

THE POPULAR/RATIONALIST IMAGE OF SCIENCE: AN OVERVIEW OF THE POSITIVIST VIEW OF SCIENCE

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Introduction

There is no gainsaying that science in our modern world is viewed as a highly esteemed and rational enterprise. As Ernst Cassirer says, “there is no power in our modern world which may be compared to that of scientific thought. It is held to be the summit and consummation of all our human activities, the last chapter in the history of mankind...”¹ F. H. Giddings adds: “We (scientists) control everything that happens. We determine when it shall occur and where. We arrange circumstance and surrounding atmosphere, and possible ways of getting in and possible ways of getting out.”² This popular and esteemed image of science is believed to stem from various reasons: it is ‘the’ paradigm of rationality because of its commitment to a form of reasoning - inductive reasoning - embedded in its method that

enables it give adequate evidence for the justification of its beliefs, notions, knowledge claims, laws or theories; it is objective; its truth claims are universal; it is impartial; it has a public character; it is committed always to some general laws, assumptions, axioms and precepts that guide its activities. For these reasons, the scientific enterprise is believed to be ultimately based on evidence and facts and all these distinguish it from all other forms of life and disciplines as an objective enterprise and the apex of rationality. Bertrand Russell therefore says: “it is not what the man of science believes that distinguishes him, but *how* and *why* he believes it. His beliefs are tentative, not dogmatic; they are based on evidence not on authority or intuition.”³

Based on this popular image of science, scientists and science-oriented scholars have advocated that science should be the model for any inquiry and its method 'the method' such that a proposition is rational if it is scientifically or empirically verifiable or if it is a proposition of science. This is reemphasised by the positivist view of science.

Put differently, science has taken the stage as the paradigm of rationality, the model of truth, the standard of knowledge, the possessor of the method of inquiry because of its relationship with concepts like observation, verifiability, (individuated) facts, naïve realism, testability, impartiality, objectivity, and its commitment to inductive reasoning.

The aim of this paper is to show that science is only a paradigm of rationality and a model of truth and not the paradigm of rationality or model of truth. It cannot, therefore, serve as the yardstick for accessing the rationality of other belief systems and modes of thought.

The Popular Image of Science

According to C. G. Hempel, science is widely conceived as seeking to formulate an increasingly comprehensive and systematic worldview that is explanatory and predictive.⁴ Put differently, science is the “specific modality of human activity investment which consists of producing objective knowledge based on discovery of laws in the various areas of reality enabling us to give a rational account and an extremely good anticipation of events and phenomena.”⁵ How does science go about producing these objective facts about the world?

First, science is said to possess a reliable form of reasoning – a process of the inductive reasoning generally referred to as scientific method which, according to R. S. Rudner, “is not a matter of its transient techniques but of its logic of justification. The method of science is indeed, the rationale on which it bases its acceptance or rejection of hypothesis or theories.”⁶

Thus, when people talk of the scientific method, they are simply referring to the general properties and consideration that are used in the confirmation or refutation of a hypothesis in the various sciences, that is, the common way in which hypotheses are assessed or researches are carried out in the sciences. As a method of research, the scientific method is said to be identified with a number of procedural stages, phases or steps. Scholars are generally not unanimous about the exact number of the research stages in the scientific method.⁷ However, Kwasi Wiredu gives a characterisation of the method as involving hypothesis, experiment and observation. This, he notes, has in practice, attained a high degree of complexity. However, in bare essentials, it is characterised as follows: The mind is challenged by a problem and casts about for a solution. However plausible it

may be, it is not immediately asserted as true. It is merely entertained as a hypothesis, a tentative proposal, to be put to the test. But before that, its significance has to be explored, that is, its logical implications have to be unravelled in conjunction with other known facts. This is the stage of the elaboration of the hypothesis, which often requires techniques of deduction available only in quite advanced mathematics. The result, however, is always of the logical form of an implication: “if the hypothesis is true, then, such and such other things should be the case. The stage is then set for empirical confirmation and disconfirmation”.⁸

Straightforward observation or very technical experimentation may be called for in this stage of confirmation or disconfirmation. If results turns out not to be in agreement with the implications of the hypothesis, it is said to be falsified. It is, accordingly, either abandoned or modified. On the other hand, if results prove to conform to the elaborated hypothesis, it is said to be confirmed. It is the confirmed hypotheses that are regarded as laws and constitute the main corpus of scientific knowledge.⁹

According to Siegel, what is striking about the method of science is its commitment to evidence and to the form of reasoning as described above¹⁰ which is what ensures the objectivity and rationality of science. In other words, science is rational to the extent that it proceeds in accordance with such a commitment to evidence or form of reasoning.¹¹ For this reason, the method is seen as the most assured technique man has yet devised for controlling the flux of things and establishing stable beliefs.¹²

From another perspective, science is as an objective inquiry into reality. The sciences are said to be objective insofar as their conclusions are drawn directly from the hard and naked

facts about the world of everyday perceptual experience. These facts are not obscure but appear to the scientist as if he were viewing himself in a mirror. They are said to form the bedrock of scientific theories and discoveries.¹³ Scientific objectivity is a naïve realist position that: there exists a world of physical objects; statements about these objects can be known to be true through sense experience; by means of our senses, we perceive the physical world pretty much as it is; the sense impression we have of physical things is caused by those physical things themselves.¹⁴ Scientific statements are therefore believed to describe facts out there or, in other words, they are believed to correspond with states-of-affairs.

A third character of the popular image of science is its inter-subjectivity. Scientists are said to state their results or findings in an unambiguous fashion accessible to any interested person, such that they can replicate one another's work and expect to come to the same conclusion.¹⁵ Science in this sense, is public in character because its method, findings and products are exoteric rather than esoteric, they are inter-subjectively verifiable and are open to all and sundry. From this, the claims in science are said to be universally true. Due to its commitment to its method, objectivity and inter-subjectivity, it is believed that scientific statements are true facts or states-of-affairs about the world. The scientific statement: Water boils at 100°C, is a universally true statement because it is factual about the world and can be tested or verified by any one.

Also, science has gained this popular image due to its obedience to the general laws it has established. This refers to its strict adherence to the requirements of logical consistency and coherency in its hypothesis, laws and findings. In other words, its adherence to the formal rules of logic which are (i) The law of

identity (if P, then P), (ii) The law of non-contradiction [Not (P and non-P)], and (iii) *Modus Ponens* [If P and (if P, then Q) then Q].¹⁶

Science is also said to be impartial or impersonal because scientists do not allow their idiosyncrasies to affect their researches. In fact, scientists are said to be detached from their objects of study, allowing them to present themselves as they are. There is, therefore, the subject-object dichotomy which accounts for why scientists are said to be dispassionate and unprejudiced in their researches.

It is also important to note that the popular image of science is also informed by the belief that scientific results are analysable into simple components or individuated facts because it is the aim of science to deal with particular observable objects in the world and present us with specific information about them.

These characteristics of the popular image of science identified above are, therefore, responsible for the highly esteemed position occupied by science in modern societies and why it is seen as the only tool that can adequately describe, explain and understand the world as it is devoid of idiosyncrasies. Being able to understand the world, it is therefore seen as the best means of predicting future occurrences and equipping man with the ability to control the world. Consequently, any belief, notion, action or thought that does not conform to science is considered irrational. Science thus, becomes 'the model of rationality', since according to I. C. Jarvie, rationality is "normally ... attributed to those views which can be shown to be based on facts, or on science, which can, in other words, be justified."¹⁷ This view that science is the paradigm of rationality to which all views and forms of inquiry must

conform, or else irrational, is the main thrust of the positivist view of sciences.

The Positivist View of Science

The positivist view of science is made explicit in the doctrines of the logical positivists of the Vienna Circle: a group of philosophers of the 1920s meeting in Vienna and so, called members of the Vienna Circle.¹⁸ Some key members of the group were Moritz Schlick, Rudolf Carnap, Otto Neurath and A. J. Ayer. They are famous for their criterion of meaning referred to as the verifiability principle or more accurately, the “Empiricist Criterion of Verifiability.”¹⁹ Their distinction between meaningful and meaningless statements; their insistence on the verifiability (empiricist) principle; the universality of scientific investigations; their rejection of metaphysics; and their emotivist theory of ethics marked them out. Hence Isaac Ukpokolo says that:

The most important of the doctrines for the logical positivists is the theory of meaning according to which the cognitive meaning of a sentence is its method of verification. If a sentence is not verifiable (... some positivists said directly verifiable, others, indirectly verifiable ...) or is not a truth-value tautology, then it is cognitively meaningless. Logic, mathematics and science are regarded as legitimate because they satisfy the verifiability criterion.²⁰

In other words, only propositions of science, logic and mathematics are meaningful. Others are meaningless. The verifiability principle is therefore a statement about the necessary and sufficient conditions that must hold in order for a statement to be considered meaningful. It is not expected to be used in finding out the exact meaning of a statement or in

determining the truth or falsity of a statement. Rather it is intended to furnish us with the appropriate conditions for classifying certain statements as meaningful and others as meaningless.²¹ The principle is also meant to justify scientific findings as universal because when analysed into their elementary propositions, they are empirically observable or objectively verifiable anywhere. Popper says thus that an alleged proposition (or sentence) is genuine if, and only if, it is a truth function of, or reducible to, elementary (or atomic) propositions expressing observation or perception. This is also Carnap's idea of Protocol statements (statements reporting immediate observation needing no justification).²²

The positivists' rejection of metaphysics is lucidly expressed in this famous passage of David Hume's *Enquiry Concerning Human Understanding*:

When we run over libraries persuaded of these principles, what havoc must we make? If we take in our hand any volume of divinity or school metaphysics, for instance let us ask, *Does it contain any abstract reasoning concerning quantity or number?* No. *Does it contain any experimental reasoning concerning matter of fact and existence?* No. Commit it then to the flames for it contains nothing but sophistry and illusion.²³

Auguste Comte, influenced by Hume, made explicit the positivist rejection of metaphysics and endorsement of science in his distinction between three stages of human development.

Human development, he says, exemplifies a *law of growth*. It expresses itself first, in a theological form, next in metaphysical speculation and, finally, in a *positivistic*, truly scientific manner. Its first phase represents a necessary point of departure from which all intellectual activity must start. The

second marks a period of transition. The third is the fixed and final goal of all thinking.²⁴

In the initial theological stage, all phenomena are explained by supernatural arbitrary causes. At the metaphysical level, the individuals have dispensed with the quasi-human and personal causes of things. But they still find the explanation of phenomena in causes conceived as existing beneath the surface of events and as possessed of a superior reality to the appearances grounded in and upon them. Positivism, the final stage, is reached by criticism of the other methods. It involves a *rejection* of all hypothetical construction of entities regarded as existing apart from and beneath the sensible universe. It is a mere empirical observation of sense-data and inferring from their behaviour certain *laws* which their behaviour exemplifies and follows. It is a process of generalisation. These natural laws are no more than descriptions of how phenomena do behave; they are not underlying principles determining or governing the sensible world.²⁵ Comte is therefore trying to prevent the scientific stage from having the same problems he identified with the previous stage, though one can hardly say if he was successful. His position that laws describe how phenomena do behave tends to support uniformity of nature which is a metaphysical principle as well. Comte, in order to avoid this, adds that laws are not *necessarily* absolute in the sense of being of necessity universally true, since it is impossible to observe the past, present and future before arriving at laws.²⁶ This, logical positivists would however, not agree to, since they hold that scientific laws are universally true and can be confirmed or verified by anyone. Comte still maintains nevertheless, that science is the best tool for cognizing the world as it is based on

observation, evidence and objectivity. It is his view that what science does, and what it can do is that:

It organises knowledge, it gives the power of prediction and enables us to control nature in many ways and to harness her in the service of human progress and happiness. Surely then, it should also be able to give certain ideals to humanity and to afford mankind moral guidelines and inspiration.²⁷

A. J. Ayer also expresses his positivistic view about metaphysics in his *Language, Truth and Logic* that metaphysics claim to afford us with knowledge of a reality transcending the world of science and common sense.²⁸ Thus, he says:

No statement which refers to a 'reality' transcending the limits of all possible sense experience can possibly have any literal significance, from which it must follow that the labours of those who have striven to describe such a reality have all been devoted to the production of nonsense.²⁹

This attitude toward metaphysics and anything scientifically unverifiable therefore, influenced their view about ethics. To them, ethical statements simply reflect the feeling or desire of the speaker who wishes another to accept his view. This, they called, emotivism. Thus, if someone says: Stealing is wrong, he is simply saying: I feel that stealing is wrong and I desire that you accept my view. Hence, there is nothing special about ethical statements.

Generally, therefore, the positivist view of science can be summarised as follows: science is in pursuit of truth and it discovers truth; science makes definite claims about the world; these claims can be verified or confirmed as either true or false; science employs the inductive form of reasoning or model of accumulating facts; it thus relies on observation; science's framework of reference is the paradigm of rationality; subjects

like metaphysics and ethics are meaningless and irrational because they are not in conformity with science or the verifiability principle. Therefore, according to Peter Machamer,

The epistemological project of the positivists was to explicate how science was grounded in our observations and experiments. Simultaneously, the goal was to provide an alternative to the neo-Kantianism that was the contemporaneously concurrent form of philosophy. Taking from the tradition of British empiricism, empirical grounding, or being based on the facts, was seen as the major difference between science and the other theoretical and philosophical pretenders to knowledge.³⁰

This view of science presented by the positivists expresses the popular image of science. However, an attempt will now be made to critique this popular image of science with the aim of finding out if it gives an apposite picture of the scientific enterprise such that it is the only meaningful and rational enterprise that mankind has devised in explaining reality. In doing this, an attempt will also be made to clarify the concept 'rationality' to see if it is a sole property of scientific thinking.

A Critique of the Popular Image (Positivist View) of Science

The popular image of science can be summarised thus: science is the paradigm of rationality because it has a framework of reference that is based on the inductive model of accumulating facts by which it determines what is rational, true, meaningful, etc.; science is objective; its claims are inter-subjectively verifiable; it is impartial; its truths are universal; hence, it is the most reliable form of knowledge, the best tool man has yet devised for cognizing the world. All other inquiries or human

endeavours can only be seen as rational only if they conform to science or employ the scientific framework of reference otherwise, they are irrational or meaningless. Therefore, a belief or notion is regarded as irrational if it is not scientific, logical or verifiable.

Steven Lukes had outlined that beliefs, or sets of belief, are said to be irrational if they are (i) illogical e.g. inconsistent or (self) contradictory, consisting of or relying on invalid inference, (ii) if they are partially or wholly false; (iii) if they are nonsensical (though it may be questioned whether they would then qualify as propositions and thus as beliefs); (iv) if they are not universalized because they are bound to particular occasions; (v) if the ways in which they come to be held or the manner in which they are held are seen as deficient in some respect.³¹ Science, the positivists say, does not fall prey to any of these conditions hence reliable. But how true is this popular/rationalist image of science?

We will recall from our discussion so far that science is seen as a paradigm of rationality because of its claim to possess a universal, tested, reliable, rational, and productive method of inquiry regarded as the method of science. Post-positivist philosophers of science have variously argued however, that either science does not possess the method for all inquiries as it claims or that there is really no method at all. The views of Thomas Kuhn and Paul K. Feyerabend come readily to mind.

Kuhn for example, says that science does not have “the” method or the singular approach or paradigm for solving problems. He explains this by citing certain stages or processes that scientific inquiry follows from time to time: at the onset, it is normal science, then a period of crisis or an uneasy revolution which produces a normal science for the process to repeat itself.

In the stage of normal science, science possesses a set of unchallenged principles that give it its paradigmatic schema for its operations. After some time, the normal science comes into confrontation with problems which bring about a period of crisis, leading to a scientific revolution of paradigm change (like a religious conversion). As the new paradigm takes over, the old one passes away until the new one becomes a normal science, a new paradigm or approach for solving problems.³²

Kuhn's position is that there is no criterion for measuring one (the new) paradigm as better than another (the former), no yardstick for such comparison. Each paradigm has its own framework of reference and its rationality or irrationality, truth or falsity, meaningfulness or meaninglessness, etc., can only be sought within that framework of reference, not with the use of another paradigm. Thus one cannot be said to be better than another as such can only be sought within the context of use. Science can not be said to have a better framework of reference than say metaphysics, magic, voodoo, witchcraft, etc. as this will amount to an impossible comparison, for they are incommensurable. This is his theory of incommensurability.

Feyerabend goes a step further than Kuhn to assert strongly that there is no rationality or truth anywhere; they are only our creations and products of our historical experiences; we are the ones who say A is rational, B is true, C is real, D is false, etc. This is his theory against method. He recommends an epistemological anarchism where all these make-ups of man can thrive and be used to solve problems because they have their uses and no one, not even science, is superior to another.³³

Objectivity of science has also come under criticisms. Are all scientific claims observable or based on evidence? Does a scientist perceive things as they are or as they appear to him? In

other words, is science value-free or free from personal idiosyncrasies? The scientist can only defend pure objectivity devoid of all idiosyncrasies blindly because as a human being, he has his own idiosyncrasies which affect how he carries out his observation of the world. The fact alone, that he was born into some place in the world that moulded him, is enough for him to have some bias. Emery N. Castle, in her paper, “On Scientific Objectivity” identifies several factors that hinder objectivity in the sciences. They include desire for personal interest (say, financial gains), desire to avoid controversial problems, desire for approval, holding tenaciously to a particular theory, law, hypothesis or approach, etc.³⁴ Hence to assume that science proffers indubitable, infallible knowledge claims about the world as it is will be out of the place. Karl R. Popper says, therefore:

If scientific objectivity were founded... upon the individual scientist's impartiality and objectivity, then we should have to say good-bye to it... for there is no doubt that we are all suffering under our own systems of prejudices; that we all take many things as self-evident; that we accept them uncritically and even with the naïve and cocksure belief that criticism is quite unnecessary; and scientists are no exception to this rule even though they may have superficially purged themselves from some of these prejudices in their particular fields.³⁵

We now turn to a critical analysis of the concept “Rationality” as this is essential to buttress the fact that science is simply a model having its own framework of reference which it uses to determine rational and irrational claims within it, and not “the” paradigm of rationality. According to Dipo Irele, rationality is an essentially contested concept, and like any other essentially contested concept it is bound to have certain features

as identified by W. B. Gallie.

First, such concept is highly appraisive, not purely descriptive... Second, it is inevitably controversial and thus involves endless dispute since its proper use are determined by their users. Third, such disputes are nevertheless sustained by perfectly respectable arguments and evidence. Fourth, though the disputing parties adhere to different views as to the proper use of the concept in question, nonetheless, each party recognize that his/her own use is contested by others, and each party has some appreciation of the different criteria in light of which other parties claim to be applying the concept. Fifth... each party continues to argue most seriously that his/her use of the concept is sound even while, at times, realizing that other participants in the dispute can make a rational case for their own view and that no conclusive argument can be advanced for any of the competing views.³⁶

If this is the case, it means that there is no single or ultimate meaning of an essentially contested concept that can be said to be the standard for the application of the essentially contested concept. Hence, there is no ultimate fundamental criterion for the concept rationality, not even science, as the positivists have advocated. Thus, if there is no single, but rather, different criteria or modes for marking out something rational or otherwise, it simply means that the criterion used will be context-bound. As Richard Rorty says, there is nothing to be said about rationality apart from description of the familiar procedures of justification which a given society uses in one or another area of inquiry.³⁷ Thus, there is no one model, but rather models or paradigms of rationality, forms of life, conceptual schemes, or canons of interpretation. Rationality or irrationality is only determined by the relationship between the inquirer and his/her context of inquiry, not between an inquirer and another context

of inquiry. The rationality of science, for instance, can be known by examining the relationship between the scientist and science based on his/her compliance to the model or framework of reference inherent in the discipline. As Russell Ackoff explains, rationality is not a property of a decision-maker considered in isolation, but a property derived from a comparison of the researcher's and the subject's decision-making process. It is a function of the way the subject and the researcher *interact* and hence a systemic property.³⁸ To this end, it will be out of place for an enquirer or researcher to seek for the rationality of a belief outside his scope of study or form of life using his own model of rationality. It will only make such belief look irrational. This is what science does: using its own model or paradigm of rationality as a means of assessing the rationality of other modes of thought or forms of life and the result has been unfair to those other modes of thought.

Science is therefore, simply 'a' model or paradigm of rationality not 'the' only model of rationality as the popular, positivist image of science makes us believe. It has its own problems of rational and irrational claims, which it seeks to resolve using its own model. Once this fact is accepted, the meaningfulness and need for other forms of life or modes of thought like the metaphysical, as advocated by Feyerabend, would be more appreciated. Besides, it is an obvious fact that science, as an aspect of reality, cannot comprehend the whole of reality. Hence, it needs the complementary support of other modes of thought or forms of life for a full grasp of reality rather than having an exclusivist and ethnocentric mind-set towards them. These modes of thought are as essential as science and play their complementary role with science in the cognizing of the totality of reality. For instance, it is metaphysics, not science,

which asks and answers ultimate questions about existence, man and his task in the world: Questions such as: Why do I exist? What is the end of existence? How did everything begin? What are we here for? Why are we living?; and so forth.³⁹ Hence, dismissing metaphysics as irrational because it does not conform to the scientific model of rationality is not feasible because these questions are meaningful to the human person, maybe not cognitively as sought by the positivist, but functionally and meaningful.

K. C. Anyanwu has, therefore, posited that such modes of thought as the metaphysical and religious (specifically in African thought systems), operate on a different form of logic from the analytic/formal logic of Western science. This form of logic is called organic or holistic logic.⁴⁰ Thus, one form of logic cannot be used to assess the other. They are both meaningful and rational in their own right. Other modes of thought only become logically problematic when assessed by a procedure of reasoning solely guided by analytic or formal logic of the Western scientific tradition. It is however obvious that scientific logic is only one variety of logic.⁴¹

Conclusion

Science has been and is still an effective means of understanding and explaining events, predicting occurrences, controlling nature, and solving some of man's problems. However, the highly esteemed position given it in today's world, the popular/rationalist image painted of it by scientists and positivists as the best tool or only tool for cognizing the world, and the only subject with meaningful statements, is overrated and overemphasized. Being that science cannot, in reality, explain everything and drawing from our discourse so far, we

can aptly conclude that science is only a model of inquiry with its scope of discourse and not the model of rationality. That means, it is only 'a', and not 'the' means of comprehending the world as it is. Other means exist and are evidently useful. Science has no special feature that renders it intrinsically superior to these other branches of knowledge.

ENDNOTES

¹ E. Cassirer, cited by J. A. Aigbodioh, *Philosophy of Science: Issues and Problems* (Ibadan: Hope Publications, 1997), p.168.

² F. H. Giddings, cited by J. A. Aigbodioh, *op. cit.*, p.24.

³ B. Russell, quoted by H. Siegel, "What is the Question Concerning the Rationality of Science?", *Philosophy of Science*, 1985, Vol. 52, No. 4, p.517.

⁴ *Ibid*, p.520. *Philosophy of Science: Issues and Problems*, p.3.

⁶ R. S. Rudner, *Philosophy of Social Science* (New Jersey: Prentice Hall, 1966), p.5.

⁷ J. A. Aigbodioh, *Philosophy of Science: Issues and Problems*, p.24.

⁸ K. Wiredu, *Philosophy and an African Culture* (Cambridge: Cambridge University Press, 1980), p.144.

⁹ *Ibid*, p.145.

¹⁰ See H. Siegel, "What is the Question Concerning the Rationality of Science?", *Philosophy of Science*.

¹¹ See B. R. Baigrie, "Siegel on the Rationality of Science", *Philosophy of Science*, 1988, Vol. 55, No. 3, p.436.

¹² M. Cohen, E. Nagel, cited by J. A. Aigbodioh, *op. cit.*, pp.23-24

¹³ J. A. Aigbodioh, *Philosophy of Science: Issues and Problems*, p.4.

¹⁴ J. Hospers, *An Introduction to Philosophical Analysis* (London: Routledge and Kegan Paul, 1973), p.494.

¹⁵ See E. N. Castle, "On Scientific Objectivity", *American Journal of Agricultural Economics*, 1968, Vol. 50, No. 4, p.809.

¹⁶ M. Hollis, quoted by D. A. Masolo, *African Philosophy in Search of Identity* (Nairobi: East African Education Publishers, 1995), p.126.

¹⁷ I. C. Jarvie, "Understanding Cargo Cults" in Bryan R. Wilson (ed.) *Rationality* (Oxford: Basil Blackwell, 1974), p.50.

¹⁸ I. Ukpokolo, "Philosophy of Science: Nature and Programmes" in K. A. Owolabi (ed), *Issues and Problems in Philosophy* (Ibadan: Grovac Networks, 2000), p.209.

- 19 J. A. Aigbodioh, *Philosophy of Science: Issues and Problems*, p.120.
- 20 I. Ukpokolo, *op. cit.*
- 21 J. A. Aigbodioh, *Philosophy of Science: Issues and Problems*, p.120.
- 22 K. R. Popper, *Conjectures and Refutations* (New York: Harper and Row, 1963), p.261.
- 23 David Hume, *Enquiry Concerning Human Understanding*, L. A. Selby-Bigge (ed.) (Oxford: Clarendon Press, 1975), Section XII, Part III, p.165.
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- 25 *Ibid*, p.386.
- 26 *Ibid*, p.387.
- 27 *Ibid*, p.386.
- 28 A. J. Ayer, *Language, Truth and Logic* (London: Camelot Press, 1936), p.33.
- 29 *Ibid*, p.34.
- 30 Peter Machamer, "A Brief Historical Introduction to the Philosophy of Science", in Peter Machamer & Michael Silberstein (eds.) *The Blackwell Guide to the Philosophy of Science* (Oxford: Blackwell Publishing, 2002), p.3.
- 31 See S. Lukes, "Some Problems about Rationality" in Bryan R. Wilson (ed.) *Rationality*, pp.207-08.
- 32 Cf. J. A. Aigbodioh, *Philosophy of Science: Issues and Problems*, pp.69-75.
- 33 Cf. A. F. Chalmers, *What is this Thing called Science* (Buckingham: Open University Press, 1990), pp.134-45.
- 34 See E. N. Castle, *op. cit.*, pp.810-12.
- 35 K. R. Popper, *The Open Society and its Enemies*, Vol. II (London: Routledge and Kegan Paul, 1962), p.217.
- 36 D. Irele, "Essentially Contested Concepts and the Question of Rationality in Traditional African Thought", *Ibadan Journal of Humanistic Studies*, 1997, No.7, pp.126-27.
- 37 See *ibid*, p.128.
- 38 See R. L. Ackoff, "An Interactive View of Rationality", *The Journal of the Operational Research Society*, 1983, Vol. 34, No. 8, pp.719-22.
- 39 See O. A. Oyeshile, "The Nature of Scientific Reasoning" in Dipo Irele (ed.), *Philosophy, Logic and Scientific Reasoning*, p.113. *The African Experience in the American Market Place* (New York: An Exposition University Book, 1983).
- 40 H. Seigel, "Farewell to Feyerabend", *Inquiry* Vol. 32 No. 3, p.344.