientificity, Popper proposed pancritical rationalism as the better option to justificationism. While critical rationalism is open and promotes the growth of knowledge, the logic of justification is authoritative and cumulative. Justificationism defends and accurate theories leading to dogmatism while critical rationalism opens scientific theories for criticism. As such, he proposed the argumentative function of language as the belt alternative to the descriptive function of language that is central in logical positivism. The descriptive function does not promote the growth of knowledge while the argumentative function is the grounding for criticism, learning and the growth of knowledge. The crisis of justificationism are more evident where Popper offers a tragic solution to the problem of induction, proposing conjectural learning as a better alternative to inductive learning. In the same way, he proposed corroboration as a good option to probability in the evaluation of the degree of testability. In the same way, Popper views verification and induction as sources of the subjective theories. Popper defends an objective theory of truth on grounds that inter-subjective criticism of theories can be exercised by all. In his tentative theory of truth, Popper places more emphasis on verisimilutide or truth-likeness. The essence is to define the truth in a way that it will be possible to realise criticism and the growth of knowledge.

In the last chapter of part two of the work, dedicated to the metaphysical bases of science and the crisis of the problem of demarcation. We first examined Popper's defence of realism as the adequate theoretical framework which represents how science is practiced. Popper criticises instrumentalism and offers salient arguments to defend realism. The argument for realism stems from the universal accent of mind-independent world as the necessary condition for any descriptive or argumentative functions of language and the fact that physical theories implies the existence of an extra-linguistic world. His realism is evident in the propensity interpretation of quantum physics. Scientific objectivity to Popper is also based on metaphysics as x-rayed in the regulatory role of the idea of objective truth and in the theory of three world. Moreover, metaphysics play a great role in the scientific context of discovery and justification. This is seen in the heuristic role of myths and metaphysical research programmes in the development of science. With this, Popper asserts that a rational discourse on metaphysics is possible in his idea of critisable metaphysics. We however end part two by unveiling the crisis of the problem of demarcation implicit in Popper's rationality of science. The crux of this crisis stems from the contradiction between Popper's insistence on a rigourous criterion of demarcation in the first moment and his insistence on the value of metaphysics in science in the second moments. Thus, there are to Popper's, a more rigorous Popper of his early writings who advocates for a sharp criterion of demarcation between science and metaphysics and a less rigorous Popper who asserts that we cannot exhaustively

separate metaphysics from science. With this contradictions, many logicians of science assert that the problem of demarcation is useless both to scientists and philosophers of science.

In part three of the work, articulated on entical evaluation and stakes, we examined the limitations of Popper's criterion of scientificity and proposed a solution to the problem of the demise of the criterion of scientificity. Moreover, we equally evaluated the implication of Popper's revalorisation of metaphysics in his definition of the criterion of scientificity. In the critique of Popper's criterion of scientificity, we evoked the asymmetry between falsification and realism and the opposition between falsification and conventionalism in Popper's rationality of science. The issue at stake here is that it seems logically contradictory to defend realism and falsification at the same time. Realism does not only hold that there is a mind-independent reality but it also asserts that such reality can be known and sometimes with certitude. However, Popper defends realism but at the same time argues that the aim of theories is not to describe and confirm but to prohibit. This is contradictory because realism defends the possibility of knowing the wold while falsificationism claim that we construct theories to refute them. In conventionalism, science excels in generally or community accepted canons but in falsification the scientific mind is that of contradiction and disagreement. This is apparently contradictoty in Popper's rationality of science. In the same way, Popper's methodological rigours is opposed by Hilary Putman and the Duhean-Quine thesis, in which rectitificative testing is proposed as alternative to Popper's falsification. Moreover, antifoundationalism opposes Popper's criterion of scientificity. Thomas Kuhn proposes paradigm-based to logic-based science while Paul Feyerabend goes beyond the limits of Popper's methodological monism to propose methodological pluralism and anarchism.

Despite the limits of Popper's criterion of scientificity above, it has plausible impacts and stakes. On the epistemological plan, Popper's principle of falsifiability permits the growth of knowledge while his negativists scientific mind preserves science from antiscience and irrationalism. Popper's notion of the metaphysics of science opens the avenue for new frontiers between science and philosophy in what we term as impartibilist naturalism. This does not only reveal the need for epistemology to be informed by the great ideas of metaphysics but it is also a challenge for new pedagogy of philosophy to lay emphasis on the notion and practice of interdisciplinarity.

In this critical part of our work, we attempted a logical surpassment of Popper and the development of our thesis of positive metaphysics. Instead of sophisticated falsification of Lakatos which considers scientific theories as a chain, we propose progressive falsification which consider

theories as units. The demise of the criterion of demarcation is evident not only in Popper's insistence on the importance of meatphysics in science but in Popper's abandonment of the regour and prescriptivity he initially held about falsification. Given that metaphysics plays a role in science, we then propose a second criterion of demarcation which demarcates between metaphysically useful and metaphysically useless metaphysics. This thesis of positive metaphysics is examined in analytical metaphysics and the metaphysics of modality. Instead of naturalising metaphysics, as if the latter was empirical science, we propose negative metaphysics as that which scientific theories do not require them. This is seen in traditional metaphysics and pure ontology. The thesis of positive metaphysics proposed is different from that of Henri Bergson. Henri Bergson in his project of positive metaphysics instead called from a unitary approach to knowledge, without giving the exact and precise nature of positive metaphysics. His positive metaphysics was more of an approach than a notion having a content. However, our thesis of positive metaphysics is grounded on two modes; notably, the metaphysics of modality and analytical metaphysics. Thus our "positive metaphysics" refers to scientifically useful metaphysics. This second criterion of demarcation treats science and metaphysics as two independent disciplines.

In the last chapter of our reflection, we evoked the social, pedagogic and the African implication of Popper's rationality of science. On the social plan, we examined rational discussion as the basis of tolerance, freedom. Also, liberal democracy is presented as a political consequence of Popper's rational discussion. In the context of pedagogy, Popper's principle of falsifiability is the groundings for the pedagogy of error and the development of the competency-based pedagogic approach. Popper's rationality also has implications on African thought. It is a challenge for a rupture from a spiritualist and afroncentric cosmology to a rationalist and physical cosmology. If Africa has to meet up with her developmental visions then African epistemologists have to affect a transition from considering the universe as sacred to its consideration as an object of knowledge and scientific transformation. Moreover, it is also a challenge for the transition from closed to open societies in the African cultural landscape.

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