UNIVERSITY OF CAPE COAST

RETHINKING AFRICAN SCIENCE: THE PERSPECTIVE OF CONVERSATIONALIST PHILOSOPHY

MAXWELL OMABOE

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BY

MAXWELL OMABOE

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature: ……………………… Date: ……………………

Name: MAXWELL OMABOE

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ………………… Date: …………………

Name: ………………………………………………………………………..

Co-Supervisor's Signature: ……………………….. Date: …………………

Name:……………………………………………………………………...

ABSTRACT

A popular scholarly tradition suggests that mainstream science and African science are tied to an irreconcilable interest. The distinction often maintained is that African science is a footnote of African indigenous religion(s). As such, whereas mainstream science employs methodological tools typical of observation, data gathering, experimentation, etc. to explain, predict and keep the world under control, African science pursues same agenda, this time, in terms of postulates whose essence is construed as personal spiritual forces. This (theoretical) orientation associated with indigenous science is consequently accused of entertaining methodological protocols that mystify rather than demystify the nature of reality. As a result, African science is said to constitute a barrier that hinders the progress of knowledge. Rethinking African science is a proposal that seeks to challenge this tradition. Using the method of concept analysis, the thesis shows that the supposed friction often maintained between the two disciplines is of no effect. My position is such that African science represents a genuine effort that expands our understanding of the universe beyond the domain championed by mainstream scientific theorizing. The finding is such that the supposed contradiction between the two disciplines is just a manifestation of substantial diversity across different cultures. Because there is no disagreement but appreciable diversity, critics have no business setting the two disciplines up in competition with each other. So, the comparative assessments that end up misconstruing African science as backward-looking is not only unfounded but a misconceived appraisal that robs African science of the worth it deserves.

KEYWORDS

Africanness

Conversationalism

Diversity

Quasi-physicalism

Science

Vital force

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DEDICATION

To my parents, Dora Ahia and Alexander Omaboe

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LIST OF ABBREVIATIONS

CP	-	Conversational philosophy
H-D	-	Hypothetico-deductivism
MN	-	Methodological naturalism
MMN	-	Moderate methodological naturalism
RMN	-	Radical methodological naturalism
ACP	-	African conversational science
MSRP	-	Methodology of scientific research program
BEC	-	Bose-Einstein Condensate
EPR	-	Einstein, Podolski and Rosen
SIS	-	Sufficient isolation of system
RDA	-	Rational divinity assumption

CHAPTER ONE

INTRODUCTION

Background to the Study

Pointing at problems is one thing, bringing out alternative solutions is another. In the *Eleventh Thesis on Feuerbach*, Marx (1954, p. 1) suggests that "philosophers have hitherto only interpreted the world in different ways, the point is to change it". Indeed, discerning academics have rehashed problems with African scientific theorizing in different ways. The overriding need now is to put in place an alternative method to change the status quo. Godfrey Okechukwu Ozumba, in his article *Analytic and synthetic dimensions of African science* tried an initiative to devise African science but with concepts that seem to merely duplicate the methodological protocols of mainstream science. In the end, his effort fell short of putting in a place precise justification for its Africanness. It may, however, be fair to indicate that similar articles that attempt to deal with same subject matter are limited by writing space to explore a comprehensive account of related follow-up queries that concern African scientific theorizing. The context of such limitation provokes a thesis of this sort to explore a much more detailed account relative to the questions that dominate discussions about African science. The motivation, then, is to contribute to addressing core issues arising from a broader perspective.

In discourses related to the indigenous African knowledge system as a whole, long-standing questions that provokes suggestions bother around whether the knowledge system should be integrated into mainstream body of scientific protocols or it should be defended along the lines of methodological pluralism (Emeagwali, 1993). In driving such a discussion, some interested scholars derive their concerns from a seeming irresistible urge to compare what may be regarded as an African orientation to scientific theorizing with mainstream science. The comparison is not itself the problem because it could lead to an integration of knowledge system across cultures in ways that tends to promote African heritage. However, it subsides into a problem when the comparison begins from a point that already prejudices the worth of particularly indigenous knowledge systems. It all begins with a seemingly innocent descriptive call that suggests the African worldview as inconsistent with mainstream science (Afisi, 2016; Alem, 2019; Gyekye, 1997b; Mosley, 2004). The supposed inconsistency appears to invite a contradiction that presents the two disciplines as modes of enquiry with irreconcilable interests (Akpan, 2010). Per this presumption, the disturbing consequences begin to unfold. Given the contradiction, it appears that any interested scholar is forced into a dilemma according to which choosing one mode of enquiry invariably negates the worth, legitimacy or both of its supposed competitor. The sort of problem that confronts African science, as Feyerabend (2006, p. 6) notes, “because of ideological pressures identical with those which today make us listen to [mainstream] science to the exclusion of everything else”. The crux of my point is that the sort of growing comparison between African science and mainstream science appears to perpetuate a sort of conflict. This conflict suggests that to embrace the former, one must invariably reject a seemingly backward superstition that parades under the guise of African science. it is as though modernization has rendered the African worldview obsolete and has therefore been invalidated by advances in mainstream science (Emeagwali, 1993; Gyekye, 1997b; Asouzu, 1998; Akpan, 2010; Wiredu, 1980; Horton, 1967; Inokoba, Adebowale & Perepreghabofa, 2010).

Concerning this conflict, I think that an unfortunate misnomer has gained grounds in forcing an opposition between two worldviews that approach the same reality at different levels of complexity without any contradiction. The motivation to reinstate what I see to be an interesting harmony comes from an insight advanced in Gyekye's book *Tradition and Modernity*. In this book, Gyekye (1997b) makes the point that Moore and Sanders (2004) re-echo; modernity does not necessarily entail throwing the entirety of tradition away, and neither does being traditional mean resistance to change. This decree provokes a painstaking urge to re-examine African science and mainstream science beyond the appearance of conflicts. In other words, I suppose it is possible to explore opportunities to integrate knowledge cultures in ways that do not require one knowledge culture to negate the other. So, I propose in this study to stimulate the debate on African scientific theorizing by exploring ways of cross-fertilizing the African worldview with mainstream science. The study, as I conceive, engenders a rethinking of African science in ways that show the diversity that comes with African science not as an opposition to mainstream science, but as a genuine effort to expand science for a better appreciation of reality.

To better appreciate the nature of the supposed conflict between African science and mainstream science, it is important to set the discussion in a general context of what it means for a method to be called scientific. In terms of having a definition that commands consensus, science entertains a deep philosophical controversy (Mumford & Tugby, 2013). Etymologically, science is rooted in the Latin word for knowledge (Abioje, 2015). As a verb, it connotes a devotion to a procedure for knowledge acquisition (Steffanides, 1965). On the face value of what the etymon implies, all systematic method of enquiry merits qualification as scientific. However, relative to debates surrounding philosophical methodologies of science, it appears not all forms of methods aimed at knowledge acquisition have been granted the status of "science" (Akpan, 2010). Western scholarship has had its fair share of disputations regarding what should pass as science and what should not. The various reactions to finding the appropriate distinctive markers which distinguish science from other disciplines are called the problem of demarcation (Godfrey-Smith, 2003). Ideally, there are three demarcation problems often conflated as one; science versus nonscience: science versus pseudo-science and natural science versus social science (Klemke, Hollinger & Rudge, 1998).

Of the demarcation problem, the much-debated concern relates to the friction between science and pseudo-science. Notable amongst these disputants include Thomas Kuhn, Paul Feyerabend, Imre Lakatos and Karl Popper. For Thomas Kuhn, scientific theories are measured by the three stages of evolution. The first phase called pre-science is defined by the absence of strict methodological procedures. Because of this, every method of enquiry holds water because there is no pressing need for adherence to specific methodological protocols in the second phase, pre-science evolves into an era appropriately identified as normal science. According to the demands of this era, a prevailing methodology is formalized and accepted by practitioners as the working methodological procedure for scientific enquiry. The third phase is called revolutionary science where prevailing overwhelming anomalies relative to the established methodology give way to a shift in paradigm (Kuhn, 1996). Feyerabend (1993) proposes methodological anarchism, in which relegating binding methodological rules is very much consistent with the way science has achieved progress. In Lakatos' (1998) view, paradigms can be grouped as progressive or degenerative. The hallmark of genuine science is for a research program to be progressive; it must serve as a gateway to the discovery of novel facts.

Suffice it to narrow down the concept of science to the African context. In African philosophy, insistence on questions relative to science has been focused on concerns about uniqueness. This concern breaks into a larger discourse that derives from methodology debates in African philosophy. The questions that come with the methodological issues put the nature of African science down to debates across the universalist and particularist divide (Alem, 2019; Ogungbure, 2013, Keita, 2007). Wiredu (1998) for instance indicates that it is simply an expression of colonial mentality to devise an African orientation of philosophy by detaching it from mainstream philosophical thinking. The universalist, then, subscribes to the view that any methodology worthy of the label science ought to retain a systematic theoretical structure based on rigorous logical reflections (Ogungbure, 2013). The universalist impression suggests that there is only one methodological yardstick fit for description as science. By implication, cultural differences cannot tamper with the laid down procedures of science. So, all a culture is allowed to do is apply (the same) method to solve the supposed unique challenges of the related cultures (Emedolu, 2015; Afisi, 2016). Kwesi Wiredu's *Philosophy and African Culture* exemplify such a position. To the particularist, knowledge never comes from a vacuum, it evolves from one culture or the other. Because of this ineliminable link between knowledge and the supposed unique cultural experiences, the particularist holds that the methodological protocols are open to adopting unique features if they constitute a relevant procedure to the subscribers of a particular culture (Ogungbure, 2013; Alem, 2019).

Following the particularist orientation, African science seems to have attracted disrepute for particularly its strong association with the spirituality of related indigenous cultures. I have no genuine issue if the legitimacy of African science is justified in connection to its relevance to subscribers of related cultures. However, this particularist orientation appears a divisive conditioning of knowledge systems that ultimately opens another door for a conversation about a potential problem. For instance, for those who cease the occasion to demand more clarity, it appears the particularist conceptualization of science is either evasive or imprecise about a lingering question. For it appears one is left unsure about whether or not the particularist niche of African science does not in any way imply a typical negation of mainstream science. Following this, I am pushing for the kind of reconciliation wherein African science does not lose its loyalty in terms of cultural relevance whilst at the same time ensuring a considerable degree of consistency with mainstream science. The thesis, then, is a challenge to the status quo as I serve African science with an opportunity to carry its unsung rich knowledge culture from local relevance to global significance. At the end of the day, I seek to close the curtains against the supposed contradiction tag as I replace it with a way of thinking that projects an appreciation of the salient harmony between mainstream science and African science. The expectation (before the study), then, is the lookout for evidence that demonstrates how both worldviews constitute a manifestation of diversity which together renders our appreciation of reality even better. So, in this challenge, I am essentially going after any position that perpetrates unmerited friction between the two disciplines. In short, it all comes down to dissipating one conviction; scholars have no business retaining any friction between African science and mainstream science simply because there is no contradiction but diversity.

To achieve this feat, I have in use a frame of thinking called conversational philosophy. As a framework for advancing knowledge, Conversational Philosophy (CP) pushes the borders of knowledge systems through a design that fosters knowledge synthesis. As such, it prescribes a clear path procedure for cross-fertilizing knowledge systems on virtues of creativity, critical questioning and the rigour of argumentation (Chimakonam, 2018). African conversational science, as I call the agenda before the study, constitutes a method of scientific enquiry that cross-fertilizes the centrality of the African worldview with the methodological protocols of mainstream science. Before I proceed, it is important to say a little in defence of the need for cross-cultural knowledge synthesis. Otherwise, there seems to be no need for ink to be spilled in dissipating the supposed myth of contradiction between mainstream science and African science. Indeed, the respect for cultural dynamism imposes a sense of duty not to force the intellectual tradition of one culture over the other. So, as I indicated, I have absolute regard and recognition for science that resonates with the worldview of a group of people. However, I also have no shred of doubt that like mainstream science, indigenous science is saddled with imperfections. So, one may be narrowing the scope and hence trivializing the bounds science can break if we fail to explore how one discipline can help evolve the other from possible limitations. The point is such that if there are ways to advance a synthesis in ways that serve to better the interest of African scientific theorizing, I deem it a needless Afrocentrism to decline any such invitation. When we sacrifice opportunities aimed at advancing intellectual tradition merely in the name of conservatism, African science would be reduced to a petty racial gallery. A method of African scientific theorizing worthy of its sort should, I suppose, rise beyond these sentiments. One need not consider a call for collaboration as necessarily an inditement, disruption, or rejection of African science.

Indeed, a point we may all agree on is that like mainstream science, the method of African science is not without blemish. At least Robin Horton (1967) and

Evans-Pritchard (1976) raised salient criticism of its methodological issues in ways that yearn for attention. Because even the oceans accept the little drops of rain, I suppose there is always room to advance African science for the better. If this motive is well understood, then it clarifies the spirit behind how this study approaches African science. I am simply delving closer to understanding the supposed friction between African science and mainstream science, and based on the findings, I intend to trigger a synthesis that would enable African science to do what it does even better.

Closely related to the methodological debate of African science is also the issue of legitimacy. The question often raised here is whether or not African science can be legitimately qualified as science. On one hand, the query has been that the worldview typical of traditional Africa (and by traditional, all I mean is a description of the pre-colonial epoch) is essentially unanalytic, mystical, or superstitious, and hence, unfit to bear recognition as scientific thinking. Belonging to this school of thought are Asouzu (1998), Wiredu (1980) and Akpan (2010). Other scholars have also alluded to case-by-case examples, referencing at least one of numerous advances in metallurgy, medicine, and formal sciences (Mathematics and Logic) as a basis for the legitimacy of African scientific theorizing (Keita, 2007). Proponents of these views have notable examples like Diop (1991) and Ogungbure (2013). There is also another thorny controversy that borders on the seeming redundancy of the "African" qualification relative to the rendition of "African science". The query is that if one cross-fertilizes the features of mainstream science and the worldview typical of African science, in what precise terms can we justify the latter's sense of African belongingness? I host a debate that elaborates on these concerns in ways that at least expand our understanding of African science.

Before closing chapters to the background issues, it is important to inquire what the new method of African science proposed in this study would achieve differently. Some scholars have suggested that until African science revises its methodology and metaphysical presuppositions, it will continue to remain stagnant. Akpan (2010) Asouzu (1998) and Inokoba, Adebowale & Perepreghabofa (2010) just to mention a few, have tried defending this view. Others also suggest that African science is vested with its own peculiar strength and has only been side-lined from mainstream disciplines for the wrong reasons. The appeal made by this view is that if African science is given (i) the necessary attention through documentation of its achievement, (ii) proper generational transmission and (iii) incorporated into the mainstream research programs, it will have a far-reaching consequence for Africa and the world at large (Bodunrin, 1981; Diop, 1991; Hountondji, 2002). The methodology I propose for African scientific theorizing is inspired by protocols of mainstream science. I call it "African" because it resonates with an ontological worldview typical of indigenous knowledge systems. For identification sake, we may refer to this theory as African conversational science (ACS); a science whose ontological underpinning is motivated by a culture but whose epistemic protocols' "appreciation transcends the borders of the environment that created it" (Gyekye, 1997b, p. 226). The intention as Emeagwali (1993) indicates is to invoke deeper appreciation for the contribution ushered by the inventiveness of African heritage to world civilization after years of marginalization and devaluation.

It appears that the present state of African science lags behind mainstream scientific research programmes in terms of relevance in global impact. Yet, one must tamper this judgment with a fair hearing of African science. To sustain any valid objection against African science with regard to any comparative assessment, one must first identify precisely what existing method is being regarded as an embodiment of African science. One may even go further to interrogate, as Wiredu (1980) initiated, whether it is appropriate in the first place to compare what seems like footnotes of a spiritistic thought system with mainstream scientific methodology. Beyond this, it may also be fair to note that colonialism may have shut the doors to the pace of development relative to African indigenous knowledge systems. Even so, the challenge of African philosophy is to spearhead any such relevant recoveries if there are (Etieyibo, 2018). That said, we as Africans must also take caution not to be led by Afrocentric tendencies to, consciously or unconsciously, exaggerate the worth of African science. This would mean that one should also not be carried away by racial sentiments to keep to tradition at all costs. As Bodunrin (1981, p. 176) succinctly states, “Our culture may be dear to us, but truth must be dearer”. So even as we try to respect cultural dynamism, we must also have standards of tolerance that do not sacrifice the quality of African indigenous knowledge systems on an altar that sorely prioritizes loyalty to one’s culture. So, I must reiterate that by reconstituting a method for African science on the protocols of mainstream science, I do not imply that any one of the knowledge systems is superior to the other. What I should be heard suggesting is that both represent avenues to understanding the universe in ways that simply leave contradiction out of the equation. This understanding invariably implies that neither of the worldviews represents backwardness but diversity.

To be sure, I should not, therefore, be understood as attempting to subtly collapse African science by replacing it with mainstream science. The initiative to show their unity is the beginning of what I consider to be a harmonious relationship that promises to promote the interest of both parties. The beauty of science is that it is far less dogmatic. So, any anticipated changes that the study brings to the African worldview are defacto an important expectation that comes with scientific theorizing. The thesis endeavours to stimulate a conversation on the issues so far highlighted. At the end of the day, the task is worth the effort, for African science has nothing to lose but her "chains".

Statement and Justification of the Problem

Scientific knowledge plays a crucial role in the development of societies (Odhiambo, 1991). African science, be it indigenous or modernized as categorized by Akpan (2010) is accused of suffering from either identity crises, stagnation or both. On one hand, modernized African science as theorized by Ozumba (2000) conflates the method of African science with the general procedures of mainstream science in ways that make it difficult to make out any difference(s). Following this challenge, Akpan's (2010) objection is that the imposition of the general procedures of mainstream science on African science renders the latter indistinguishable from the former and hence, imposes identity crises on African science. This means that if African science is worth any substance, it must stand by some unique features. Sympathizers of the discipline are therefore moved to make a call that stands African science out as a set of unique principles or approaches to understanding the universe (Afisi, 2016). To substantiate the supposed unique features claimed for the discipline, sympathizers like Munyonga (2020), Chimakonam (2012) and Selin (1993) have relied on indigenous knowledge systems as the preferred methodological resources fit for African-oriented science. The claim has been that before contact with Europeans, sub-Saharan Africa in particular had both theoretical and technological science, which, for lack of research, have been wrongly denied the continent (Kienom-Kabore, 2017). So, except for the formal sciences, several attempts to filter out supposed distinctive markers of indigenous science have ended up in copious allusions to applied technology and medical practices of ancient Africa, usually resonating with Kemetic civilization (Emeagwali & Shizha, 2016; Afisi, 2016; Diop, 1991; Ochieng-Odhiambo, 2010; Olela,1998; Osahon, 1998; Alem, 2019).

It is often acknowledged that the utility essence of African scientific theorizing is driven by the instincts to preserve livelihood or to sustain the survival of concerned societies (Sithole, 2016). In other words, African science approaches the universe as a resource with considerations for sustaining existence (Emeagwali, 2016). Beyond this, however, science also considers the universe as a posing mystery to be explained, understood, controlled and appreciated. This charge gives science the mandate to continually push the frontiers of our understanding for purposes of knowledge's own sake. As such, a distinction often clearly maintained is such that science in its fullness does not rest with the applied technology (which restricts itself to finding solutions to pressing local needs) alone but it is also a field of knowledge that entails a set of cognitive abstractions and principles (Klemke, Hollinger & Rudge, 1998; Asouzu, 1998). The latter which is the theoretical dimension is motivated by the use of intellectual powers to seek the truth or truth verisimilitude. Theoretical science for that matter is the framework that allows for analysis, understanding, testing and the provision of a coherent basis for rendering explanation and predictions (Gyekye, 1997; Dawkins, 2012; Salmon, 1998; Engwa, 2014). Indeed, without a progressive theoretical base to sustain science, the creative spirit of innovative technology will be hampered for want of a framework to analyse data (Odhiambo, 1991; Gillies, 1993). Relative to African science, the theoretical component of indigenous science suffers what seems to be an avoidable setback as it is often linked to footnotes of African spiritism in which an oath to exercise the craft in secrecy remains an integral virtue (Emeagwali & Shizha, 2016; Tempels, 1959; Emeagwali, 2004; Alem, 2019; Ashforth, 2004; Ani, 2020; Gyekye, 1997b). Henry Olela (1998, p. 46), then, indicates that “the priest told laymen how to use this knowledge (technology-oriented science) for their activities but the actual theorems and proofs remained a sacred trust”.

On one hand, there are several reports (particularly from the universalist orientation), accusing the spiritistic orientation of African science as an illegitimate basis for advancing a progressive theoretical science (Wiredu, 1980; Akpan, 2010; Asouzu, 1998; Abioje, 2015; Alem, 2019; Ogungbure, 2013; Gyekye, 1997; Wambebe, 2018). As Gyekye (1997b, p. 245) puts it “But where this [causal interaction between supposed natural phenomenon] is enmeshed with—made inextricable from supernaturalistic molds and orientations, as a purely empirical pursuit, it hardly makes progress”. In response to the query, sympathizers of African science insist that the discipline is charged with a different core mandate (from mainstream science), and this mandate (to investigate phenomena beyond the reach of mainstream science), apparently, inspires her spiritistic orientation (Selin, 2003; Moore & Sanders, 2004; Bodunrin, 1981).

It seems, therefore, that altering the supposed metaphysical character, or to be more precise, the spiritistic orientation of African science is tantamount to disturbing its very claim to an African identity (Afisi, 2016). As Chimakonam (2012a, p. 35) notes, “In a way, describing and explaining the metaphysical is the main distinguishing factor of African science. A science which does not include the metaphysical in its map of reality is surely not the African science”. On one hand, this supposed metaphysics niche carved for African science (to proceed using the spiritistic foundations) presupposes that the discipline concerns a world, events, or phenomenon before which the methodological protocols of mainstream science are of no effect. In choosing to carve its identity niche this way, African science seemed to have opened itself up to a serious dilemma. On the other hand, the very methodological orientation that supposedly gives African science its unique identity (in terms of dealing with spiritistic mediums) is accused not only of deepening the superstition and mysticism associated with the discipline but also entertains methodological features that militate against its own progress (Afisi, 2016; Wiredu, 1980; Inokoba, Adebowale & Perepreghabofa 2010; Apkan, 2010). For that reason, Gyekye (1997b, p. 245) seems to have been left with no other option but to sum up his view on the description of African science in the subtitle "negative features of our African cultures". African science, then, is torn between either keeping to stagnation or giving up her unique orientation as "African" if it desires to progress. The problem of the study is, therefore, the ensuing challenge of how to reconceptualize, repackage, rethink or rebrand African science with a kind of methodological orientation that evolves the discipline from this dilemma.

Purpose and Objectives of the Study

Subject to conversationalist analysis, I aim at streamlining indigenous knowledge systems into the larger body of scientific research programmes. By so doing, I aim to reconstitute an African-oriented theoretical science using methodological protocols that feature in mainstream scientific theorizing. Pursuant to this, the study is guided by the following core objectives:

1. Examine the meaning, nature and scope of African science
2. Explore the criteria of Africanness sufficient for reconstituting African science into the larger body of scientific research programmes

3. Analyse the nature of relationship (if any) existing between mainstream science and the African worldview.
4. Theorize an alternative philosophical methodology for African scientific theorizing based on the nature of relationship between the African worldview and the methodological protocols of mainstream science.

Research Questions

1. What is the meaning, nature and scope of African science?
2. What criterion of Africanness applies in identifying science as African oriented?
3. How does the African view of reality compare with the worldview presupposed by mainstream scientific theorizing?
4. How can the methodological protocols of mainstream science be oriented to reflect the peculiar properties of the African worldview?

Thesis Statement

My proposed idea for reconstructing African science is to explore the possibility of cross-fertilizing indigenous knowledge systems with the methodological protocols of mainstream science, a strategy that seems not to have received a sufficient share of attention so far. Even though African science and mainstream science appear to have different orientations in their respective approach to cognizing reality, the study presupposes that a detailed analysis reveals an underlying unity that has so far eluded the appreciation it deserves. Following this presumption, I claim that between mainstream science and African science, there is no friction but diversity. In other words, the label that suggests an irreconcilable friction between both worldviews is of no effect and for that reason a rethinking of the seeming opposition rather leads to an appreciation of a fundamental unity that underlies their diversities.

Method of Study and Sources of Information

The method of study is qualitative and the design is exploratory. The method proceeds by content analysis of concepts relative to philosophical methodologies of science and African metaphysics. The tools for data gathering are essentially theoretical instruments, particularly the use of dispositions typical of critical thinking skills, namely: analysis, interpretation, explanation and synthesis. These tools are used to analyse the basic theoretical assumptions and concepts that characterize the African worldview and mainstream science. Logical argumentation would be used to explore the nature of the worldview presupposed by mainstream science. Through the analysis of selected African ontology, I show how the African worldview resonates with the features of the world presupposed by mainstream science. I synthesize their relationship into a hybrid methodology by analysing ways by which additional protocols of mainstream science can be of use in correcting identifiable gaps in the method of African science.

I use both primary and secondary related sources of information. These materials are drawn from across interdisciplinary backgrounds particularly relating to themes from philosophy of science, African philosophy, African indigenous religion, and Western metaphysics. The predominant sources of primary documents are published books of related themes and online related articles. Secondary sources covering unpublished research works, published books, articles and journals obtained from public university libraries will also be used. I employ two major avenues to ensure the validity of findings; peer debriefing and information triangulation. By triangulation of information, I use consensus on ideas from multiple sources, particularly when it comes to interpreting key technical concepts and theories in the field of physics.

Scope and Delimitation of the Study

Some sympathizers of African science suggest that there are no real barriers to what divides scientific knowledge from other forms of knowledge. A major reason cited in support of this view is that science etymologically means “to-know”. Accordingly, the argument is that science could be stretched to cover all methods of acquiring knowledge (Abioje, 2015). The implication of this line of argument reinforces a classification of indigenous knowledge systems where sources such as divine revelation, intuitionism, authoritarianism, empiricism and rationalism could all lay claims to African science. Despite this advocacy (which rather seems to advertise African science from such a broader perspective), I approach African science with particular reference to the divine theory of knowledge. The divine theory of knowledge is a consequent of the Africans’ belief that knowledge is fundamentally a prerogative of the divinities headed by God and is transmitted via appropriate instituted means through lesser forces to the elderly and consequently to be imparted to children (Mpofu, 2016; Peek & Yankah, 2009; Chimakonam, 2012b; Hamminga, 2005). Even so, those with integrationist orientation insist that metaphysical presumptions are pivotal considerations in scientific theorizing (Popper, 1962; Gyekye, 2009; Mumford, 2008). Consequently, because to the indigenous African, all sources of knowledge come down ultimately to divine origin (Tempels, 1959; Mbiti, 1970), I deem the scope of the divine theory of knowledge exhaustive enough to contain a study of this sort.

Significance of the Study

Mainstream science, whenever it brings one solution, invariably creates another problem usually of debilitating effect. Since Newton discovered the relationship between force, mass, and gravitational acceleration, breakthroughs in locomotives, machines, and factories have overwhelmed the 20th century. Nonetheless, in various fronts of social and economic lives particularly environmental and climatic conditions, we have had (Western) technological science effecting serious crises of global concern (Chimakonam, 2012b). If any other thought system promises a vested interest in assisting the effort of mainstream science in resolving our existential challenge, it is important to give it a fair hearing. In other words, the study is significant to the extent that it serves as a reflective basis to evaluate how far African science goes in complementing the effort of mainstream science in terms of generating an appreciable understanding of our universe and dealing with our day-to-day challenges of life.

Secondly, calls have been made for the establishment of African science as a component of both Western and African educational curriculums (Afisi, 2016; Akpan, 2010). Since 1999, part of the aim for establishing the Ghana Federation of Traditional Medicine Practitioners' Association was to set the foundation for the inclusion of traditional medicine in the curriculum of medical schools (Nimoh, 2014). Following such proposals, Akpan (2010) avers that Africa is awaiting the introduction of voodooism, climatology, divination, etc. in our school system as Obafemi Awolowo University has already initiated Herbalism as a course of study. University of Dar es Salaam has a unit block dedicated to the study of indigenous medicine just as in Ghana there is a research institute committed to herbal and plant medicine (Offiong, 1999). Clearly, the theoretical study of African science is gathering momentum to stamp its place as a relevant discipline in academic curriculums. A study of this sort is therefore a stimulant to expand discussions relative to alternative methodological perspectives in African science. The interdisciplinary nature of this study brings into focus the cross-fertilization of sciences of diverse cultures in the bid to find an alternative theoretical approach not only for explaining the worth of indigenous knowledge systems but also to advance the frontiers of science in general.

Conceptual and Theoretical Framework

The conceptual scheme adopted to frame this study is a mode of thinking that prescribes procedures for obtaining cross-fertilization for the purposes of promoting coexistence among knowledge systems. As an apt conceptual framework, conversationalist philosophy is an approach that concisely maps out the procedure for achieving knowledge synthesis across the background of different cultures. For knowledge cultivation, the method presupposes, "is not supposed to be a place thing alone; it is also an inter-place activity" (Chimakonam, 2017a, p. 115). Conversationalist thinking is a methodological procedure for critiquing and correcting thought systems by opening up a thesis for questioning to locate shortfalls, providing answers and sustaining the process ad infinitum (Chimakonam, 2018). Conversationalism, then, remains a viable approach aimed at yielding a constructive transformation from tradition to modernity. As Wiredu (1991, p. 105) once alluded to, the "conversation" between indigenous inherited insights and intellectual resources of modern age is the appropriate task of African philosophers.

Conversationalism derives from a loose sense of the word "converse", which presupposes parties of opposing interests coming together to initiate, where applicable a considerable compromise in good fate. This means that the requirement that renders conversationalist philosophy applicable is a perceived conflict, opposition or a supposed irreconcilable interest across identified knowledge cultures. Indeed, the core of this philosophical methodology is traceable to a motivation Kwame Gyekye inspired from his work *Tradition and Modernity*, and similar ideas could be picked out from views expressed by Kwesi Wiredu. What Chimakonam did to merit an originator is the initiative to draw out a clear formal procedure for achieving the cross-fertilization of intellectual cultures across the divide between tradition and modernity. As reckoned in Wiredu's (1991) voice, a conversationalist urge is a mandate to shuffle inherited philosophical insights with the intellectual legacies of modernity.

Conversational philosophy is a reactionary way of thinking regarding the way to go about reconstructing themes in African philosophy. The aim is to evolve themes in the discipline that transcends the strict bifurcation occasioned by the universalist-particularist divide. The presupposition is that on one hand, the universalists' undue emphasis on individualistic reflections, argumentation and criticality, leads African philosophy to enclaves of logocentrism. This logocentric sentiment that tends to negate other knowledge cultures somewhat detracts from the effort at achieving epistemic decolonization and in a way, it undermines the equal validity presumption required to foster intellectual diversity. On the other hand, the particularist orientation to African philosophy risks walling ideas in ways that have the potential to limit the scope of its relevance. The consequence of erecting such barriers also nurtures a sense of negation relative to other knowledge cultures. So, when Chimakonam indicates that undue stress on particularism has the potential to instigate sentiment of the "self" against "others", he is clearly insisting that particularism is vulnerable to creating a perspective as if all realities represent irreconcilable interests. In between this dichotomy lies the good fate of conversationalism. It is a way of thinking that initiates an option to reconstitute a philosophical village where reason transcends the local to the global front. Thus, the conversationalist way of thinking seeks to break the supposed friction where the "self" unites with the "other". In this unity, opposition turns out to be mere appearances, and beyond the smokescreen of such supposed opposition lies a fundamental relation of complementarity (Chimakonam, 2018, p. 136).

According to the conversationalist frame of thinking, ideas, theories, principles, etc. are at first considered or seen to be at variance with one another. Their opposition generates what may be called "tension of incommensurables". A scholar positioned in this framework aims to see to it that these seemingly opposing ideas achieve some degree of synthesis that expands our understanding of reality in general. To achieve this, the framework requires a theorist to trigger a synthesis, particularly from the metaphysical underpinnings of the ideologies in question. The first requirement is a step called arumaristic complementarity; creating a basis for unison. The method requires the use of rigourous argumentation, question and answers, to draw closer to the ontological underpinnings of the supposed rival knowledge systems under study (Chimakonam, 2018). The presupposition here is that one reality is insufficient and therefore it depends in some way on other realities to make complete sense of or expand our understanding of reality (*ibid*). As I indicated earlier, by its metaphysical orientation, African science, bears imprints of idealist presuppositions because of its emphasis on the core presupposition that spiritual agencies or vital forces form the essence of all substances including material reality. On the other hand, mainstream science presupposes the foundation of physicalism. So, the two worldviews identify with a threshold that suffices to treat them as variables in opposition.

By and large, the conversationalist idea compares with Descartes' innovative approach to establishing what he regards as an unshakable foundation for the sciences. Having made the point that the world of the senses is so prone to errors, Descartes had no option but to look for a supposed better foundation from within the idealist world (Descartes, 2008). From the option to situate the framework of the sciences on metaphysical axiom, the "I", a telling problem that lingers even till this day was just inevitable. It was the challenge of how to situate the exact sciences typical of physics on a supposed spiritual ontology, the "I". Descartes' challenge could only get worse as Hume latter advanced what seems to be an admirable logic for why the generality of metaphysics is as needless as that which ought to be committed to flames, let alone to talk of making science its foundation.

To reinforce a harmony between (mainstream) science and metaphysics, the intervention of Immanuel Kant comes to sympathizers of the latter as a great sigh of relief. Kant proposed that all cognition starts from experience because the cognitive faculty itself is awakened into activity through stimulations from sensory impressions. However, experience by itself cannot guarantee the certainty of contents if all rules by which it precedes are products of same supposed questionable foundation of experience. The faculty of understanding comes in to compare, separate or connect impressions in order to yield understanding. The faculty of understanding, then, constitutes what Kant calls "transcendental cognitions"; a faculty of a priori concepts that imposes itself on sensory impressions to yield a meaningful experience (Kant, 1998). On that note, metaphysics is born out of the power of the faculty of understanding in its very attempt to achieve transcendence.

By transcendence, the mind is simply going beyond experience to achieve a synthesis with the a priori faculties. Kant notes that the faculty of understating alone cannot intuit anything, in the same way the senses alone cannot think anything. "Only from their unification", Kant (1998, p. 194) further notes, "can cognition arise". For a meaningful knowledge, experiential knowledge cannot negate, but is rather reinforced by transcendental cognitions which are themselves outside the remit of empirical knowledge. The key tenet as emphasized in the narrative is echoed in conversationalist thinking; physical concepts (which pervades mainstream scientific theorizing) and non-physical concepts (typifying ontological postulates of the African worldview) are fundamentally complementary to each other. African conversational science takes off from this frame of thinking.

Conversationalism, then, seeks to highlight the co-existence that fosters an alignment between the material world and the supposed spiritual realm. Per the alignment envisioned by the conversationalist perspective, African science derives its cardinal features from the nature of African metaphysics, however, it does not negate the complementarity of empirical knowledge as championed by advances in mainstream science. Mainstream science explores the world from objective presuppositions. Whilst this objective aspect may be quiet adequately explored, the impact of the subjective correlates typifying consciousness (within which the supposed objective reality is known) gets ignored. In the subjective background (of consciousness) lies all the immediate awareness that presents the supposed objective features to be known in the first place. At last, so long (mainstream) science yearns to remain objective, it forever needs a constant reminder that ensures its reconciliation with the dynamics of subjective reality. In other words, science may have the truth about things supposedly out there, but it neglects the science concerning how our consciousness comes to possess or know in the first place (Sokolowski, 2000).

As such, an enquiry worthy of a scientific label requires the complement of an investigative frame of thinking that explores the role and function of the subjective (consciousness) in creating that which is deemed objective reality by mainstream science. The supposed subjective (African) vital forces are conceived principles properties that endow the physical with their respective essences and therefore the physical remains unknown without prior knowledge of the fundamental properties of the vital forces. That said, conversationalist framework, then, finds an anchor in the phenomenologist frame of thinking, since subjectivity which manifests as consciousness is not only brought into harmony but is also conceptualized as the essence of the material world explored by mainstream science. In line with phenomenology then, conversationalist thinking simply invites us not only to recognize but to appreciate and restore a deeper realm of existence that gets swept under the carpet in our supposed scientific quest to explore the world out there.

So, in triggering the agendum of arumaristic complementarity, advances in mainstream science are used as a reference point to facilitate our understanding of the conscious forces that typify the African worldview. In other words, rather than portraying the forces as opposing theses to (the objectivity sought by) mainstream science, the theories, laws and principles of mainstream science are to be used as corroborative insight toward expanding our understanding of the African worldview.

Conversationalism makes room for a threshold (*Bere n'oke*) that controls the limit at which the two opposing ontological systems achieve a synthesis. The conversationalist way of thinking therefore guides the investigator to locate the points(s) of dissimilarities between the ontological variables. Indeed, this dissimilarity is only meant to ensure that cross-knowledge fertilization does not dissolve the identity of one ideology (in this case the Africanness of science) into another knowledge system (say mainstream science). This presupposes that no matter the degree of complementarity, scholars in the discipline of African philosophy ought to be mindful not to fall for epistemic injustice where extolling the virtues of one knowledge system indirectly marginalizes the relevance of the other (Chimakonam, 2018). In other words, conversational philosophy presupposes that there are always new vistas for knowledge systems to explore alternative ways of closing their differences, but in ways that never collapse one into the other. So, the task imposed by conversational philosophy requires an exploration of how the African worldview exists as a complement to each other without the option for one to subsume the other (Chimakonam, 2017b). In my case, I explore the opportunity to eradicate any supposed conflict by approaching the domain of each knowledge system as exemplifying diversity.

From the concerns above, it is obvious that the theory of African science to be constructed is given by looking out for ways in which mainstream science and the African worldview can bring their interest to co-exist without instigating any rivalry. Accordingly, the kind of rethinking sanctioned by conversational philosophy is an approach that looks at both disciplines as lenses whose primary aim is to use cultural differences as an advantage towards achieving a common interest; expanding the borders of scientific theorizing in particular and our understanding of reality in general. In achieving the goal of cross-fertilizing knowledge systems from diverse cultures, the importance of three main theories has a salient link to the conceptualization of African scientific theorizing. These are, so far, the leading theories relative to the logic that underpins a procedure deemed to be worth the label of science. In effect, their place in the study is to serve as the "ingredient" from the "other" knowledge culture required to synthesize with African indigenous knowledge systems to constitute the hybrid methodological alternative I intend to propose.

In other to come to terms with these theories, it is important to note that philosophers often maintain a distinction between two kinds of context when it comes to the analysis of the scientific method. The first context concerns what is usually referred to as the logic of (scientific) discovery. This context is about the logical procedures by which scientists construct, invent, or discover an idea in the first place, pending the sort of test that would lead to its acceptance or rejection as a (scientific) theory. In other words, this context dubbed logic of scientific discovery is about the methodological procedures for coming out with a hypothesis (Feyerabend, 1993; Nola & Sankey, 2007; Mumford, 2008; Appiah, 2003; Morvillo, 2010; Smith, 2009). Typically, there are two recommendations representing two different camps here. The first is inductivism. As a theory of scientific method, the basic idea of inductivism is such that science begins from particular observations and proceeds from them to form generalizations by way of theories and laws (Gillies, 1993). Here, it is the underpinning implications of observation that distinguish science from other informal or ordinary forms of investigation such as the use of common sense.

To appreciate the difference made by observation in science, it is important to contrast it with perception. This concern is well spelt out by James K. Feibleman in his book *Scientific Method*. When unimpaired senses are opened, they are bombarded from all angles by sensory stimuli. The central nervous system carries the stimuli to be interpreted by the brain, and the concepts formed give an impression from which the subject recognizes the sensation for what it is. This means that anyone who has formed the concept of a tree requires no conscious effort to make such awareness should he/she perceive one. In observation, however, not only does the scientist rely on his senses, but in addition to that he/she also acts and thinks, and these two necessary additions are what render observation a systematic exercise. Let's take the procedures of action for instance. Even in the simplest observation, the scientist is required to position himself in ways that minimize error. By so doing, his action is motivated by the urge to receive and accurately take a record or description of a particular sensory percept. So, whereas perception can induce awareness accidentally, observation requires the initiative of precise commitment, concentration and in some cases, specific training. This takes us to the next point, an important factor in observation is the use of instruments. Because of the obvious limitation of the senses, observation sometimes requires the aid of instruments to extend the efficacy of the human senses, all in a bid to avoid mistaken appearances for reality. Again, observation is a sustained act of self-discipline. This means that the quest to gather accurate sensory data may require the scientist to consistently stay on one task for a longer period. It may require the scientist to give up some personal values in order to stay focused and committed. Because of all these, observation is said to be selective. In other words, it involves picking out salient sensory impressions as fit for purpose and the scientist performs these discriminations by taking into consideration how each of the observations may be prejudiced by some background assumptions or even the context in which the study is being carried out.

So, some philosophers typical of Karl Popper (2005) suggest that inductivism as a logic of scientific discovery does not exist. Actually, what Popper meant by the non-existence of inductivism is an attack on the propriety of using inductive logic as a foundation for scientific discovery. His major reason for sustaining this attack is to get rid of a major problem known very well in philosophy of science as the problem of induction. The problem simply holds that there is no logical guarantee for future expectations no matter the positive instances shown by past observations (Popper, 2005: 8; Appiah, 2003:164). The nature of the problem leads to another proposed method for devising a hypothesis.

The alternative proposal called hypothetico-deductivism (H-D) is premised on the assumption that knowledge earns the label "science" not because of the specific procedure used in generating the related hypothesis per se. So, in place of induction for instance, the proposal suggests that claims typical of conjectures can serve as the foundation of scientific theorizing (Haig, 2014). In other words, surmounting the problem of induction requires that a genuine enquiry worthy of the label science should begin with a trial informed by a bold conjecture (hypothesis). From the conjecture, deductive logic is used to infer clear consequences pending the sort of test that would either confirm or falsify them. In defence of why science could be allowed to associate with such a weak epistemic foundation typical of guesses, proponents indicate that people learn the right answers by constantly revising their mistakes (Whewell, 2011; Popper, 1996 Derksen, 1985).

As indicated, the context of discovery need not follow any rational or recognized procedure. However, another critical endeavor begins after a discovery (of a hypothesis) has been made. At this level, the second context of the scientific method comes into its own (Feyerabend, 1993). This (second) context construes the proper mandate of the scientific method as a function of the methodological procedures by which (empirical) evidence is generated to support, warrant, validate or prove a claim (hypothesis) that either awaits confirmation as a theory or rejection. In contrast to the context of scientific discovery, this (second) context of proof is typically referred to as the logic of scientific justification (Nola & Sankey, 2007; Appiah, 2003; Smith, 2019; Morvillo, 2010; Ruse, 2001; Curd & Cover, 1998). In exploring ways for constituting African scientific theorizing, my attention predominantly focuses instead on analyzing the methodological protocols of scientific justification. As such, in reconstructing a preferred methodology for African scientific theorizing, I propose to build on the foundation of three well-discussed theories of the logic of scientific justification; namely, confirmation theory, falsificationism and methodology of scientific research programs (Ladyman, 2002; Appiah, 2003; Lakatos, 1989; Kuhn, 1996; Haig, 2014; Popper, 1996; Popper, 2005). In generating a method for African scientific theorizing, the idea is to put the African worldview at the center whilst securing means of cross-fertilizing the theory(ies) of scientific justification with the essence of the African worldview.

As a logic of scientific justification, confirmation theory traces back to one of the legacies of the 19th century in which a group of philosophers called the logical positivist adopted a radical view concerning the appropriate methods of enquiry (Boyd, 1991). The agenda of the logical positivist somewhat fell out of favour but one of their intended legacies which sought to lay a firm logical foundation for natural science and mathematics remains an influence on the nature of the scientific method (Carnap, 1960; Wiredu 1998). The logical positivists hold the view that philosophers are bottlenecked in a pot of persistent problems that are rarely if ever resolved (Frank, 1957). Their position is that the whole problem is linked to how the task of philosophy has been misconceived. Their plea is that the focus of philosophy has been on dealing with no genuine problems. In other words, metaphysical questions which engage the effort of philosophers since Plato are regarded misuse of language in ways that rendered it meaningless and hence pseudo-problems. They recommend that in its quest to get over what they consider to be self-inflicted problems, philosophy should take a (new) role as an intellectual therapy aimed at ridding off linguistic misconception through concept clarifications. Their stance assigns philosophy to a new mandate. By this mandate, philosophy had no distinct subject matter of its own as it poses as a general mode of enquiry used in clarifying what can be said and what cannot (Carnap, 1960). In short, the logical positivist made philosophy into a general method of enquiry for clarifying concepts which are presupposed as a fundamental assumption of all disciplines (Moore, 2010).

The strategy they urged on philosophers gave birth to a revolution in the criteria for conducting an investigation. As advanced in Wittgenstein's *Philosophical Investigations*, the business of philosophy is to provide a criterion by which a meaningful statement can be distinguished from a meaningless one and the condition for this motivated what has come to be called the picture theory of language. As such, unless it is analytic, the meaning of a statement is at least in principle, given as a function of a method for verifying it (Wittgenstein, 1972; Carnap, 1960). This method, it is maintained, hinges on how a statement opens itself to be (conclusively) verified through systematic observation of what pertains to the state of affairs, otherwise called the fact (Schlick, 1960; Ayer, 1960). The influence of these criteria resonates with the core of the theory of scientific justification called confirmation theory. On the tenet of confirmation theory, scientific justification, then, is a function of obtaining a positive observation (fact) that instantiates a generalization (hypothesis) (Couvalis, 1997; Appiah, 2003). According to Boyle's law (H): "A decrease in the volume of a gas (G) increases its pressure (I). Confirmation theorists suggest that any observation that satisfies "G • I" (where "•" is indicative of conjunction) exemplifies a justification that raises the belief in or the reliability of H (Nicod, 1930; Hempel, 1966; Hajek & Joyce, 2018; Boyd, 1991).

There are several challenges associated with confirmation theory, one is such that the criterion (that the meaningfulness of a statement lies in the method of verifying it) is itself not open to verification (Ayer, 1960). As such, it is meaningless, and hence cannot be judged as true. Another is related to the classical problem of induction; that no positive number of instantiations suffices to justify a generalization (*ibid*). In the wake of these challenges, an alternative methodological philosophy of science emerged called falsificationism. Falsification theory whose major proponent is Karl Raimund Popper emerged as a reaction particularly to the problem of induction (Popper, 2005). Popper held that it is out of the reach of a scientist to verify a hypothesis but it is within his/her power to falsify it by seeking counter evidence. So, even if it is impossible to confirm the truth of scientific theories, science could make progress towards the truth through the process of gradually falsifying erroneous conjectures. As an advantage over confirmation theory, this task seems to be easier because the refutation of a generalization requires securing a singular counter-evidence (Appiah, 2003).

On the tenet of falsificationist justification of a hypothesis, a serious empirical test posed to a theory should be motivated by the effort to locate a counter-observation to refute a generalization in question (Popper, 1962). In other words, a claim is scientific owing to its openness or potentiality to conflict with observational evidence and the more open it is (to potential falsifiers), the better the theory is (Lakatos, 1989; Afisi, 2017). In the other of priority, the yardstick for a successful falsificationist test takes into consideration (i) the level of rigour a theory is subject to and this is reflective of how bold a hypothesis is relative to potential falsifiers, (ii) how many of such test or less rigorous test the theory has withstood and (iii) the degree of simplicity vested in the theory (Popper, 1962). This, in essence, is the criterion of falsifiability.

In the effort to surmount the problem of induction, the falsification theory requires that a claim (aspiring to be labelled scientific) does not necessarily need to be premised on any shred of positive (observational) evidence (Lakatos, 1998). The requirement is simply its openness to refutation. The essence of the problem of induction queries the justification for thinking that past successful observations translate into a reliable foundation in terms of future expectations. Popper's theory attempts to dispense with the problem (of induction) by making positive past observations irrelevant in conceiving a hypothesis. Thus, it seems the problem (of induction) as per Popper's (1966) anticipation, loses grounds because a corroborated theory is not hinged on past positive observational instances but a "negative" test (a test to show that a hypothesis is false) (Popper, 1996). The prize that had to be paid is this. After every failed attempt to show that a theory is wrong, the resulting theory still comes across as a claim without proof. For there is no positive evidence in favour of it. So, the best of theories that stand the attempt to falsify it is simply described as having been corroborated; it has demonstrated admirable stamina before past attempts to refute it (Popper, 1996).

Some theories could be more corroborated than others. However, if stamina in the past means anything at all to the theory in question, then it certainly should boost the belief in the theory. Yet, this would expose Popper's theory back to the problem of induction. This is precisely Wesley Salmon's (1998) contention. Either

Popper accepts that there are no legitimate grounds to regard a corroborated theory as reliable or falsification theory is likewise vulnerable to the problem of induction. My impression of Popper's falsification theory is in support of Salmon's criticism. So, although falsification theory constitutes a very commendable effort in fashioning out a philosophical methodology for scientific theorizing, it fails to successfully dispense with the problem of induction. Even more seriously, there are significant cases where scientists appear to deviate from giving up on a falsified theory. This seems to render Popper's proposal as a methodology that does not align with practice (Kuhn, 1966). So it brought a need for philosophers to put in some amendments. The amendments led to another influential proposal I shall put into consideration; it is called the methodology of scientific research programmes (MSRP).

The theory according to the methodology of scientific research programmes is premised on same fundamental rationale that informs falsification theory. According to this rationale, positive evidence alone cannot define a scientific research programme. Indeed, positive evidence could be obtained by way of fabrications meant to accommodate a known fact (Lakatos, 1998). However, unlike (naïve) falsificationism, Lakatos proposes that a theory does not lose its value as science simply because it conflicts with an observation. Indeed, scientists have no option but to stick to it unless there is an alternative theory whose potency in problem-solving supersedes the embattled paradigm. So, in addition to abounding conflicting observation instances, the warrant for rejecting a paradigm is the availability of an alternative theory that better deals with the problem in question. Indeed, instead of scientific theories, Lakatos advances a concept he calls research programs; successive theories connected by modifications in methods. As such, Lakatos insists that to reject a paradigm without a substitution is to reject not a paradigm, but science itself (Lakatos, 1989; Kuhn,1996; Bird, 2008; Bascom, 1991). Thus, relative to scientific theorizing, a research programme is adjudged as simply progressive or degenerative. It is progressive if it leads to the discovery of novel facts. As an advocate of MSRP intimates, novel facts are ideas which are unknown at the time a theory is being proposed or an idea that has been contradicted by rival research programs. If a research programme is not committed to leading the scientific community to the discovery of novelty, it is simply degenerative (Ruse, 1998).

Consequently, in reconstructing a methodology for African scientific theorizing, I am guided by the contributions from the assumptions of the theories I have briefly explained. By so doing, I seek to draw their strength together and to seek how the strength resonates with the African worldview. Where necessary, the resulting assumptions are used in filling gaps associated with African scientific theorizing. Conversationalist rethinking of African science, then, is a frame of thinking meant to facilitate synthesis by, as Ochieng-Odhiambo (2010) would say, sifting through our legacies to retain relevant ones, casting off those that need in order to harness the African heritage with mainstream science. In other words, the mandate of conversationalist rethinking constitutes a reorientation of African science by way of exploring ways to cross-fertilize the theories of scientific justification with the African worldview. The implied objective of this cross-fertilization is to foil the growing conflict whilst promoting co-existence between the two worldviews. For there is no contradiction but diversity.

Organization of the Study

The structure of the thesis is organized into five chapters. The first chapter, the introduction, is organized under the following sub-themes; background of the study, statement and justification of the problem, thesis, purpose of the study, the significance of the study, methodology, scope and delimitation of the study, conceptual and theoretical framework and organization of the study.

Chapter two consists of a review of related literature. It aims to explore the meaning, nature and scope of African science. This chapter is a necessary exploration that analyses and unpacks the concept of African science into categories according to identifiable themes. The chapter aims to expose existing gaps in ways African science has been conceptualized. The gap makes room to situate the sort of (meaningful) contributions I intend to render towards the advancement of African scientific theorizing.

Chapter three is explorative. An important aspect of the agenda to promote African science revolves around resolving the question of Africanness (Emedolu, 2015). Ordinarily, the Africanness of science presupposes some features that stand the method in question out. However, as I indicated in the problem statement, the unique (Africanizing) features have been identified as contributory factors that impede the progress of the discipline. It is this appeal to a notion of identity that invariably invites questions about the appropriate criteria to condition the Africanity of (African) science. In other words, it appears that justifying the legitimacy of African science hinges on, first of all, detailing an investigation into the appropriate criteria to condition its claim to Africanness. Therefore, in the effort to reconstruct a method for African science, this chapter is specifically concerned with securing a foundation in terms of an appropriate criterion that justifies its claim to Africanness.

Chapter four is essentially the analysis of the key concepts, theories and laws relative to African worldview and mainstream science. As I indicated in the problem statement, a prejudice held against African science stems from its supposed incommensurability with the worldview presupposed by mainstream science. To confront this notion, Chapter Four is preoccupied with the effort at reconceptualizing a relationship between the African worldview and mainstream science based on salient evidence I consider to be an important link between the two disciplines. Throughout the analysis, the aim is to initiate a kind of relationship that explains away the opposition between both knowledge systems. Indirectly, I challenge the notion of opposition (between both knowledge systems) by coming out with ways by which theories and principles in mainstream science sit well with the nature of African ontology. Based on the evidence to be adduced, the salient connection, then, should suggest why our acceptance of one worldview does not negate the other. The analysis offers an insight into why a good understanding of advances in mainstream science rather lends the African worldview to be deeply appreciated.

Chapter Five marks the conclusion of the thesis. Based on evidence from previous chapters, I infer a method of scientific theorizing that takes into cognizance the peculiarities of the African worldview. Following identifiable gaps in the method of African science, I focus on coming out with ways by which theories concerning the logic of scientific justification can be rendered consistent with the core properties of the African worldview. The resultant method of this synthesis constitutes my contribution as an alternative method of African scientific theorizing. For reference sake, I call it African conversational science (ACS).

CHAPTER TWO

LITERATURE REVIEW

Introduction

Generally, African science is conceived as African man's ways of accounting for, understanding, exploiting, and controlling his environment (Afisi, 2016; Emedolu, 2015; Ozumba, 2000; Chimakonam, 2012a). Mainstream science also accounts for, understands, exploits, and controls related environments. It seems therefore that if the concept of African science is in any way different from mainstream science, then such difference must have been associated with the qualification "African man's way". In the literature that accounts for the nature of African science, the details of this supposed "African man's ways" can be understood across three major themes; (i) the functionalist perspective (ii) the force thesis, and (iii) the critical rationalist perspective. The chapter aims to have an in-depth engagement with the concept of African science by unpacking the meaning, scope and nature of the discipline along these three identifiable thematic perspectives. By review of related literature, the chapter seeks to explore not only how existing perspectives have salient challenges, but also, how such gaps leave room for contributions required to advance the interest of African science.

African Science Perspectives

The view that societies including cultures of Africa evolved problem-solving methods of their own is beyond dispute (Nnuroh, 2010). The strategy of some African science sympathizers hereby construed as the functionalist perspective has been to generally draw inspiration from various problem-solving skills resonating with ancient Kemetic civilization. These problem-solving skills, the school contends, exemplify proof of African-oriented science. Proponents of this perspective conceptualize science with an emphasis on the means employed by man's effort to solve related problems of his environment (Akpan, 2010; Emeagwali & Shizha, 2016). As such, African science is considered a manifestation of several indigenous skills that gave rise to industries like metallurgy and the glass-making industry. For emphasis, such skills are understood as African oriented because they were believed to have been nurtured by Africans before the contact with the Western world which, if not disrupted by slavery and colonialism would have competed with the contemporary innovations in technology (Emeagwali & Shizha, 2016; Ogungbure, 2013; Olela, 1998). The conviction is that African history speaks to a glaring feat of scientific knowledge before contact with Europeans, which, but for the disservice of colonialism, indigenous knowledge would have led African science to undoubtedly led global advances. Proponents think that had it not been, for instance, laws passed in Apartheid South Africa against typical indigenous knowledge systems like the practice of witchcraft, African science would have carried a different success story by now (Emeagwali & Shizha, 2016; Ogunbgure, 2013; Ashforth, 2005; Niehaus, 2001; Diop, 1991; Munyonga, 2020).

Concerning the functionalist perspective of African science, Akpan (2010) triggers a critique by tracing the theoretical evolution of the method of science to Aristotle, Bacon, and Feyerabend. He concludes that science generally is human's devotion to bettering his/her life as he/she organizes a systemic body of impersonal and objective knowledge, which by way of observation, experimentation and explanation, unveils underlying truths about the natural world. Akpan distinguishes between two phases of scientific culture as far as Africa is concerned. He restricts the first, indigenous science, to an unadulterated method of acquiring knowledge aimed at benefiting humanity. In contrast, modern African science is the product of cross-cultural influence on traditional science for problem-solving purposes. To further contrast indigenous African science from mainstream science, Akpan avers that whilst the latter is a theoretical enterprise conceptually distinguishable from technology, the former seems not to show any direct interest in distinguishing between the two (*ibid*). According to this approach to understanding African science, therefore, science is construed as a function of resolving related societal problems. So, as proof of the legitimacy of African science, proponents of the school allude to technological feats including the brewing of alcohol, indigenous medical practices, soap making, textile manufacturing, fire-making techniques, the mixing of paints, architecture and coating objects with iron oxide as well as food processing methods as clearly attesting to the credence African science (Emeagwali, 1993; Akpan, 2010; Emeagwali & Shizha, 2016; Diop, 1991). As it turns out, the evidence deployed in justifying African science as far as the functionalist perspective is concerned comes down to the application of skills and knowledge to keep society going. African science, then, is construed as the utility which accrues from the application of a knowledge system. The focus of science here is on the set of capabilities and techniques deployed to control the environment and solve related challenges for the subscribers. As such, so long as it works, it appears that the indigenous African need not possess a special systematic account that substantiates how the technique at his/her disposal is able to work the way it does (Appiah, 2005; Emeagwali & Shizha, 2016; Chimakonam, 2012a).

Nnuroh's (2010) work on the indigenous knowledge system of the people of Nzema set our appreciation of the functionalist perspective of African science in an appreciable context. For him, scientific knowledge should relate to the accumulated practices and worldviews of a particular group of people. Such accumulated practices and worldviews are deeply recognized in African society and are tailored to materialize the total ends of the society. He notes illustrations to buttress his point. One of the examples concerns the "ominous child" (*ibid*). According to a procedure deemed scientific, the people of Nzema observe post-partum abstinence between the periods of nine months to two years to avoid contracting immediate pregnancy. Within the first three months of the post-partum period in which a woman must menstruate, if she conceives another baby, the child to be born from the pregnancy is an omen. This idea is hinged on the presumption that the menstrual flow within the first three months of post-partum is impure and hence ought to be allowed to flow. The fact that the pregnancy within the said period prevented the said blood from flowing indicates, according to the people of Nzema, the formation and consequent birth of an impure child. According to the belief system, the child is ominous to the extent that he poses a danger to both his family and society. Nnuroh dismisses the supposed danger the "ominous child" poses to society as unscientific whilst praising the post-partum abstinence period of two years as necessary for health purposes. Indeed, Osahon (2002) equally prescribed a safe period of two to three years minimum post-partum rest for women of African society whilst Abraham (2010) mentions three years minimum regulatory period for mental and physical health as backed by taboos. However, such prescriptions, as Nnuroh says, seem to be based purely on health grounds relative to the mother involved. As such it does not imply any ominous threat to society should the taboo be breached. Here, the fact that there are no scientific laws to explain the supposed danger following the breach of the taboo need not be a matter of concern. What matters is that, given the time and circumstances, the belief is worth holding on to once it is able to resolve an existential threat to livelihood.

The position of the functionalist perspective is clear; science is a function of any utility-based procedure. How so? When one evaluates the options at the disposal of African science sympathizers, the justification seems to go this way. Knowledge is categorized into two forms; knowledge as a propositional attitude and knowledge as technical know-how (Feldman, 2003). Proponents of the functionalist perspective are inclined towards the belief that there is no universally binding concept of science. Following this premise, proponents think that there are no overriding concerns that bar technical know-how, particularly as exemplified by indigenous knowledge systems from being understood as legitimate science. The rationale for this defence derives from a concession that relates to the etymological sense of "science". Science is derived from the Latin word "Scientia", meaning "to know". As a verb, the classical definition of "science" implies the method put out in the quest to obtain knowledge (Lakatos, 1998). It came to be associated with a method because it almost became a synonym for the Greek word "methodos" which loosely translates as "to be crafty". This presupposes that science comes down to a set of crafts for achieving a particular end in mind (Nola & Sankey, 2007). The crux of the argument is that the rendition of science is not a preserve for any particular method, and as such, all avenues for achieving an end or gaining insight into the way the universe works can legitimately lay claim to scientific status. Clearly, African science embodies technical know-how procedures. So, proponents conclude that denying this rich culture of problem-solving techniques appears to expose one's intolerance for diversity. In Abioje's (2015) view, the core of the point is summarized as follows:

> *That is explicit in the statement that "the word 'science' comes from the Latin for knowledge" (above). Thus, the original meaning of*

science is knowledge, and in modern understanding, it still refers to sure knowledge or certainty, as different from guess, myth, assumption, hallucination, or anything in that category. To that extent, indigenous Africans cannot be said to lack scientific knowledge and technological devices.

Evaluation of the functionalist perspective of African science

To reiterate the major points, the perspective that draws on technology to justify African science construes science generally as a problem-solving skill. The supposed scientific knowledge is essentially practical-oriented rather than theoretical. This perspective in question, then, limits the scope of African scientific theorizing to technological inventions. A seeming unfavourable consequence of the etymology-based justification is that it appears to open a floodgate that ends up describing all forms of crafts, ones it solves a problem and can be dissociated from myth, hallucination, etc. as duly scientific. First of all, this raises concern for whether the credential of scientific knowledge can sorely be justified with recourse to utility. My concern begins from the notion that as I indicated in the problem statement, the functionalist perspective seems not to empower science with the audacity to be curious beyond the need to sustain the livelihood or survival of the societies concerned (Sithole, 2006). It seems to me, then, that instead of looking at science from utility-driven potency alone, we may begin to have a more inclusive approach that combines the interest in utility with the quest for truth, whether in the realist sense, probabilistic sense, verisimilitude sense, etc. The reason is that inaccurate beliefs can condition a craft that works perfectly in ways that defy explanation (Tart, 2012). However, the hope in a procedure that works may no longer remain a valid hope once practitioners find out that they have believed in a methodological procedure but for the wrong reasons (Geyer, 1914; Stace, 1970). The concern, therefore, is advocacy for African science to look beyond utility as the only defining principle of scientific theorizing. To be sure, African science loses nothing but its chains if it should supplement its technology-oriented enterprise with a theoretical orientation that makes the interest in truth equally an important component of the discipline.

Again, the use of the etymological sense of science in defense of the functionalist perspective of African science carries another challenge. Mainstream science has evolved from crude stages (where it served as a handmaid of religious thoughts) to modern science in which experimentation, mathematics and the construction of precisely generalizable conclusions are essential components (Gyekye, 2009; Omnes, 1999). Through these ages, mainstream science has kept its distance from personal opinions superstition and religious dogma through the search for laws on which nature supposedly runs (Ruse, 1991). Thus, it constitutes an abuse of etymology, otherwise referred to as etymological fallacy, when proponents assume that the way a concept in question is used at a time must be in consonance with its historical usage particularly when the etymon is more conducive to the position (Arp, Barbone, & Bruce, 2019). It is fallacious because it fuels the cyclops' sentiment that either no further academic deliberations have advanced the discourse in question or findings of further research have made no significant corrections to the concepts in question. In other words, it appears mainstream science has evolved definite methodological features and conformity to these methodological principles is the benchmark for tagging an enquiry as a science. So, an objection may be sustained by saying; the fact that a certain craft has utility expediency does not guarantee its claim to science unless it conforms to the laid down methodological protocols (Afisi, 2016).

The call that prescribes the rigidity of procedures to be adhered to in scientific theorizing invites into the discussion the work of perhaps, the most notable methodological anarchist, Paul Feyerabend. His very famous work *Against the Method* requires extensive attention. Feyerabend advanced an important thesis that sought to show that science must be relieved of any attempt to be guided by strict methodological requirements. His conviction stands on at least two major rationales. His agenda, as he says in the preface is anchored on humanitarian interest rather than defending an intellectual tradition. This, however, does not mean that his position was not anchored on arguments that made a rational appeal. He only sought to suggest that science is one of the several and equally important outlets employed by different cultures to understand, control and hence sustain livelihood. This (sustenance of life) for him is paramount and any attempt to trade it for the superiority of mainstream science is not worth it. As he insists, any idea that seeks to challenge fundamental ideals we are so conversant with engenders a discovery that leads to an increment in knowledge base. This is shown by how mainstream science itself posed as a challenging force to the religious dogma that dominated the course of humanity before the Age of Enlightenment. If science should detest complementarity and co-habitation of opposing ideas, then it is walking in the same dogmatic shadows it sought to overthrow some time ago. Therefore, it is implausible to hide behind mainstream science to trivialize the worth of other knowledge-cultures.

Again, as one of his key arguments suggests, history proves that human experiences are full of complexities and diversities often unpredictable. This is a further indication of how obscure, less explored and limited our knowledge about reality is. A comprehensive grasp of these complexities, as he says, cannot be forced into any single prescribed methodological framework. For no one can guarantee that mainstream science is not only bringing up isolated facts without leaving behind some deep underlying secrets of our universe. So, a more progress-oriented effort at understanding reality must lead subjects of investigation to keep an open mind at all times. As Ian Hacking (1983, p. 152) puts the same rationale, “there is not just one way to build a house, or even to grow tomatoes. We should not expect something as motley as the growth of knowledge to be strapped to one methodology”. In keeping with this, the requirement to abide by strict methodological principles as dictated to by mainstream science seems to restrict in advance this art of innovativeness. So, because Feyerabend considers conformity to strict methodological rules an inditement on any genuine quest to understand reality, he hails scientists for not ever sticking to any singular methodological prescription.

In *How to Defend Society Against Science*, Feyerabend suggests another insightful piece of argument that reinforces his views in *Against Method*. He indicates that many ideals govern the human way of life of which truth is just one of them. Others include freedom, mental liberation and so on. So granted science is very much equipped to make out the truth. Even so, when truth conflicts with the quest for say liberation or freedom, then any decision comes down to one’s choice. That said, one may choose truth, but one may also abandon it for an idea that conditions liberation. Indeed, achieving the feats of other ideals (such as freedom) equally comes with same sense of genuine inner excitement that comes with a scientific discovery (Haig, 2014; Klemke, Hollinger & Rudge, 1998). Feyerabend’s criticism is that undue emphasis on the importance of science is not humanitarian because it inhibits the freedom of choice. For if science prides itself on the capacity to unravel the truth, then, as Feyerabend further insists, there are equally important things beyond finding and following the truth. It appears, then, that seeking to understand the world from the perspective of mainstream science alone is too narrow a perspective to defend. This argument implies that regardless of its rational status, the fact that African science serves to answer questions that are of emotional worth alone substantiates its legitimacy (Bodunrin, 1981). So, given the significance of the pursuit of this ideal (since it is not only truth that man yearns for but also other values of emotional worth), it appears mainstream science has no business arrogating to itself a sense of unparalleled respect (Couvalis, 1997).

Another argument that seeks to undermine the supposed rigidity of science as a method of enquiry proceeds from the premise that scientists themselves, as far as history is concerned, have more than once felt an overriding reason to pursue protocols that deviate from the fundamental tenets of mainstream science. As such, there is no single methodic principle that has gone unviolated by scientists' efforts to break bounds in discovery. By way of example, induction requires that scientists should proceed by critical observation of particulars to generalizations about the whole. However, besides the fact that observation is theory-laden, there are fundamentally doubtful assumptions taken for granted by scientists, one of which is the task of differentiating between veridical and non-veridical phenomena. Because a theory may be inspired by similar doubtful assumptions, it may clash with observational evidence not because there is something wrong with the theory but simply because the evidence is itself contaminated by erroneous assumptions. Now, for the scientist to examine the possible source of the conflict, he/she must avoid the use of methodological protocols that presume the "sanctity" of observation. In such an instance, the scientist cannot make progress by limiting his/her search initiative to the limits of observation. Rather, the practitioner must be guided by an "uninvited" standard of criticism that clashes with the fundamentally accepted canons of science. He must, as Feyerebend (1993, p. 22) notes, "invent a new conceptual system that suspends, or clashes with, the most carefully established observational results, confounds the most plausible theoretical principles, and introduces perceptions that cannot form part of the existing perceptual world". To wit, Feyerabend implies that using methodic principles that violate the methodological protocols of science (such as the counter-induction rule he demonstrates) does not render the method of enquiry less of a science. Mainstream science, then, should water down to the pursuit of novelty which should in turn be achieved by intellectual freedom, not strict adherence to laid down methodological protocols (Feyerabend, 2006). If for nothing at all, such a move is a requirement for progress in nothing but science itself.

Following Feyerbend's defense of society against science, it may be argued that the problem-solving capacity of indigenous knowledge systems is sufficient to constitute a warrant for admitting the legitimacy of African science. Harding (1994) stresses the anarchist conviction by further suggesting that the attempt at proffering a demarcation criterion between science and non-science is an expression of Eurocentric sentiments as it seeks to rate mainstream science as superior over that of other cultures. Closely connected to Harding's view is Selin's position that a good way to study non-Western science is to first concede that science is legitimately found in every culture. In this sense, Selin (2003) construes science as an approach that gives the African an opportunity to control and predict events in his environment. To be sure, for the anarchist position to be rejected, one must be able to show beyond any reasonable doubt that mainstream one can offer an exhaustive explication of reality should scientists abide by any single methodological prescription, preferably the method prescribed by mainstream science. Without this demonstration, methodological pluralism as Afisi (2016) defends, seems very commonsensical. To say the least, it seems to me that denying the validity of methodological anarchism makes a needless appeal to ignorance. For even if one finds any particular methodology fit for exploring nature, it does not show that no other parallel method exists that could serve the better interest of the same objective. It, therefore, makes a lot of sense not to close doors to the exploration of other presumably potential alternative methodologies, whatever their nature may consist of.

Several attempts have been made to discredit the soundness of the anarchist view, as Horsthemke (2017) in particular indicates that the objective of science is to pursue truth, and as far as this specific ambition is concerned, none but the scientific method alone is apt to deliver. In other words, the objection suggests that mainstream science attracts a sense of respect not because of practitioners' wilfulness, but simply because it maintains a track record as an instrument for delivering the truth. As Popper (1962) holds, even if truth is unattainable, science comes to its own because it conveys truth verisimilitude. And should science fail in conveying the truth, there ought to be a demonstrably defensible basis for trusting other methodologies as legitimate alternatives worthy of delivering on that mandate. In the absence of such proofs, it appears that throughout history, unprogressive methodological alternatives, have had their disciples decline over time (Chakravartty, 2007).

Even if African science has managed a decline in discipleship, it may be premature to blame this judgment on its supposed unprogressive essence. For there are also convictions among some scholars that the mental slavery of Africans, as well as a deliberate attempt to stifle the worth of their indigenous knowledge systems, is at least partly to be blamed for the situation (Munyonga, 2020). Concerning African science, therefore, I prefer to consider Chakravartty's observation as inconclusive. In my view, however, there is a fundamental issue that challenges the concept of African science from the functionalist perspective. To put this explanation in context, technology is the application of tools and devices for the purposes of problem-solving (Asouzu, 1998). Indeed, on the one hand, technology has always been with humanity as its implementation could be traceable to the stone-age epoch where tools had to be made from stones. On the other hand, science is often spoken of as a civilization that evolved at a specific stage in society. In other words, the intellectual tradition associated with science is often referred to within a period in the history of a specific culture, be it Mesopotamia, Milesian or the Kemetic culture (Speiser, 1942; Omoregbe, 2021; James,1954). So, in his work *Almagest*, Ptolemy for instance acknowledges the Mesopotamian origin of several observational techniques and procedures that formed the foundation of his scientific inferences.

If technology could date older than the beginning of science, then the former cannot be defined as a necessary consequence of the latter. In this case, the inspiration for the invention of technology could emanate from diverse sources; conjecture, concrete observation of nature, intuition, divine inspiration, or even through sheer accident, etc. (Feibleman, 1972). In other words, it is fairly possible for instance, for a man to inherit the skill of alcohol distillation without prior understanding of the theoretical underpinning of the set-up involved. This informs the exact conclusion advanced by Kwame Gyekye (1997) as he closely analyzed the possibility of technological inventions in the absence of a theoretical foundation. In doing so, he re-echoes the Marxist maxim that man has an immediate need to provide for himself food, clothing, and shelter, and this need is before the formation of concepts. In achieving the end of catering for his fundamental needs, Gyekye thinks that man does not need a theoretical understanding, explanation, or even a rational insight into the workings of nature. At this stage, it is sufficient and perfectly admissible for man to engage in any avenue that works to meet his needs. On that note, Gyekye (1997) concludes that applied technology does not necessarily imply a theoretical foundation because it is possible to get hold of and have good use of technology without necessarily having an awareness of the principles by which the technology operates. By theoretical foundation, Gyekye meant the systematic framework for analyzing and explaining data of the observable world. The implication is that the indigenous African could have produced for example a metal technology to serve a pressing material need before he could probably think of providing an explanatory framework to analyze and explain why the metal exerts precisely stress-free force in felling a tree.

Now, when the invention of a problem-solving device originates from the application of a theory already designated as scientific, the result is what is usually referred to as applied science (Feibleman, 1972). In other words, in applied science, as the name suggests, a body of knowledge already designated as science has to be applied in the first place. From this premise, it makes no logical sense to speak of applied science when there is no prior existence of a theoretical understanding to be applied. It seems to me then, that to speak of applied science without a theoretical backing (from which the technology in question could be traced) is not only a misnomer but a violation of common sense that places the cart before the horse. I am therefore led to conclude that technically, science comes to its fullness only when there is a complementary theoretical underpinning in which application yields problem-solving tools. In other words, science in its fullness is the combined enterprise of first of all a theoretical assumption that could be used to explain a technology in question. For that matter, Gary Zukav (1979) has called on scholars to make concerted efforts not to confuse the technologist with the scientist. The technologist applies known tools and principles; the scientist searches for the theoretical elements that explain the application of the laws and principles. So, when we cannot connect a tool to a prior scientific methodology in which terms it was invented, it is only said to be science in a very loose sense. If the problem-solving technique is not derived from theoretical science, it is not science in its full complement. Accordingly, we must candidly withhold designating such problem-solving feat as science and call it for what it is; it is simply technology.

To be sure, this is a major contention one has to come to terms with in order to render a sound and fair judgment about the scientific status of the indigenous knowledge system. For indeed, the failure to distinguish between science and technology is considered an ideal condition that distinguishes the unique essence of African science from mainstream science. So, in drawing a line between African science and mainstream science, Afisi (2016, p. 60) notes that

> *unlike Western science which distinctly separates science from technology as independent fields of human endeavor, traditional African science stands out in its ability to combine the inquiries into the nature of the cosmos with the application of such knowledge into*

technicalities. The African traditional scientists are regarded as scientists and technologists at the same time.

This way of defending the uniqueness of African science is simply a loosely held misnomer emanating from confusing technology with applied science. Technology is not preceded by a theoretical understanding of the workings of nature. It is just an insight backed by the instincts to survive a pending existential threat to livelihood. So until there is that finding that connects the problem-solving insight to a theoretical foundation, there is, strictly speaking, no science involved. For Henry Olela, the attempt to distinguish between knowledge in technology and pure science (theoretical science) is a ploy in Western scholarship to try to settle a distinction between mainstream science and African science. He appeals to some fear that if such a distinction is allowed to hold, our supposed pure science of today may end up one day being rendered a display of pure techniques. He again indicates that even if the distinction is of any sound merit, then the basis for a knowledge system to be classified as theoretical could be because it is (i) pursued for its own sake or (ii) it is underpinned by mathematics. He concludes that since generally every knowledge is to some extent pursued for its own sake and moreover Africans had developed far-reaching mathematics for formulating theories, the worldview in question merits full qualification as science in every sense of the word (Olela, 1998). As it turns out, this approach to conceptualizing African science is very much short-sighted. To explain why, it is important to revisit the import of Gyekye's point.

Gyekye holds that science comes into its own when technology is followed by a critical understanding of nature, based on observation, experimentation, explanation verification, and generalizable findings (*ibid*). Here, Gyekye is clearly attempting to extend the parameters of science to contain technology in ways that consider progress as a core aspect of science. So, he goes further to suggest that in the absence of a sustained spirit of inquisition, interrogation, and systematization of our observed experiences through rigorous experiments, (applied) science, be it African or not, is bound to stagnation (*ibid*). For a similar reason, Steffanides (1965) proposes that science properly so-called should be traced forward to the Greek thinkers. This is not because the technological feat of antecedent Kemet civilization does not merit appreciation in an intellectual discourse but sorely because Aristotle is said to have laid a legacy that established the logical reasoning underpinning particularly the technology of ancient civilizations. Indeed, it is a subject of controversy whether or not the Greek thinkers are owed the originality of the theoretical traditions that underpin mainstream science (James, 1954). Even though this controversy need not occupy my attention, the point it suggests is that there is more to science than pointing to the utilitarian values typical of technology.

Science, properly so-called, is a framework that allows for analysis, understanding, and the provision of coherently elaborate explanation of a given phenomenon, which usually leads to a prediction whilst technology may refer to the product of applying the theorems of the latter to deal with a social need (Gyekye, 1997; Engwa, 2014; Unah, 1998; Rogers, 2005). In a way, comparing African science with mainstream science is just about this difference. As the Zande for instance can cure and demonstrate an admirable set of industrious feats, but as Appiah (2003) notes, what they lacked is, typical of non-literate culture, the required substantial theoretical basis for systematizing those skills. There is no doubt that the usefulness of theoretical science ends at the doorstep or translates to the skills or abilities to solve existential problems and indeed, there is an attendant prestige for scientists if their findings indeed present such opportunities for problem-solving

(Klemke, Hollinger, Rudge, 1998). However, this feat is anchored and hence better achieved when it is followed by a desire to unpack phenomena into theories that help to better explain and render accurate predictions. It appears to me then, that the quest to justify the soundness of African scientific theorizing with recourse to technological feats alone is a very limiting context to hold an argument which intends to stand African science on its feet.

In sustaining the plea of the functionalist perspective on African science, it is fair to give it all the hearing it deserves. Sympathizers justify the practical orientation of African science on a core principle called an integrative criterion of knowledge. It simply holds that knowledge should be desired based on its instrumentality, that is, its relevance output to solving earthly problems (Ozumba & Chimakonam, 2014). As a methodological approach to problem-solving, African science, then, seems undisturbed by its failure to take the distinction between theoretical foundation and utility seriously.

My verdict, however, insists on the claim that there is a complementary aspect of science which remains lacking in this perspective; the need for a theoretical foundation. However, this neglect does not invalidate the legitimacy of African science, it only renders African science an incomplete avenue for gaining insight into the workings of nature. In other words, it takes a lot away from the functionalist perspective of African science for failing to take the quest for explanation as an indispensable component of science. So, inasmuch as science is desired for its potential to solve related problems, it is also charged with the responsibility to account for a theoretical foundation that is useful to the provision of sound explanations (Gasper, 1991). So even though "thought without practice is empty" it is equally important to reiterate as Nkrumah (1969, p. 59) does, that "practice without thought is blind". The functionalist perspective of conceptualizing the culture of African science does not satisfy this condition which requires that practice ought to be sustained by a theoretical foundation. Clearly, sympathisers of the functionalist perspective show no commitment to drawing technologies typical of indigenous knowledge systems from theoretical foundations. Consequently, I am unable to grant the adequacy of conceptualizing African science according to the said perspective.

I spell out one further argument to show that indeed, in the strict sense of the word, science rests not with technology, but with the theoretical underpinnings of technology itself. It appears to me that it makes much sense to put out the question "Why is any particular technology scientific?" or that "Can we explain the science behind a particular technology?" Yet, if technology is science in the strict sense of the expression, then such a question would be a meaningless gyration that translates to "Why is any science a science?" or "Can we explain the science behind a particular science". Understanding the relationship between technology and theoretical science in this way would also make a clear sense of Odhiambo (1991) and Gillies (1993) who suggest that without a progressive theoretical base, the creative spirit of innovative technology will itself be challenged for want of analytical framework. If technology is science put to use, then the reference to technology as the basis for affirming the existence of science constitutes a blatant appeal to the fallacy of affirming the consequent. This reasoning is fallacious because, as I partly alluded to earlier, technology can arise from other procedures to which indigenous Africans have long been predisposed to. A typical example worthy of reference here is the method according to trial and error (Sogolo, 2005). To break the vicious circle of defining African applied technology in terms of science and vice-versa, the way to understand science is to do so in terms of its theoretical orientation from which technology may be constituted. Accordingly, technology, strictly speaking, cannot be science in its own right. To recap the main concern, technology merits the label science only in the loose sense; another important aspect derives from the underpinning theoretical orientation by whose complement, strictly speaking, science comes to its own. Therefore, the copious allusions to applied technology without recourse to the theoretical basis on which rests the technology makes no sound argument in defence of African science.

The stance of the functionalist perspective relative to the concept of science remains unambiguous; science is a function of utility. This approach to understanding African science entertains a gap that suggests no concise theoretical foundation for the scientific enterprise. It is therefore up to scholars to evaluate options about what constitutes the theoretical foundation from which derives the much-extolled technologies in question. For according to Odhiambo (1991), the creativity required to sustain innovative technology is impaired if there is no underpinning theoretical framework from which related observational data could be analyzed. In doing so, an idea that seems very popular among subscribers of the functionalist perspective readily comes to mind. Its details are therefore worth exploring with the aim of evaluating its sustainability in terms of substantiating the legitimacy of African science. On that note, there is a cluster of views that suggest trial-and-error as an underlying theoretical framework based on which African science makes progress. A notable example is suggested by the following concern:

> *The traditional methods of tanning and dyeing in northeastern Nigeria anticipate and reflect to a large extent the fundamental basis of contemporary tanning and dyeing. These principles were neither*

linked to spirits nor magic but trial and error experimentation as well as accidental discovery. It therefore points to the fact that at some point, our ancestors had the effrontery to carry out trials that involved testing the efficacy of one substance over another, which we in contemporary times associate with scientific research (Zaruwa & Kwaghe, 2014, p. 33).

Mention could also be made of Engwa (2014), Emeagwali and Shizha (2016) Fadahunsi and Oladipo (2004), Sogolo (2005), Munyonga (2020), Afisi (2016), and Chimakonam's (2012a) theory called Ako-nwalee (Trial and error). Generally, the method of trial-and-error requires a clear definition of a problem or a puzzle which awaiting a solution. The indigenous Africans' response to this need is initiated through an informal or jovial research program. Several attempts at providing solutions are made after one another devoid of any strict laid-down methodological rules until a final solution is reached (Chimakonam, 2012a). Another related example finds expression in the conversations with Ogotemmeli where the Dogon ancestry entered the ant-hill out of curiosity. Upon doing so, it chances on the teeth of the ant-hill. From their curiosity and subsequent attempts at trials to imitate things in their environment, successful clay tools were made for protection for the first time. The technological feat, it is said, marks a tremendous attempt at advancing from a primitive society (Grialue, 1965).

Firstly, it is worthy of note that no novelty renders the trial-and-error specifically African. The approach Chimakonam describes particularly substantiates this criticism. So, in terms of identity, it fails as a theoretical framework for advancing African-oriented scientific theorizing. The reason is such that Popper advanced a similar call that accorded an ideal role for trial-and-error relative to scientific theorizing. Even so, Popper advanced a concise case on how to advance the method of trial-and-error in a specific scientific enquiry. This renders Popper's proposal not only concise but also quite practical. So, in Popper's formulation for instance, errors are sought for by an attempt to refute the idea put up for trial (Popper, 1962). The trial and error adduced to support African scientific theorizing seems to be vague. As such, it is not clear how practitioners working within the context of same enquiry can apply it with the consistency required to ensure findings are not arbitrarily generated. Again, because there is no precise direction or guidelines that regulate how to validate or invalidate these trials, it appears that it can be used to gather ad-hoc success for typical guesses or even false beliefs. Therefore, it seems not surprising if Evans-Pritchard (1976) accuses African science as a methodology that proves events which are likely to happen anyway. In other words, the call for African science seems to be side-stepping a core mandate of science, which requires that science properly so-called should imbibe systematic effort to fish out false beliefs. Instead of insistence on trial-and-error, we may rather want to try a conscious effort to reconstitute a theoretical foundation to warrant progress. To get African science to do more exploit, it is therefore imperative for the discipline to move from its comfort zone where trial-and-error coupled utility has been the sole yardstick. The opportunity to advance African science should begin with this concession. Consequently, the search for a concise and systematic theoretical foundation is to be regarded as a non-negotiable task that leaves a dent in the adequacy of conceptualizing African science in light of the functionalist perspective.

African science from the perspective of the Force thesis

To understand African science in terms of the force thesis, the narrative must be traced to an ancient institution of Kemet civilization which sought to develop a standing tradition of both formal and informal education in Africa (Diop, 1991). Whilst basic and tertiary education was classified as formal type, informal education constituted interactions at home, where children learnt vocational skills and social values from parents. Botchway (2010) observes that the basic level of education vested the students with artistry, physical education, and writing. Students who exhibited high skills in the training were engaged in a rigorous intellectual culture based on philosophy, science, mathematics, and artistry. The devotion to the higher educational and religious cultic practices is called the Mystery System, a legacy that is said to have been later appropriated by the Greek intellectual culture. The Mystery System took students through science and art to ensure the students' gradual rise to revered status. Such a status was achieved by practices intended to free the soul from the fetters of the body, and the closer one gets to this state, the better one gains control over nature (Botchway, 2010; Osahon, 1998).

Because the Mystery System consists of principles intended to purge one spiritually (James, 1954; Osahon, 1998), looking at African science from this perspective brings the discipline in sync with African spirituality. Indeed, even formal science like mathematics was regarded sacred and taught only to the priesthood (Olela,1998: 46). Under this perspective, practitioners of African science then, included all manner of agencies, namely prophets, scientists, hypnotists, mystics, sages, priest, witch doctors, herbalist. These practitioners are initiated to access the knowledge system under the ordinance of trust reinforced through swearing an oath to exercise the craft in secrecy (Olaoye, 1993; Gyekye, 2013;

Offiong, 1999; Akpan, 2010). According to the force thesis, medicinal practices, for instance, are administered by men who obtain such insightful herbal knowledge from ancestral spirits. So, the material composition of herbal medicines does not heal, healing power is a prerogative of the god that gave the insight or the vital force emitted by the sun to the plant (Konadu, 2007). Because access to practice is a preserve of particular initiates, this orientation has attracted labels that describe African science as a backward-looking superstition that is incomparable to mainstream science (Akpan, 2010; Chimakonam, 2012a).

To better appreciate African science from the perspective of the force perspective, the analysis should be set in the context of, first of all, how indigenous Africans conceptualize reality. To do so, it may be insightful to contrast it with how mainstream science construes reality. For mainstream science, reality is nature. On one hand, typical physicalist breakdown of nature reduces all reality to sub-atomic constituents, forces, and fields (Goswami, 2009). However, according to Duhem-Quine's thesis, a hypothesis cannot be isolated for testing because of the network of background assumption play (Duhem, 1991; Quine, 2013b). To the indigenous Africans then, these background assumptions constitute a complex ecology of forces that transcend the world of the physical. So, on the other hand, the indigenous African reduces the essence of a phenomenon to disembodied ontological forces at play (Emedolu, 2015; Appiah, 1992). This in the African worldview initiates two levels of causation, the spiritual domain is ontologically prior to the physical (Alem, 2019; Akpan, 2010). Thus, it appears that the force thesis does not negate the essence of the physical reality. The physical world is rendered a gateway for initiating contact with the spiritual realm where all the observable phenomena are supposedly configured. So, approaching the world from the force thesis is just a matter of not side-lining the physical per se, but delving deeper into same reality beyond a threshold mainstream science can investigate.

The existence and well-being of Africans are premised on the ability to be in constant connection with ranks of existing forces either above or below them (Onyewuenyi, 2003). In this relationship, knowledge about the potential deeds of the forces and how they can be exploited to benefit mankind is carried on from the hierarchy of forces above the individual, with the ancestors being the last to convey such knowledge to humans (Chimakonam, 2012a; Hamminga, 2005). Since happenings in nature are only aftermath (manifestations) of the spiritual realm, explanation and control of nature necessarily involve making contact with the forces whose duty it is to superintend over the various aspects of the phenomenal world (Afisi, 2016). The knowledge that pertains to this supposed deeper realm of existence is a prerogative of the forces, so a supposed African scientist plies his trade by firstly establishing the right contact with the ancestry who are the final conveyors of the knowledge in question. Consequently, under the perspective of the force thesis, science ultimately reduces to a body of knowledge about the actions and inactions of the forces under whose control things happen in the physical world. The duty of an African scientist, then, is to build a kind of personal relationship with the forces in ways that give access to exploit the forces' insight in assisting the course or interest of humanity.

An important observation is that the force thesis appears to bridge a gap typically associated with the functionalist perspective of African science. For the (force) thesis presents African science as a theoretical foundation in terms of providing a framework for analyzing, understanding, and explaining the course of nature and related African technology. The indigenous African working with metals knew that brass and lead do not rust whilst iron is susceptible to rusting. This knowledge led related industries to make tools and implements to assist the course of humanity. From the theoretical perspective offered by the force, the scientific status of the implements is not limited to the utility values borne by skill in metal technology. The theoretical orientation made possible by the force thesis allows for further explanation in terms of why the metals in question work the way they do. So, for instance, iron finds itself in a relatively weaker state because it disobeyed God's instruction to make a sacrifice to curtail the occurrence of death (Peek & Yankah, 2004). Again, should a smelter engage in sexual activity immediately before metal works, he is likely to come out with a brittle implement even with the right tools because the preceding sexual activity is considered infidelity to the furnace (*ibid*). Likewise, by simply abstaining from sex the previous night before gathering clay, a potter would have immune himself from bewitchment which could have rendered his pots brittle in quality (Evans-Pritchard, 1976). In short, according to the perspective of the force thesis, the theoretical orientation of science is given by the explanatory framework that allows the African scientist to explain the world with recourse to postulates typical of disembodied forces at work (Selin, 2003; Appiah, 2005).

Following this perspective on African science, Innocent Asouzu (1998) concludes that there is no conscious effort to separate religion and myth from scientific reasoning in indigenous African society. The reason is that like religious adherents' aim to please their object of worship, African science from the perspective of the force thesis requires the African scientist to maintain a healthy relationship with the forces in question. The method of science, then, reduces to actions and inactions practically directed towards enhancing personal relationships with ontological forces so as to use the privileges granted by access (to the forces) to explain and control physical events in the environment (Asouzu: 1998; Mbiti, 1970). For knowledge, Hamminga (2005) notes is itself a kind of force transmitted down to humans by the ancestors.

Asouzu's (1998) seeming worry over this perspective of science is that instead of considering the natural world as sufficient data for rendering explanations about occurrences, the African changes the focus by invoking personal forces. However, the question that keeps occupying my attention is that if mainstream science is already in the business of investigating reality in terms of typical physicalist assumptions, why should African science be forced into pursuing an investigation along same assumptions? It appears the call for African science to part ways with the force perspective is an invitation not only to commit energy to redundant labour but also, it is motivated by a needless call for competition between the two disciplines. So, it should be seen as a sign of respect for African science not to commit its effort to compete with what mainstream science appears to do better. This presumption of respect for boundaries, then, imposes on African science the duty to go beyond the mechanistic approach (that limits mainstream science) to finding ultimate causes (Alem, 2019; Etim, 2013, Mbiti, 1970; Sogolo, 2005; Westerlund, 2006).

Gyekye (1997b) seems to be making same call when he intimates that the tremendous feat of science particularly in the way it has helped progressed societies requires that it is allowed to take charge of investigating the physical realm. This means that the "statute" that establishes both disciplines is to have them co-habit and not oppose the interests of one another. This sort of division of labour should create no tension at all because indeed under the force thesis, African science is said to carry the mandate of science beyond the remit of mainstream scientific enquiry (Evans-Pritchard, 1973; Sogolo, 2005). By taking this responsibility, the question that really plays out however is whether in this peaceful co-existence, African science is well equipped to deliver any meaningful result especially when it concerns itself with a supposed realm where mainstream science with all its criticality is simply handicapped.

Before evaluating possible responses, it is important to explore the force perspective in detail. Upon careful analysis, it is evident that the method of science relative to the perspective of the force thesis comes down to the method of divination. The reason is that like the sort of disease outbreak that triggers the interest of mainstream science to want to conduct an investigation, African indigenous societies use the method of divination as the primary institutional framework to seek redress when faced with an issue that defiles readily known solutions (Peek & Yankah, 2009). Like the way mainstream science brings the scientist to "interact" with subatomic particles, the method of divination brings to the awareness of indigenous Africans the happenings in the supposed transcendent world (Niehaus, 2001; Selin, 2003). Besides, the core mandate of mainstream science is to render explanation, prediction and control over one's environment (Horton, 1967; Carnap, 1966). In the same way, divination fulfills same task; it is generally employed to explain a mystery or foretell the future and to empower humans with the audacity to want to control impending fortunes to society's advantage (Bascom, 1991).

Except for a few methods of divination (such as oneiromancy and onomancy), the procedures of divination generally involve the use of a related observable aspect of nature or objects to access information from a supposed deeper realm (Mccury, 2016). Ifa divination, for example, represents a well-known and long-standing indigenous method among the Yoruba of Nigeria (Wiredu, 2010). Following the linkage of any observable phenomenon to the actions of the forces, a sacrifice is typically required to bring down a resolution or if the phenomenon is a prediction, same act of sacrifice is required to avert it (Taiwo, 2004; Bascom, 1991). The rationale undergirding the method of divination resonates with a theory systemized by Chimakonam relative to the method of African science.

The method which he calls Ako-iju-ase (Interscience) suggests that the African scientists, to begin with, assert the reality of two interdependent domains: natural and subnatural world. The natural world is further broken down into positive and negative forces. The sub-natural world is the realm of thought, in which a major instrument is the vital force. Vital force influences the natural world in such a way that its presence or absence in an entity determines life or death. Vital force influences thought by instigating a kind of motion, the result of which produces knowledge. Motion in a specific order, elliptical for that matter, results in the production of specific scientific knowledge (Chimakonam, 2012a). The method, Chimakonam holds, is predominantly used in healthcare delivery. A traditional healer enters his divine "laboratory" and establishes contact with the sub-natural world of thought. This interaction, which is sometimes believed to stay for days, takes the diviner's vital spirit around the natural forest in search of an herbal antidote until the vital force of the diviner clearly discovers it (*ibid*). Clearly, just as mainstream science attempts to give access to manipulating reality (physical properties), divination is providing same platform; albeit through an interpersonal relationship with the subnatural world.

However, in choosing to pursue reality in terms of subnatural personal forces, a seeming predominant challenge again surfaces. This time, African science is accused that it turns the mandate of science upside down. Instead of (science) resolving encountered mysteries, African science (according to the force thesis) itself poses a bigger mystery. In other words, the force perspective appears to venerate the art of mysticism instead of depersonalizing the principles of science (Akpan, 2010; Afisi, 2016). Perhaps, it is this very orientation that perpetuates the stagnation of African science (Alem, 2019; Inokoba, Adebowale & Perepreghabofa, 2010). Typical of this sentiment then, Gyekye (1997b, p. 243) notes: "In view of the critical importance of causality to the development of science, a culture that is obsessed with supernatural or mystical causal explanations would hardly develop the scientific attitude in the users of that culture".

On account of the force perspective, indigenous Africans, unlike their Western counterpart who engages in sensual enhancement tools like telescopes to investigate reality, employ words (names in particular) as the main connective to make contact with reality. In this regard, names are said to have power over what they (names) refer to (Selin, 2003). The power relation between names and their referents is well established among the Akan for a fundamental reason. On the concept of soul, Akesson (1965) agrees with Gyekye that the Akan soul is immortal. It existed with God prior to its birth as another yet-to-be-born human or a fellow kinsman. For that matter, the Okra, which is begotten from God, has its name already decided prior to its birth because it was already living with God. Therefore, when it is born into the human realm, it is named after the day it enters the universe. This is called by the Akan as the "natal name" and it is by this name that God and the gods know the Akan. The idea is suggestive of the inextricable tie that gives names a special power over the entities they refer to (Akesson, 1965; Horton, 1967).

Mainstream science may be said to resist the temptation to easily discard a theory that fails a test (Lakatos, 1998). Yet, mainstream science is open to criticism and this is vindicated when the method ultimately renounces any hypothesis that consistently produces failed prediction, no matter how entrenched the belief is (Popper, 1962). And this, Horton regards as perhaps the most important aspect of scientific reasoning. Emeagwali and Dei (2004) suggest a view that speaks to the lack of willingness to axe failed hypotheses relative to African scientific theorizing. Indeed, African science may reserve the right to pursue realms (of ontology) it so desires. Yet, in doing so, it appears it cannot take the requirement of progress for granted. However, to be able to monitor the rate of progress, it seems the method of scientific theorizing according to the force perspective must be open to specified procedures of refutation. The fact that this seems lacking is a genuine call for worry. Perhaps, it may serve the better interest of African science to discard the force perspective. However, before doing so, sympathizers of this perspective maintain that the spiritistic orientation is the very defining property that maintains its distinction from mainstream science (Afisi, 2016, Chimakonam, 2012a). If the spiritistic orientation is the hallmark of its unique (African) identity, and altering African science requires tampering with its spiritistic orientation, then it appears that one cannot alter the essential nature of African science without destroying its claim to Africanness. I call this problem the dilemma of African science

Evans-Pritchard's famous ethnographic study on the Azande constitutes a rich insight into African science from the force perspective. Here, the general nature of African knowledge as espoused by Bert Hamminga is true for the Azande too;

knowledge for the Azande is a consensual awareness (Evans-Pritchard, 1976). For the Azande, like an occurrence that may drive the Westerner to employ the method of science for inquiry, the force doctrine, which is the allusion to the immaterial causative agent whenever an event deviates from what is empirically testable, is the basis for rendering explanations (*ibid*). Agentive forces ultimately cause happenings in all facets of life, except those that have obvious explanations in empirical terms and social context. Witches, Sorcerers, or any agent of mystical nature ultimately create misfortunes that cause injury to humans. Given the occurrence of any misfortune, an oracle is consulted to ascertain the underlying force. The potency of agentive forces is inoperable beyond great distances. Nonetheless, some members of the Azande community are reported to entertain doubts about the efficacy of the oracles and the fallaciousness of the entire procedure is often shielded by silence (*ibid*). During heated disputes, confrontations or doubts, the Azande occasionally subjects a hypothesis to testing. However, the notion of "testing" must be placed in a proper context. Usually, they carried out the divination method of extispicy, but this time on the entrails of the accused. This allows for observation to play a role in the method of investigation, probably to vindicate the truth of the hypothesis for consensual agreement. For example, when a dead person is being investigated for witchcraft upon special accusation, the entrails of the dead are cast out and its shape is examined for the presence of witchcraft substance. Even so, the verdict passed after examining the empirical data (the intestinal entrails) is only a preserve of a privileged priesthood class believed to be vested with spiritual insight (*ibid* p. 16). In cases involving the activities of a witch, a personal experience in witchcraft is a requirement to explain the relation of a witch's activity to the happenings under investigation. Evans-Pritchard expresses misgivings about the potency of the agentive forces as narrated. As such, he explains the existence of such belief among the Azande with recourse to them (Azande) wanting an explanatory framework just to make sense of their environment (*ibid*).

Relative to the force perspective of African science, an important methodological protocol of African science requires attention. By this, I am referring to the much-extolled virtue of secrecy. As a methodological protocol, secrecy generally regulates in whose hands African science is deposited. This is very much obvious looking at Ogotemmeli's intention even before he begins to share his knowledge about the cosmos and cultural traditions with his European visitors. Before Ogotemmeli could initiate his interlocutors into discussions about indigenous knowledge systems, the first task which lasted almost for the entire day was a decision about the venue for the discussion. It turns out that Ogotemmeli's major consideration was for a choice of place inaccessible to the attention of both women and children (Griaule, 1965). In furtherance of this point, we see the virtue of secrecy extolled in African folktales where animals like the tortoise employ secrets as a weapon to outsmart competitors in any contest (Hamminga, 2005; Achebe, 1986; Peek & Yankah, 2004). The significance such stories seek to portray is that knowledge can achieve so many feats so if it carelessly lands in the hands of an anti-social agency, the entire society is in trouble. So, more often than not, potent verses of divination are not to be recited before clients. The very supposed deeper insights constitute the last stage of training of diviners or medicine men and usually, it may even be required to be exchanged with huge sums of money (Bascom, 1991).

The requirement of secrecy seems to reinforce the impression that describes African science as cultic superstition or mysticism (Gyekye, 1997b). One will recall that knowledge in the African context is regarded as something handed down from the realms of ancestry (Hamminga, 2005; Appiah, 2003). Therefore, since knowledge is not earned but an act of benevolence from the ancestor, it is only reasonable to suppose that it is not a thing for all. Instead, it is sacred and must thus be regulated in terms of who is worth the privilege. A comparison, then, with the supposed open methodological protocols of mainstream science seems to be a farfetched consideration stemming from a lack of paying due diligence to a very important distinction. There are complex and well-developed patents, copyrights, and intellectual property laws that safeguard inventions begotten from the protocols of mainstream science. relative to African scientific theorizing, enveloping the practice in secrecy, then, resonates with the conscience of equity in terms of reinforcing rights to protection of intellectual property (Emeagwali, 2016).

This presupposition ties in with the reason why the Mystery system maintained the principle that in order not to risk the chance of exposing acquired knowledge to the uninitiated, students of the educational hub are not supposed to document what they study (James, 1954). So, in Ifa divination, for instance, the sixteen divining objects have eligible 256 probable figures (Odu). Each figure in turn has 16 verses that inform problem identification, interpretation and resolution measures. So, in all, there are 4096 verses, all of which are expected to be kept in memory by the practitioner (Bascom, 1991; Frisvold, 2016). The value of secrecy is simply telling if a practitioner is enjoined to keep all this to memory. Besides this, for the Zulu, only those who go into ecstatic communion with ancestral spirit (by getting possessed) are supposed to be initiated. And after extensive rigorous long-term training, a final public demonstration is required before one graduates in fitness for practice (Peek & Yankah, 2009). I suppose, however, that the idea of "ancestry" which is the source of knowledge symbolizes enlightenment, integrity or a fitness status required to prevent manhandling of the insight into the African knowledge system. It signals an indication that the enterprise (of African science) is a dining table meant for the "child" who knows how to "wash his/her hands" well. If one approaches the protocol of secrecy from this angle, it serves an intention that seems to promote a good course. It is meant to enhance the safety of society by regulating the sort of characters to whom such delicate knowledge should be entrusted.

As an organized intellectual culture then, the Mystery System is a forerunner that institutionalizes the pact of secrecy into African scientific theorizing. On that note, it is required that an African scientist would swear an oath of allegiance to secrecy as part of the training to become a practitioner (Ashforth, 2005). In Afisi's view (2016) the principle of secrecy is intended as a measure to ward off the tendency of distortions by third parties, and this he thinks should stand unless there is legislation meant to check and safeguard African science from plagiarism. The role of knowledge secrecy is so ingrained in African science that, for instance, the potency of witchcraft is said to evaporate with the exposure of a possessed identity (Ashforth, 2005). A possessed witch hardly shares its mechanism of operation, even at the risk of getting killed (Engmann, 2010; Middleton, 1960). Sometimes, possessed children die young even before they grow to be interrogated for further information (Achebe, 1986).

Justification of African science from the perspective of the Force thesis

In the light of the force perspective, the mandate of African science comes to its own when it comes to events or phenomena before which the protocols of mainstream science are incompetent. So, when situations reveal a mystery, mainstream science comes to the rescue. When mainstream science meets a dead end in dealing with such mystery, African science comes to its rescue. Apparently;

where the mainstream scientist would give up, the gods would take over (Selin, 2003; Bodunrin, 1981). In evaluating the soundness of African science from the force perspective, it is imperative to cast our minds back to a challenge I mentioned in passing; the dilemma of African science. According to the dilemma, African science seems to have appropriated for itself a task that is clearly a self-inflicted wound. The crux of the challenge is such that African science ought to abandon its claim to uniqueness (as presupposed by its spiritistic orientation) or forever remain stagnant.

First, it is important to find out what rationale informs the necessity to create a unique stance as presupposed by the metaphysical orientation of African science. Doing so takes one into comparing the nature of tasks dealt with by mainstream science and African science. Indeed, mainstream science may ask "why" questions, but when it does so, it typically expects answers that satisfy "how" questions. Technically, "why" questions about a phenomenon understudy presuppose teleological assumptions and mainstream science is not committed to unraveling that kind of purpose-driven causes (Krauss, 2012). So, in mainstream science explanations truncate too soon. In other words, it is a conventional practice for an inference to be admitted as the best explanation of a phenomenon even when there is no explanation to cater for why the explanation in question should be admitted. For Newton, an object falls towards the center of the earth because of the gravitational attraction that is directly proportional to the product of masses involved and inversely proportional to the square of the distance between them. However, it may be interesting to ask why same fact does not usher objects to fly past each other, or even stay in their respective initial location. For there is no contradiction, neither is it inconceivable for same force to injunct them from attracting one another.

Newton will not go any further to adduce reasons why gravity is committed to attracting rather than dispelling objects. This, as Zukav (1979) explains, is the mystery that characterizes action at a distance, and it gave Newton the title of someone who introduced an occult hand into science, for how do the mere mathematical facts about mass and distance allow the earth to reach up and draw objects to its center. This neglect is what extends an invitation for African science to join the quest of science to render our appreciation of reality complete. However, from the very nature of the difficulty that rendered science incapacitated, it is commonsensical to assume that for African science to extend the mandate of science further, it must adopt a methodological orientation equipped in ways that the former is not.

From his popular methodological principle “Hypotheses non fingo”, Newton holds that it is not open to scientists to generate any further explanation that cannot be deduced from the phenomena at hand (Newton, 1846; Feynman, 2011). In substance, it is enough for science to discover the existence of gravity and how it works, whilst bracketing questions that concern the nature of the things that motivate their behavior in the way that mainstream science describes it (Dougherty, 2016). So, mainstream science would associate certain illnesses with the activities of microorganisms like viruses and bacteria and indigenous African belief systems do not oppose this. As Evans-Pritchard (1976) notes, the Azande acknowledges that physical causes typical of the activities of termites or processes of decay can weaken the foundation to collapse a granary. Where African science typical of the force perspective extends the boundary of same investigation is a further commitment which construes these viruses and bacteria layers over a depth of agentive forces at work. This presupposes that an equivalent material medication cannot do the healing alone, insight from the gods to effect the spiritual treatment is a key complement (Konadu, 2007). So, the supposed spiritual causes are not understood as opposing the causes from a physical point of view. Indeed, a supposed cure in the spiritual realm is just meant to prepare the body to be in a state in which the efficacy of any physical drug to be administered is maximized (Sogolo, 2005). The driving motive of African science from the force perspective, then, is not to carve an identity that opposes the operations of mainstream science but to complement the effort of scientific theorizing in general.

From the narrative so far, the force perspective as a method of enquiry is in search of "answers to questions not only of “Why did it happen?”, but also “Why did it happen to us?” and “Who caused it?” (Selin, 2003, p. 8; Gyekye, 1997b p. 244; Moore & Sanders, 2004, p. 6). Bodunrin (1981) has referred to these as emotional questions and has called out on the consequent nature of investigation as a religious paradigm. So, the contention relative to the dilemma of African science seems to play back again. This time I want to rephrase it in ways that take into consideration Bodunrin’s concerns. As such, the question is whether the supposed religious tainting can constitute a legitimate extension of scientific theorizing. Answering the question in the negative, Gyekye (2009) indicates that African science seeks answers to questions that are rather independent of scientific interest. In other words, the force thesis is denied the credentials of legitimate science.

Evaluating African Science from the perspective of the force thesis

From the perspective of the force thesis, African science could be summarized according to the following core features (i) it does not negate physical causes but is not limited to it (ii) following (i), African science manifests through a paradigm akin to typical religious rituals, and (iii) it extolls the primacy of secrecy.

Following these features, African science entertains the potential abuses that can interfere with the legitimacy of the sort of findings the discipline guarantees. First of all, the role of a diviner amidst concerns for supposed secrecy creates some loopholes for influencing the findings. Indeed, the tendency of the diviner to receive and appropriately dissect the message is itself a function of one's vital force (Graw, 2009). Growth in age also influences experience and is therefore followed by an increase in the potency of one's vital force. At the peak of the vital force enhancement, practitioners are therefore said to become a "walking encyclopedia" of indigenous medicine (Peek & Yankah, 2004). Diviners, because they have different vital forces, can claim different findings relative to the same hypothesis. Again, long-serving medical practitioners can influence diagnostic tests with their experience. The substance of my objection to the force perspective is that it leaves little to no room for objective testing because the essential role played by vital force violates full-scale transparency from a third party's point of view. In support of this notion, a similar concern, raised by Emeagwali (2016) suggests that the requirement for the African scientist to plough his/her trade in secrecy retains the potential to individualize the practice in ways that grossly militates against effort at maintaining standards across board. I suppose that these are grey areas that provide an opportunity for studies of this sort to try to advance the course of African scientific theorizing.

I noted earlier that the regulation in terms of who gets to know what is a positive virtue because African science is humanist-oriented and one of the safe ways to assure the stability of societies is to keep control of such delicate power away from unbridled patronage. Besides, ploughing the trade under veils of secrecy appears to align with the conventional practice of safeguarding rights to intellectual property, especially in areas of economic endeavour where competition abounds (Emeagwali, 1993). This seemingly good intention, however, comes with an opportunity cost. One of such ramifications is the description the method has attracted as next to, “mystical and magical means, a means not subject to public objective scrutiny and analysis” (Gyekye, 1997). This conviction is further exacerbated by assumptions of extolling secrecy which militates against measures of transparency, accountability and accurate transmission of information for continuous improvement. To Nimoh (2014) then, the crucial difference between indigenous medicine and Western medicine comes down to this very concern. Indeed, the veil of secrecy could obscure the opportunity for critical evaluation of findings and Offiong (1999) is unequivocal in re-echoing the problem. On the contrary, the methodological protocols of mainstream science extoll transparency and criticality. To this end, Hountondji (1983, p. 46) observes;

> *Science is generated by discussion and thrives on it. If we want science in Africa, we must create in the continent a human environment in which and by which the most diverse problems can be freely debated and in which these discussions can be no less freely recorded and disseminated thanks to the written word, to be submitted to the appreciation of all and transmitted to future generations. These, I am sure, will do much better than we have.*

The point is that the methodological protocol of secrecy appears a double-edged sword. In so far as it guarantees safe custody and hence regulates the safe use of the knowledge, it also parades as a hideout that appears to vitiate transparency and critical attitude towards scientific theorizing (Emeagwali, 2016). Moreso, it takes the death of a well-versed priest or indigenous healer to evaporate all the science he/she embodies. As Nimoh (2014) observes, exploiting indigenous medicine for instance is by far subsiding because older generation experts are going into their graves with the value of knowledge that should have been not only cherished but preserved for future exploration. This appears to sit well with the reason why Gyekye (1997b) blames the stagnation of African science partly on the virtue of secrecy. Indeed, if the art of secrecy has been well exercised by African science practitioners, then like Ashforth (2004) seems to imply, it is rather doubtful if researchers in the discipline have adequate information that reflects the accuracy of information on the nature of African science. As Offiong's (1999) study indicates, some practitioners of African science have actually expressed unwillingness to be transparent about their practice, and they would rather prefer giving out partial or wrong procedures should they be coerced into doing so since. For they believe no one has the right to tap into their only means of livelihood. Indeed, like any specialized gift, the practice of shielding such knowledge is an acceptable convention that must be welcomed in good fate (Hamminga, 2005). Yet, the other pressing concern is about how a method in which secrecy is so ingrained could render a sufficient dose of open criticism. Besides, it is this very critical appraisal that leads to discovering opportunities to advance the discipline. So as a double-edged sword, secrecy protects African indigenous knowledge systems alright, but it also frustrates the growth of the discipline.

There are glaring feats, attestations, and hence some credence to African science, particularly the healing potencies of medicines acquired through acquaintance with ontological forces, even in situations where mainstream science had lost grip over the situation (Emeagwali, 2004; Gyekye, 1997b). It is the case that generally, some people lack confidence in indigenous medicine but there are also practitioners such as diviners who make false claims about the potency of their craft (Hoppers, 2002; Horsthemke, 2017; Evans-Pritchard, 1976). Be that as it may, questions about the vulnerability of African scientific theorizing relative to false cause fallacy seem a genuine concern (Horton, 1967). In gynecology and obstetrics for instance, wheat and barley tests are conducted on the pregnant woman's urine to determine the sex of the unborn child. It is reported by studies that seven predicted cases proved correct whilst 16 were incorrect (Diop, 1991). Horton's evaluation of African science suggests that indigenous knowledge systems are to some extent closed. In other words, looking out for alternative knowledge systems does not cross the mind of the indigenous Africans simply because their beliefs do not occur to them as doubtful (Horton, 1969). As Evans-Pritchard's (1976, p. 202) observation seems to corroborate, "Many of his [Zande] beliefs being axiomatic, a Zande finds it difficult to understand that other peoples do not share them". It is my conviction that the attribute of infallibility that underlies indigenous knowledge systems is potentially harmful to achieving progress in African science. Following a concession of this sort, it is in the interest of African science to subject its framework to a kind of assessment that is not aimed at destroying it, but a rigorous and critical attempt to empower it to do better at what it does. Conversationalist philosophy comes in here as an approach to sustain this all-important recommendation. As Chimakonam (2018, p. 147) indicates, holding a conversational analysis of African science "aims at critiquing and correcting; opening but never closing; creating and innovating upon ideas, thoughts, and theories of other philosophers through the reshuffling of theses and anti-theses which goals include… creating new thoughts, unveiling new concepts, opening new vistas". "Our culture may be dear to us", but if the exercise suggests a need to revise the fundamentals of our belief system, then we owe it to ourselves as Africans to put truth first (Bodunrin, 1981, p. 176).

Before closing chapters on the force perspective of African science, it is important to balance the criticism with a notable development in mainstream scientific theorizing in general. As I noted earlier, an important concern that confronts African science from the force perspective is its essence as metaphysics in orientation (Teffo & Roux, 2005; Akpan, 2010). The metaphysical orientation (which stems from its spiritistic ontological foundation) seems to protract African science into consideration as superstition or as Afisi (2016, p. 68) describes it "mystico-religious". Indeed, when Newton cautioned that scientists have no business postulating entities that cannot be inferred from the phenomenon, he clearly was looking at reality from advances in classical physics, for quantum theory is a latter development ushered by the era of the early 20th century (Zukav, 1979; Krauss, 2012). The inception of quantum theory, however, suggests that the picture of the universe painted by classical picture is but a half story of truly mind-boggling complexities (Wallace, 2012). Following this development in science, the time seems long overdue to revisit the African worldview, this time, with the intention of assessing whether the supposed spiritistic orientation of African science is reconcilable with mainstream science. The reason is that it appears quantum theory challenges a typical physicalist understanding of reality (Smith, 2019; Plantinga, 2001; Johnson, 1991). As Stenger (2009, p. 126) indicates, quantum theory gives those with spirit-oriented inclinations about ultimate reality "so much confidence that physics has opened up for them a world beyond matter". In other words, thanks to the stunning advances in quantum theory, mainstream science now seems to provide a clearer opportunity to rethink the extent of harmony between African science and mainstream science. This resonates with the reason why Ntuli (2002) subsequently urges, rightly in my opinion though, that the cradle of quantum theory brings up a new conceptual framework from which the African worldview can be reviewed.

In my view, quantum theory raises fundamental concerns that project a salient harmony between African science and mainstream science. The quest to substantiate this view, however, carries the study (Chapter Four) into a detailed comparative analysis between the advances in mainstream science and the African worldview. The said chapter explores evidence that makes developments in mainstream science concrete reasons to appreciate the African worldview. In light of developments in quantum theory, the challenges, then, come down to securing proof of how their supposed opposition is but diversity in disguise.

As I indicated in the background to the study, the questions that concern methodological issues in African philosophy put the method of African science down to the particularist and universalist divide. Whereas the functionalist and the force thesis could be seen to represent a conceptualization of African science from the perspective of the particularist, the review is yet to take concerns from the other half of the divide. It is therefore important to consider the nature of proposals associated with the universalists' orientation to African science. For the universalist, the main concern in African science revolves around methodological criticality. Their views constitute the perspective I label as a critical rationalist stance on African science. Generally, they blame the stagnation of African science on its affiliation with what may be regarded as relics of African indigenous religion. So, their plea is to advocate for a methodological reorientation that seeks to free African science from the bondage of African indigenous religion.

One attempt that fits the critical rationalist orientation is an effort Jonathan Chimakonam systematizes a Ako-nyiri-onwe (Semscience). According to this method of carrying out African science, when an effect is confirmed from an observed event presumed to be the cause, the indigenous African generalizes the observed effects over similar cases where the causes are known to be present. As such, the method is typically inductive and only disconfirmation of predictions would call for a revision of a hypothesis. First of all, it appears *Ako-nyiri-onwe* is a shadow of typical inductive reasoning. As such, it hardly makes any special distinction that merits an African identity. So, by way of rendering it African, Chimakonam further notes, on one hand, that Ako-nyiri-onwe generates a hypothesis from naive sensual impressions. Thus, he calls the method naïve inductivism (Chimakonam, 2012a, p. 39). So, by contrast then, induction as employed in mainstream science requires careful and detailed observations based on adequate sampled variables from which generalizations could legitimately be inferred (Gillies, 1993). To be sure, there are salient problems that detract Ako-nyiri-onwe (Semscience) from any serious consideration as a progress-oriented method of African scientific theorizing. As a proposed scientific method, the contours of the procedures are very imprecise. There are no clear details on how a hypothesis in question is tested against observational consequences. The method does not tell us under what conditions a hypothesis is considered to have failed a test meant for it. Worst of all, given the concerns that the African worldview entertains spiritistic essence of reality, the method makes no detailed clarification of the role of observation in subjecting hypotheses that seem to have no basis in direct observational evidence. These are but a few genuine questions that leave the study with no choice but to stimulate an effort towards reconstituting an African-oriented methodology for scientific theorizing. In Chapter Five of this study, I consider these challenges as I stay preoccupied with an effort to reconstruct a method that takes into cognizance the nature of the African worldview.

Other scholars whose views align with the perspective under consideration suggest that regardless of place and origin, a body of knowledge worthy of the label science must take seriously the core critical methodological protocols that characterize the orientation of mainstream science. The core of the critical thinking skills they urge upon African science emphasizes data analysis in terms of the logic for mainstream scientific theorizing. An identifiable member of this tradition, Pauline Hountondji (2002), analyses what science ought to be according to three stages: the initial stage of data gathering, the intermediate stages of analyzing gathered data to validate a generalizable hypothesis, and the last stage involving the application of the knowledge to a specific problem. For Hountondji, science comes into its own neither at the data collection stage nor the application of the theoretical results. A genuine scientific method is marked by the intermediate stage, the stage of data analysis (*ibid*). The implication is that in Hountondji's account, African science, be it the functionalist or the force perspective, cannot satisfy the full complement of science if there is no complementary framework to critically analyze data. For that matter, Hountondji (2002) is of the view that science in the ideal sense is theoretical; it consists of the rational procedures that open a belief up for subsequent experimentation.

Ogungbure (2013) appears to support this view as he claims that the stagnation of African science is a result of Africa's dealing only with the initial stage of data gathering as well as the final stage of applied science. As he further intimates, the theory-building systems of science which consist of higher institutions of learning, research centers and laboratories that allow for the analysis of data were rather adopted very late in the history of Africa. Hountondji's position points to the conclusion that when science is put down to its very core essence, the stage of data analysis, there is truly no science to be called African. Indeed Hewson (2015) exploits the lack of data analysis in indigenous knowledge systems to differentiate between mainstream science and African science as he suggests that the latter makes no serious attempt at empirical testing of data for the purposes of theory building. Hountondji (2002) thinks that the state of traditional science is a direct reflection of Africa's place within the global economy; the production of raw materials and the consumption of finished goods, whilst the intermediate stage is a complement that reflects the role of the colonial master in the mode of production. Hountondji further indicates that it is of no use should Africans appraise indigenous knowledge systems with biases. Rather he calls for the integration of knowledge cultures where the key emphasis is placed on the use of methodological protocols typical of mainstream science. To this end, Hountondji (2002) thinks an African science worth its sort "should also allow lucid and responsible testing, verification, and occasional validation – in short, a critical re-appropriation of our indigenous knowledge systems". In sum, Hountondji's clarion call, which he refers to as the need for "critical–appropriation" is an invitation to reconsider the state of African science and to reconstitute it based on methodological features typical of mainstream science, particularly the need for data analysis procedures and critical testing of data.

Dismas Masolo (1994) interrogates Levy-Bhrul's basis for comparing Western mechanistic causation with African indigenous religion for which reason the latter unfortunately concluded that the indigenous African thought system is prelogical. In the same way, in response to Robin Horton (1967), Wiredu (1980) focuses our attention on why the former's comparative assessment of Western and African indigenous knowledge systems leaves much to be desired. Consequently, in the task Wiredu takes up, he claims to be exposing the awful agenda of scholars who try to compare mainstream science with any supposed indigenous science. Wiredu begins his analysis on an assumption that seems to grant Horton's categorization of indigenous knowledge systems and mainstream science. Per Horton's categorization, Western thought identifies with mainstream science and indigenous African thought commensurate with African indigenous religion. From Wiredu's analysis, all societies have once lived in an era in which the explanatory framework of events was described in terms of purely pre-scientific analysis. What makes the difference, Wiredu intimates is that some societies, Africa in particular, still keep to the use of pre-scientific explanatory framework.

As we noted earlier, the Force thesis construes African science as essentially agent forces at work, and this metaphysic orientation is used as a distinguishing feature of the discipline (Hamminga, 2005; Westerlund, 2006; Appiah, 2003). From Wiredu's concerns discussed so far, the metaphysical character that supposedly justifies the uniqueness of African scientific theorizing rather exposes the discipline's lateness in evolving from using agentive forces as a framework for rendering explanations. Accordingly, Wiredu's point seems to suggest that the best approach for comparing thought systems across societies is to stick to a common denominator. In this particular case, the comparison should stick to the prescientific explanatory framework which once characterized the Western thought system but still lingers in indigenous knowledge systems. On that note, Wiredu thinks the ideal conclusion of Horton's work should have been motivated by the desire to make known the various ways in which the supernatural belief systems across the divides achieve explanatory coherency. This, Wiredu notes, is the only appropriate task open to a theorist engaged in cross-cultural analysis of knowledge systems (Wiredu, 1980).

On the exact nature of the method presented as African science, Wiredu (1980, p. 9) speaks plainly, "it is the intuitive, essentially unanalytic, unscientific mode". Wiredu's call sought to stimulate a conscious search for a demarcation criterion, clear enough to avoid conflating different frames of thinking. So, he notes, "Obviously, it is of prime philosophical importance to distinguish between indigenous, prescientific thought and modern scientific thought by means of a clearly articulated criterion" (*ibid*, p. 38). Indeed, the search for a criterion of Africanness constitutes a contention traceable to Hountondji's attempt to differentiate the basis of African philosophy from Western philosophy. From his controversial “geographical criterion” several mixed reactions have surfaced. Indeed, some scholars accepted it wholeheartedly, others accepted it with modification, and some outrightly rejected it (Segun, 2014; Bodunrin, 1981; Chimakonam, 2015a). This reaction led to alternative formulations including the logic criterion (Chimakonam, 2019), ontological criterion (Tempels, 1959; Ogbonnaya, 2018) and post-modernist criterion identifiable with Peter Amato (1997), Kwame Gyekye (1997b) and Kwasi Wiredu himself (2010).

By these contentions, concerned scholars seek to situate themes in African studies on what they consider to be the appropriate foundation. They want to secure a criterion that renders themes in African studies neither as petty racial gallery nor relics of colonial mentality. African science is inevitably drawn into the debates as it seeks to stamp its authority as a legitimate discipline in its own right, and if possible, with its own features and methodology. It appears that the attempt at rethinking

African science follows, first of all, an investigation into an acceptable criterion that stands the discipline out as legitimately African. For there is really no point in discussing African science if there is no identifiable criterion that sufficiently marks the discipline as one with an African identity. Any neglect of this nature exposes subsequent analysis to the danger of oscillating between different methodological approaches to scientific theorizing without regard to how Africanness derives from the context of the exercise. Thus, as part of the agenda to rethink African science, chapter three explores a detailed investigation into the various criteria offered by scholars to obtain the warrant required to distinguish science as African in the first place.

Wiredu is convinced that the supposed appropriate task of African science theorists is not to invent localized rival species, but rather one should tune his effort to "master and advance a body of knowledge which has already been developed". So, he further indicates that "The sensible African, will, in other words, try to develop a particular orientation not in the discipline themselves but in their application" (Wiredu, 1980, p. 26). Wiredu's view seems to acknowledge the fact that the method of science is not a finished product but that it is in a continuous process of development and this is implied by his call for theorists to "advance a body of knowledge which has already been developed". If that is the case, then clearly there is room for different cultures like Africa to use home-grown concepts to, in his view, advance the method of science. That said, my intention is far from inventing a new species in terms of a method to rival mainstream science. However, the reason for labelling it as African is an acknowledgment of the specific contribution by which the background of African philosophical tradition champions an expansion of the frontiers of science.

Evaluation of the critical rationalist perspective of African science

For purposes of evaluation, the critical rationalist stance, particularly the view advanced by Hountondji and Wiredu implies some consequences I am unable to accept. I concur that science, be it African or not, should take the criticality of methodological protocols seriously. This is why Wiredu thinks that science, unlike other aspects of our culture, should not be subjected to differentiations resulting from cultural interferences. This call, however, makes sense only on the assumption that African science is getting ready to take the place of mainstream science. Yet, as I indicated, the motivation of African science has never been so trivial as to make competition its ideal goal. Indeed, it is intriguing to note that African science existed as a body of knowledge relevant to the subscribers who we expect should have by now abandoned the intellectual tradition if it were a mere hoax (Appiah, 1992). I suppose that just as there are lapses in mainstream science, so is African science imperfect. So, I depart from the critical rationalist view to the extent that their position represents a will to project mainstream science by collapsing African science. In other words, the implication of the critical rationalist view peddles a negating attitude towards the recognition of African science as a germane discipline.

It appears Wiredu in particular notes the negating implication of his stance on African science. Unfortunately, his response is an attempt to trivialize the quest to condition indigenous knowledge systems in terms of African identity (Wiredu, 2010). In rethinking African science, the conversationalist perspective I am coming from takes serious exception to the attitude of negating contributions from diverse intellectual cultures. Interestingly, I accept the critical rationalist concerns for criticality. I also accept the particularist emphasis on relevance. So, what I do differently (as far as the thesis is concerned) is to reorient African science by searching for how the criticality of mainstream science can be used as complementary methodological protocols to evolve African science from perceived limitations. Rethinking African science as I urge, is a trigger to hold a conversation that makes both disciplines diverse frames of thinking intended to render our appreciation of reality better. Rethinking African science is just about bringing this task to fruition. It is a conversation that explores the opportunity to change unhealthy opposition between both disciplines in ways that promote the beauty in diversity.

Conclusion

African science represents diverse ways of understanding, explaining and controlling a related environment. In this chapter, I sought to review related literature to trace and unpack the meaning, nature and scope of African science. I did so by addressing the conceptualization of African science across three thematic perspectives; (i) functionalist approach (ii) force thesis, and (iii) critical rationalist perspective. In the functionalist framework, African science is essentially a problem-solving avenue. Owing to this perspective, the processing and preservation of food, coating of iron, medical practices, architectural feats, and agricultural practices were all avenues that gave an immaculate expression of indigenous science (Gyekye, 1997b). The core justification in support of this perspective comes down to utility. However, I demonstrated that the focus on the problem-solving procedures without recourse to the need for a methodological basis for analyzing, explaining, and understanding of nature and technology deprives the discipline of continuity in innovative creativity. The neglect leaves a gap that renders the perspective an insufficient approach to conceptualizing African science.

The force perspective attempts to bridge the gap that comes with the functionalist perspective as it represents a theoretical orientation for explaining events of the phenomenal world. At the center of explanations are the (agent) ontological forces. As such, the actions and inactions of these entities are considered a result of human relationships with them and are therefore constituted as an explanatory basis of happenings in the physical realm. The justification for this perspective has been that the enterprise of African science is characterized by uniqueness, for it solves problems before which mainstream science breaks down. I took an exception to the framework because its fundamental methodological virtues (secrecy and lack of empirical testability) have tendencies that drag the feet of the discipline. The critical rationalist perspective advocates that a methodology worthy of the label science ought to retain features that engage observational data from the point of view of criticism, analysis, transparency, and rigorous testing. The stance therefore suggests that the core features of African science such as utility, uniqueness and the requirement of secrecy are not compelling persuasions to justify the legitimacy of African science.

Regardless, African science exists as a body of knowledge that continues to serve as a delightful source of hope to those who claim to experience its glory. It is an undue arrogance to deny its existence and efficacy or even to tamper with it, especially without giving it a fair hearing. Indeed, African science is not without imperfections, but so is mainstream science too. I suppose, then, that the diligent thing opened to interested academics is to take a keen interest in investigating the procedures of African science, critiquing it, and patching related gaps to champion Africa's meaningful contribution to world civilization (Chimakonam, 2012b). This is the spirit in which the subsequent chapters unfold. My aim for advancing ACS is to expand the frontiers of science by stimulating an agenda for peaceful co-existence among both disciplines. However, this can only be achieved by first dissipating presumptions that conceive these disciplines as competing with one another. In place of the unhealthy competition, I am undertaking a search to present both worldviews by what I regard as a fundamental manifestation of diversity. It is an exercise to rethink African science.

CHAPTER THREE

UNIVERSALISING AFRICAN SCIENCE; A SEARCH FOR CRITERION

Introduction

For a discourse to be worthy of the attention of African philosophy, it must meet a threshold characterized by at least one of three major themes, namely; (i) methodology, (ii) relevance, and (iii) identity (Bello, 2002). Relative to (i), the theme of the discourse must be endorsed by an identifiable methodology and there are several of these; particularism, universalism, hermeneutics, conversationalist paradigm, etc. In connection to (ii), the theme must have a reason to be of relevance to first of all the related African society in particular and by extension to humanity in general. Concerning (iii), the theme in question ought to resonate feature(s) with justifiable African connection. Recall in chapter two, scholars leaning towards the universalist orientation of philosophy, particularly Kwesi Wiredu and Pauline Hountondji, made an important call by inviting scholars of African science to re-orient its methodological features. They suggest among other things that the methodological standards for dealing with knowledge cultures cannot be compromised by time and space and must therefore obtain features whose application and relevance cut across borders (Agada, 2015; Ochieng-Odhiambo, 2010). Accordingly, if a theme in African philosophy should comply with the universalist project, then it would have to align its methodological protocols to be of relevance across boarders (Gyekye, 1997).

Pursuant to the universalists' call, one is faced with another consequence, an age-old problem of identity that has an essential bearing on the constitution of African science. This problem is formalized in Robert Bernasconi's work *African Philosophy's challenge to continental philosophy* and has since been referred to as

Benarsconi's dilemma (Chimakonam, 2018). Indeed, the dilemma is just a formal recap of a statement often attributed to Aime Cesaire's conviction that "There are two ways of losing oneself: through fragmentation in the particular or dilution in the 'universal'" (as cited in Hountondji, 2005, p. 147). It recurs in Ada Agada's (2015, p. 382) description of the plight of African philosophy as the challenge to "reconcile the demand of 'uniqueness' with the necessity of 'universality'". The point simply suggests that on the one hand, universalizing knowledge systems eats into the features that define its unique identity and is therefore a recipe that could lend the knowledge system to suffer identity crises.

Again, universalism carries the potential of engendering logocentric sentiments that appear to devalue, instead of fostering epistemic diversity. The underpinning rationale of universalism implies that a body of knowledge may be relevant to cultures beyond. So, it appeals to reason not to fixate on artificial barriers that consciously limit knowledge systems to specific cultures. Yet, the opportunity for adaptation of knowledge systems into different cultural settings begins by first opening the corpus in question up to debate across related cultures. For any advances to be achieved in this cross-cultural debate, the evaluation must be based on a "formula" agreed upon by the interest parties. It appears that the requirement for standardized agreed criteria opens a backdoor that privileges the use of mainstream logic. This is exemplified in Wiredu's (1980) claim that true African philosophy is an intellectual adventure that rides on criticism and individual reflection using modern intellectual and conceptual frameworks. So, the particularist insists that the condition that seems to universalize themes in African philosophy lends African indigenous knowledge system to devaluation by mainstream epistemic protocols (Chimakonam, 2015b). So, in a sense, particularist orientation one way or the other fancies a barrier that invariably negates the possibility of achieving cross-cultural knowledge synthesis. From the seeming opposing, or more precisely, negating interest triggered by the universalist-particularist divide, a dilemma for African science is looming.

Consider, first of all, the universalist position. For instance, Wiredu (1980) an eminent universalist, suggests that African science will only gain recognition if it is able to universalize its methodological protocols, particularly through the implementation of precise data recordings and quantitative analysis, observation, measurement and testing. Yet, anyone with elementary familiarity with mainstream science will readily notice the implication of Wiredu's concerns. He is simply asking indigenous African scientists to employ the analytical tools associated with the methodological protocols of mainstream science. This, however, throws up a problem. If two technologies are of the same brand and have the same features and functions, the conventional practice that resonates with common sense is to keep to a single name in describing all of them. What this means is that if African science retains same methodological features as mainstream science, concerns for simplicity would compel the deletion of the African tag to keep it simply as (mainstream) science.

In effect, whereas universalism seems to imply the deletion of African science from the table of legitimate academic disciplines, particularism seems to erect a barrier against the fostering of epistemic complementarity. Indeed, Wiredu did notice the negating implication as a direct consequence of his view. His attempt to clear this objection led him to suggest that the quest by scholars to Africanize science in particular is not worth the effort of serious scholarship. For that matter, he addresses those willing to give up the "African" qualification of sciences as sensible

Africans (Wiredu, 1980, p. 26). From the point of view of a conversationalist, what the universalists are asking for has disturbing implications that stifle rather than promote epistemic diversity. Against the backdrop of this call, CP urges scholars to initiate a sort of complementarity that promotes unity in epistemic diversities.

In achieving this synthesis, however, I suppose there is an important aspect of the universalists' plea that should appeal even to opposing camps. Universalists are generally weary of the sort of push for (epistemic) diversity that may end up lowering the bar for what could pass as African oriented knowledge system. To be sure, a conversationalist interest in Africanizing knowledge systems takes a cue from this. For this reason, Bernasconi's dilemma likewise implies a couple of restrictions constituted as guidelines in conceptualizing knowledge systems worthy of the warrant of "Africaness". The restriction is meant to keep particularism on its toes by putting in place some standards to check pettiness which may blindly sacrifice reason for racist advocacy. In Nkrumah's (1967, p. 7) parlance, we may refer to this caveat as the tendency to brush off objectivity in favour of the malady of African chauvinism. The restriction dictated to us by the implication of the dilemma is that Africa should undoubtedly be the "center of attraction" in building African-related knowledge systems. However, by restricting the application and relevance of knowledge systems, sympathizers run the risk of sacrificing the quest for truth in exchange for petty racial discourse (Bodunrin, 1981). Bernasconi's dilemma is therefore at the neck of both the particularist and the universalist camp, serving as an important notice for scholars to opt for a balanced approach, a healthy dose of knowledge cross-fertilization that is neither disruptive of Africanness nor petty in its orientation (Ochieng-Odhiambo, 2010; Imbo, 1998).

My concern, then, is for us to create an opportunity to unsettle any such divisive friction that inhibits the cross-fertilization of knowledge cultures. So, in this chapter, I am guided by Bernasconi's dilemma in search for a criterion of Africanness to facilitate the cross-fertilization of African science and the features of mainstream science in ways that deliver the necessary balance. In doing so, I have organized the chapter into three main sections. I shall (i) put the features of mainstream science into perspective i.e. I will conceptualize "science" by chronicling significant developments that shaped the features of (mainstream) scientific knowledge as it stands (ii) examine four main criteria for Africanizing the features of science - (a) the geographical criterion (b) the logic criterion (c) the ontology criterion and (d) the postmodernist criterion. Throughout the examination, l exposes the challenges associated with the proposed theoretical assumptions as an inadequate basis for mainstreaming African science. (iii) Lastly, I shall exploit the existing gaps to elicit a complementary conditionality for universalizing African science into the larger body of research programs in ways that show the deserved loyalty to the centrality of Africaness.

Conceptualizing the Features of Mainstream Science

As I indicated earlier (in Chapter One), there are serious controversies that protract unanimity in concessions about the nature of protocols that define science in general (Mumford & Tugby, 2013). However, there are also a few growing consensuses. The history of the discipline is usually traced to the intellectual effort of the Milesians, the earliest recorded philosophers to probably ask questions about the constitution of the universe. Their much-appreciated effort stems from the attempt to explain a phenomenon by focusing on the natural world. Their significant contribution to the evolution of science is the creation of a materialist framework for enacting an explanatory account of nature. It is said of them that they seem to be the first to acknowledge that any phenomenon that takes place in nature has a causal relation to nature itself, and without the acknowledgment of such principle, mainstream science would not have been born (Sanford, 1899). Anaximander set the tone for biology as he contributed to the explanation of the evolution of living creatures. Pythagoreans advanced the frontiers of Mathematical theorem. The Atomists began a campaign of the physical sciences as they gave a rational explication of the universe based on crude atomism (Omoregbe, 2021). They made the effort to seek explanations by looking further down to micro-scale entities. So, they identified the imperceptibly minute scale of existence as where all the actions of the macro-world originate.

There are scholarly traditions also that trace the home of important feats in scientific thinking to ancient Egypt (Kemet), where Thales is said to have visited to receive tuition (Botchway, 2010; James, 1954). In Ancient Egypt, formal sciences such as mathematical axioms like geometry, arithmetic, and calculus were discovered and applied to astronomy. In the field of technological advancement, ancient Egyptians developed implements for carrying water across distances, metal technology, and architecture of which the great pyramids were no exception. In medicine, they had developed gynecology and means of conducting bone surgery (Diop, 1991). All this while, science was treated as a component of religion. In other words, the underpinning principles of this brand of "science" were somewhat linked to spiritual forces. So, for instance, the mystery system that sustained the culture of teaching and learning of arts, architecture, mathematics, history, medicine, and science was tied to motives of spiritual cleansing and salvation for the initiates, who had to pledge to keep the knowledge system covert (Botchway, 2010; Osahon, 1998). Clearly then, theoretical science in the crude sense began as a methodology whose relevance and application were restrained to related cultic society and the privileged class.

An important stage in the development of mainstream science regards the contribution perhaps wrongly attributed to Aristotle. As already noted, as part of the measures to keep knowledge among the circle of initiates, the Egyptian Mystery system did not permit the writing of learned philosophy among the students. Clearly then, it is during the conquest of Egypt that Aristotle, through the assistance of Alexander the Great, acquired volumes of literature in science from Egypt's Royal Library (James, 1954). The works attributed to Aristotle record the first impression of a systematized framework on which modern science has a notable connection was noticed. It was during his time too that scientific theorizing lived as a common practice beyond its restriction to the cultic Mystery society. Most of his contribution to scientific theorizing is recorded in six of his works collectively called the *Organon*. Thinkers before him had undoubtedly employed logical thinking in diverse ways for various achievements but in Aristotle's works, the theorization of logical rules stood up with definite clarity. In *Prior Analytics*, he introduces the logic of scientific discovery. In doing so, he theorized that every belief is a function of either one of two clearly distinguishable methods of reasoning; deduction or induction. He developed the concept of a proposition, expounded the various syllogistic inferences, and gave a further comprehensive account of the concept of validity. In *De Interpretatione*, Aristotle spelled out a concept well associated with his name, the law of non-contradiction, and went further to derive the various relationships on what is now termed the traditional square of opposition.

In *Book I of Topics*, Aristotle advanced the logical categories of induction and deduction. He clarified induction as reasoning that infers the universal from due consideration of particulars. He further noted that induction is more convincing and clearer since it is more readily learnt by the use of the senses, and is generally available to the ordinary intellect. If applied as conditions of scientific theorizing, at least two key concessions are implied by Aristotle's advances (i) Science ought to proceed from the use of the sense and (ii) the data gathered must be aimed at consequent generalization. The two principles constrained science to the procedure of induction; that is, proceeding from what is readily known or given to conclusions about the unknown. Despite this tremendous feat he demonstrated, it is quite unfortunate that several of his theorizations about the workings of nature were disturbing violations of what modern science teaches. In Book I of *Topics* and the expression that begins *On the Heavens*, Aristotle speaks of the science of nature as concerning the magnitude, properties, motion, and principles of such substances. His interest in the use of the senses in knowledge acquisition is signalled by his criticism of the Milesians, that they failed to support their explanation by what the senses reveal to us. In contrast to Thales' view, Aristotle thought that heavy objects do not float on lighter ones, so the earth's heavier mass cannot rest on a lighter body of water. Since per what the senses ordinarily reveal to us, heavy objects return to the center of the earth when thrown upwards, the earth as heavy as it is, must have likewise returned to its natural place from any motion. Consequently, the earth too must be resting at the center of the larger solar system.

To infer the features of his methodic principles, Aristotelian science placed minimal importance on observation. This same deficiency led him to wrongly suggest that during free fall, those objects that fall faster do so by virtue of their relatively heavy weight. From the elementary use of the senses which Gianna Pomata (2011, p. 45) calls, “empiricism without observation”, or as Dougherty (2016, p. 24) would say, “unplanned observation”, Aristotle deduces first principles. These first principles are telos-driven motives; metaphysical axioms not open to experimental tests (De Witt, 2010). So in *On the Heavens*, heavenly bodies are said to move circularly because they are divine, and as divine entities, it is in their nature to move as such. Then, using the metaphysical principles as major premises, Aristotle proceeds to employ deductive logical axioms to infer conclusions (Park, 2011). Aristotle then gave science an important leap. He whisked science off the loyalty to a particular cultural milieu. By basing science partly on observation and largely on deductive logical axioms, Aristotle had, by virtue of that, theorized a promising beginning of a method of inquiry in which application and relevance would make an immense impact across societies that nurtured it.

It is important to invite Rene Descartes’ systematic contribution from *Discourse on Methods* in systematizing the features of scientific theorizing because of the semblance in the use of deductive approach. Like Aristotle’s method of scientific theorizing, Descartes thought that all fields of study are fraught with controversy because for every claim made there are equally intelligent persons who could raise counter arguments. He thought, however, that this proneness to controversy by every discipline is not the case with Euclidean geometry. So, in order to build solid grounds for scientific theorizing he thought it important to settle for foundations of certainty that followed the deductive axioms of Euclidean mathematics. As such, the key to formulating claims supposedly scientific is secure beliefs that are demonstrable and absolutely true (Gimbel, 2011). He did not subscribe to Aristotle’s deductivism because it led to worldviews, particularly geocentrism, that were subject to serious controversies at that time (*ibid*). Per this ambition, Descartes passes four methodic principles as key features of his method of enquiry (Descartes, 2011). The first is the use of analysis in tackling a problem, that is to decompose problems into smaller bits required for adequate attention and resolution. The second is to begin from beliefs easily knowable and proceed gradually to the unknowable. The third prescription is to avoid all biases and unwarranted beliefs by accepting only those beliefs so clear and distinct to avoid any grounds for doubt. The last is to review formed beliefs to cross-check for possible omissions.

In Descartes' method, therefore, it turned out that the standards of proof prescribed for science which he regarded as a consequence of clear and distinct beliefs are meant to be a self-evident truth. A self-evident truth is one in which denial constitutes a manifest contradiction. The first of such beliefs which Descartes intended as foundational for science is deduced from indubitable beliefs, and that is the belief in the primacy of his (Descartes's) own existence. So, the "I" which is clear and distinct product of deductive thinking, must necessarily exist. Nonetheless, this "I" is only a thinking thing (Descartes, 2008; Gimbel, 2011). Descartes' rationalism meant that only truth inferred from the self-evident "I", can guarantee our latch on to the truth. Descartes' third methodic prescription requires that to avoid biases, one should not work with beliefs whose domain of application goes beyond what is present in the inquirer's mind. Given this prescription, therefore, the only suitable method of inferring beliefs from the foundational "I" is through deduction. This is necessary because only deduction guarantees the truth of the conclusion from the truth of the suggested reasons. Nonetheless, both Aristotle and Descartes agree quite ironically that the requisite methodic principle of science is to facilitate knowledge acquisition from the known to the unknown. Even so, they also conceptualized scientific reasoning as a method of inquiry that should uncover the unknown with certainty. Yet, because for Descartes in particular, the unknown must be grasped with a sense of certainty, the preferred method of reasoning cannot but rest on deduction. However, the challenge for such a method is that deductive inferences do not bring about any new knowledge.

Consequently, deductive logic is not a system for acquiring new knowledge, it is only a mechanism for validating consistency between an assumption and other sets of beliefs or propositions (Stace, 1970). So, appealing exclusively to deduction is hopeless in providing us with any new knowledge about the observable world. This is how Descartes' metaphysics agenda in the *Mediations* could not make any meaningful advances beyond the postulation of the "I". The reason is that he confounded his method of advancing knowledge to deduction, which, as it were, could not permit inferring anything that is not already grounded or entailed by the "I" (Hodgson, 2005; Bacon, 2003). So, for instance, how are beliefs about the material world, say, metals, energy, forces, etc., to be contained by pure deductive analysis of the "I"? Descartes seems to have recognized this barrier which is why he had to postulate God's existence as a necessary guarantor of his beliefs about the observable world. Consequently, by his expectation that science ought to sit on infallible truths, Descartes joined Aristotle in placing less premium on the use of the senses.

Modern Science; from Deductivism to Inductivism

The ideas of a book published in 1620, *Novum Organon*, make Francis Bacon an important link in the development of the features of contemporary mainstream science. Bacon begins by describing what he considers to be the prevailing faulty methodic principle of scientific theorizing, particularly Aristotelian science, which had lasted up to the middle of the fifteenth century. The title of Bacon's book commands the novelty he envisioned. The title of his ground-breaking work "Novum Organon" translates as "new instrument" and signifies a revision of Aristotle's six works produced under the title "Organon", meaning "instrument" (Dougherty, 2016). What Bacon writes in a description of the supposed "old instrument" is instructive:

> *There are, and can be, only two ways to investigate and discover the truth. The one leaps from sense and particulars to the most general axioms, and from these principles and their settled truth, determines and discovers intermediate axioms; this is the current way (Bacon, 2003, p. 36).*

Having alluded to the limitation facing Aristotelian and Cartesian deductivism, Bacon proceeds to the approach he considers appropriate to conduct an enquiry worthy of the new science. He writes:

> *The other [way of enquiry] elicits axioms from sense and particulars, rising in a gradual and unbroken ascent to arrive at last at the most general axioms; this is the true way, but it has not been tried (Bacon, 2003, p. 36).*

Clearly then, Bacon thinks of himself as a revolutionist who rejects the traditionalist method of deductivism. Traditional deductivist construal of science is untenable because it compels nature to fit into metaphysical axioms instead of vice-versa. One should not profess metaphysical claims as "sacred" truth and force the operations of the world to fit into them. No conclusion about the nature of the universe must be reached outside the actual observation of the way the universe operates. The new method of science, then, must begin with careful observation of nature itself rather than the presumptions of deductive axioms. Bacon (2003, p. 38) calls this new method "interpretation of nature" and the old ways of deductive axiomatic proofs "anticipations of nature". According to the appropriate method of interpreting nature, science proceeds by gathering data through careful observation. From this data, conclusions are inferred not according to induction by simple enumeration which Bacon considered childish because it bases conclusions on inadequate data (*ibid*). Therefore, Bacon insists on the role of experiment as an important tool to supplement the vulnerability of the senses. Experiment then, Bacon thinks, penetrates the subtleties of nature and makes amends by correcting errors that escape the correct judgment of our senses (*ibid*). Bacon's recommendation on the logic that ought to guide scientific discovery is called inductivism. Inductivism is the view that the logic of scientific discovery which constitutes the method of science is induction (Gimbel, 2011; Gillies, 1993). A notable inductivist, John Stuart Mills (1981), later followed up with a systematic classification of the methods of induction according to five main types; method of agreement, method of difference, joint method of agreement and difference, method of concomitant variation, and method of residues.

In the sixteenth century, Nicholas Copernicus began the agenda to turn the world away from the geocentric construal of the universe. In the book which translates as *The Revolutions of the Heavenly Sphere*, Copernicus made the point that the sun appears to be the one in motion when in actual fact it is the earth that moves because the earth is in motion together with all objects on it. When he discovered this, he removed dogmatism by showing that truth about the universe is not wielded by authority, but by independent-minded evaluation from evidence. In the preface of his thought-provoking book, Copernicus (1953) remarked that it is out of order and hence a very great difficulty he faces, that an ordinary person, (like him) should challenge the view of the philosophers (particularly in reference to the Aristotelian tradition as adopted by the Church at the time). Those were the very dogmatic character of opinions believed to be science. Yet, Copernicus further suggested that erroneous views must however be unsympathetically discounted. Indeed, the fact that Copernicus had to wait close to his death before publishing his work shows the overwhelming dogmatism that has eaten into the fabric of the traditions of science during his time. This development was enough to render science always tentative. Even charismatic opinions of authorities needed the test of corroborating evidence to survive the rendition of scientific knowledge (Finocchiaro, 1942). Indeed, by the time of Galileo, one realizes a sort of commitment to the use of experiments which gave a key indication that in science all inherited knowledge is never an absolute truth for it is always answerable to new tests (Omnes, 1999). So, as Lakatos (1998) suggests, scientists are to be open-minded by entertaining a healthy dose of skepticism about even the best of theories.

The tentative status of scientific knowledge is a very crucial point because it is usually made a reference point in distinguishing what truth means in science and how pseudo-sciences conduct their business. I have the occasion to point out another way of understanding this feature by reference to some legal cases in the history of science education in the United States of America. The case is discussed by Robert Pennock in his work *Why creationism should not be taught in public schools*. In 1981, a parent sued California State on the accusation that classes that taught evolution to his/her child were an infringement to both the parent and the child's right to freedom of religion. Now this case was very important because in 1961, the

United States Supreme Court had quashed antievolution laws on the basis that the U.S.A. cannot tailor the requirements of teaching to prohibit particular religions or doctrines. Now, in the present case of 1981, the Sacramento Superior Court gave the ruling that teaching evolution in schools did not violate religious rights and the reason for this decision is the precise point I want to draw attention to. The court suggested that evolution is taught not as a final or absolute truth to be taken without questioning. Because of this inherent methodological assumption, the teaching of evolution in public schools is not an occasion for promoting one "religious" viewpoint over others. Again, the court suggested that evolution is about how things occurred particularly how living things evolved and not teaching about ultimate causes. Both reasons give one salient message, namely that the most accurate and well-tested theorems of science cannot be construed as final answers because doing so reverts scientific truth from supposedly tentative status to absolute truth typical of religious dogma.

When Galileo Galilee's name is mentioned, the scientific object that readily comes to mind is the telescope. Indeed, the motion of the earth relative to the heavy stars is hardly noticeable given that the distance from us to the stars is too wide to occasion any significant detection in the positional changes of the star. By keen appeal to observation, Tycho Brahe generated a taxonomy of planetary motions by using very careful measurement. From that legacy, Johannes Kepler's discovery in mathematics led to an astounding deduction that would henceforth feature as an important aspect of mainstream science. These discoveries entail laws by which Kepler demonstrates that nature obeyed principles that can be formulated by way of mathematical theorems (Omnes, 1999). Science then, is a discipline in search of laws that govern the various happenings around us (Hodgson, 2005). In his outstanding piece of work, *Mathematical Principles of Natural Philosophy*, Newton advanced the legacy of Kepler's law into the popular laws of motion. It appears that science aims at the unification of theories; that is science generates theories that subsume older ones whilst expanding their explanatory scope at the same time. By this development, science witnessed the introduction of yet another important feature, the quest for unification, Feyerabend, however, has a challenge accepting the unification assumption of scientific knowledge. For him science grows by an increase in mutually inconsistent theories, each one forcing the other to be better refined, all of which by way of competition, increases our understanding of reality. The demand for the unification of theories, as he says, is unreasonable because it forces the preservation of older theories, not necessarily the better ones (Feyerabend, 1993).

With the greatest of regards for Feyerabend, I venture to side with other views which suggest that science aims to unify all laws into a single theorem called "the theory of everything" (Blin-Stoyle, 1997; Dixon, 2008; Stenger, 2009; Rosenberg & McIntyre, 2020). Pursuant to this, James Maxwell Clerk provided the quantitative basis in the form of the mathematical equations that unified the phenomenon of light, magnetism and electricity (DeWitt, 2010). Again, Aristotle has suggested that the celestial realm as compared to the terrestrial realm, was governed by a different set of principles. Newton showed that the laws that govern the falling apple, a tossed coin, or a rolling canon ball are the same laws that hold the planetary motions intact. This led to the prediction that the rate of "fall" of the apple should coincide with the gravitational pull on the celestial realm. Again, not only did Newtonian mechanics refute the Cartesian vortex theory of gravity, it provided a unified explanation that subsumed the phenomenon (Lakatos, 1989). The ideal unification being sought for today is the compatibility between seemingly irreconcilable quantum theory and general relativity (Brown & Ladyman, 2019; Allday, 2017; Perkowitz, 2011). Newton's contribution gave a settled place to what prediction can achieve for science. By the 18th century, the face of mainstream science was Isaac Newton. His differential calculus sustained a hope that if the initial fact about the force acting on a body is known, then Newton's third law can be converted into differential equations and if solved, we can tell with absolute certainty, the place and momentum of the body with respect to time (Omnes, 1999; Zukav, 1979).

In sum, from Milesians to Newton, mainstream science as a method of enquiry gathered features that distinguish it from other forms of knowledge. The crucial point of historicizing the developments in the scientific method is to have the salient features I have traced put into perspective. Therefore, generally, science is characterized by (i) its primary focus on the empirical world (not necessarily observable entities) (ii) the use of critical observation of nature to formulate laws from regularities (iii) the offer of explanation, retrodiction and prediction (iv) the allusion to a pattern of (mainstream) logic; be it induction or deduction (iv) the virtue of experimental testability (v) tentativeness of conclusions and (vi) the quest for unification of theorems (Ruse, 1991).

Conceptualizing A Criterion for mainstreaming African Science

African science and the geographical origin criterion

The principal question here is what principle can be adopted to give a touch of Africanness to the features of mainstream science? I prefer to start with Pauline Hountondji's initiative advanced in the book *African philosophy, myth and reality*. In this book, Hountondji sought to provide a theoretical assumption for identifying a philosophy as African. Since then, the position has come to be referred to as the geographical criterion of Africanness. According to Hountondji's proposal, a corpus is regarded as African philosophy if it constitutes a text authored by an African and declared by the author as philosophical (Hountondji, 1983). What Hountondji's geographical criterion did was to make the identity of a proponent a central assumption in determining the identity of a body of knowledge. The condition has met a lot of reactions. Segun (2014) for instance embraces it, Bodunrin (1981) accepts it subject to modifications and Chimakonam (2015a) translated his contempt for the criterion into describing the entire book as "a bad literature on African philosophy".

Indeed, before Hountondji, the geographical criterion was assumed by George James in the popular work *Stolen legacy* to claim in Africa's name, the authenticity of "Greek philosophy" and by extension, "Western science". George James achieved this by showing the inextricable link between the Egyptian Mystery System (from which ancient Greek philosophy is claimed to have been stolen) and the geographical origin of those who nurtured the Mystery System (James, 1954). Invariably, the approach implies that ancient Greek philosophy is African because it emanated from a knowledge base expressed by people whose origin is indisputable of ancient Egypt (Kemet). There are a couple of other philosophers including Mawere and Mubaya (2017) who have likewise conceived of Africanness in terms of the role played by the African identity in cultivating the knowledge system. Following such examples, the notable expression "African man's way" as found in various attempts at defining African science seems to indicate an influence from the geographical criterion (Afisi, 2016; Chimakonam, 2012a; Emedolu, 2015). On the count of the geographical criterion, mainstream African science is simply the application of the method of mainstream science by a theorist, practitioner, or investigator with an African identity.

Seen in the light of Hountondji's proposal, a deep-seated challenge from Geoffrey Ozumba's effort at universalizing African science gets clarified. In his work, *Analytic and Synthetic Dimensions of African Science*, Ozumba conceived of African science as knowledge grounded on the way the Africans apply the method of mainstream science, namely: observation, systematization of data, and testing. Nonetheless, it soon became apparent that Bernasconi's dilemma had been breached. Chris Akpan (2010), thus, raises the concern that it makes no sense, and hence a breach of simplicity to call the ensuing science African because the method of African science is being constituted with the same methodological protocols associated with mainstream science. The difference the geographical criterion makes is that the Africanness of the science in question is catered for under the African identity of the theoretician, the practitioner, or the investigator who applies the method either in theorizing or solving a problem. The criterion, however, comes with one enviable advantage. Indeed, one of the things that makes the question of Africanness an unending debate is because, like many philosophical themes, the method of resolution makes no direct appeal to empirical data subject to open verification (Chalmers, 2015; Imbo, 1998). If one evaluates the geographical criterion in this light, it promises a great sigh of relief. As such, according to the classification of knowledge systems, all that is required is to be able to decide on the (African) identity of the theoretician, proponent or investigator in question. Mainstreaming African science would simply mean as Hountondji (1983) would suggest, the African taking the center stage of the method as the interlocutor of nature. Again, the geographical criterion of Africanness seems to enjoy a certain intuitive appeal relative to the way we conduct our everyday business. Usually, when "African" describes a phenomenon, it ordinarily presupposes the person(s) of African identity steering the affairs of, or taking an active charge of the activity in question. For instance, when we say African Cup of Nations, it is presupposed that the participant players are people whose origin is one way or the other connected to an African nation. Similarly, the geographical criterion would expect that the participants which here means the investigators, should be those who confer the right of African identity on the method of science.

The relation of the geographical criterion to mainstream science is, however, not without controversy. The challenges, for the purposes of mainstreaming an African-oriented discipline, begin right from the controversy surrounding who qualifies to retain an African identity in the first place. Is it someone living on the African continent? It is someone who shares the morphological traits typical of an "African" description? Or is it someone who feels of himself that he is an African? Anthony Appiah has offered penetrating insights into the debate of race in volumes, contributions that are beyond the scope of this chapter. I should therefore defer my argument to his incisive point that makes direct relation to the discourse. In his book *In my father's house*, Anthony Appiah commits his effort to demonstrate that racial differentiation is an illusion. It is an illusion not because there are no identifiable differences between races but because the basis upon which racial differentiation arguments have been mounted is arbitrary. For instance, Appiah makes the argument that there is a sense in which all of humanity can be regarded as one race because the question of the geographical ancestry of humanity, which raised the need for anthropological and scientific enquiry, has all succumbed to evidence in support of the validity of the single-origin hypothesis (Diop, 1991). Invariably, all humans come from the geography of Africa. So, if geographical origin legitimizes identity, then there is a sense in which there is only one race whose decent is from Africa, the human race for that matter (Fairbanks, 2015; Osahon, 1998). This is the basis for the liberalist concession that, all organisms that can interbreed and reproduce are, properly so-called, of the same race (Bonnan & Curtin, 1995; Fairbanks, 2015). So there seems to be really no deep segregating factor to warrant racial differentiation. Racial segregation then, may suggest a superficial term of convenience for achieving a desired purpose. Du Bois for instance, advanced a classification of the sociological basis for defining race. In his very popular work, *The conservation of race*, race meant a family of people connected by blood, language, common ancestry, tradition, and the quest for achieving a common goal (Du Bois, 1897). Du Bois' conception of race, for instance, was intended as a conceptual tool for blacks and African diasporan solidarity, aimed at facilitating emancipation from social and economic exploitation (Shelby, 2002; Bell, 2002). Racial differentiation, it is claimed, has also served as a conceptual basis for justifying all manner of self-seeking projects, including the guilt of slave masters from the heinous crime of slavery (Onyewuenyi, 2003; Asante, 2015).

Segun (2014) in his article *The prefix "African" and its implication for philosophy in Africa* traces the etymological referent of "Africa" to the Romans and Greeks. To the said people, Africa simply meant a geographical terrain with high temperatures. To displace the overwhelming evidence in support of the single-origin hypothesis, the quest for racial segregation shifted evidence from the use of geographical origin to phenotypical differences, of which being an African means having a black skin colour, flat and broad nose, thick lips, etc. (Onyewuenyi, 2003, Appiah, 1992). It is worthy of note that phenotypical differences are corresponding properties which emanate from differences in human genetic structures. To be sure, the phenomenon of gene differential sequencing began with African emigrants who settled around the regions of mountain Caucasus. These immigrants gradually evolved gene mutations for natural selection, and they got typified by the phenotypical characteristics of Europeans and Asians (Fairbanks, 2015).

Grimaldi, the first migrating settler of Europe brought forth generations who underwent gene mutation for natural selection between 30000 - 50000 years, a result of which produced the Cro-Magnon, the first white to appear. The gene mutation was occasioned by excess cold weather conditions following the last glaciation, and pigment formation proportionate to the closeness to the equator became a necessary survival tool (Diop, 1991; Osahon, 1998). I have traced the genesis of racial differentiations to prove that on the one hand, the basis of supposed racial differentiation is a matter of how best nature could design a certain inhabitant to survive the conditions of their environment. On the other theoretical science is aimed at facilitating our understanding of the world around us, probably to abreast us with truth verisimilitude. It is beginning to appear, then, that the geographical criterion of Africanness relative to science is absolutely preposterous. The question being asked here is a request for a basis on which to describe a knowledge system as African. Surprisingly, in the geographical criterion, the answer invariably suggested is about how the evolution of a conscious pile of atoms survived the conditions of their environment. How does such a rendition of Africanness make any contribution to complement mainstream science and vice-versa? It simply has no reasonable effect and when measured by Bernasconi's dilemma, it fails on the ground of relevance. So, when Ani (2020) says it is unintelligible to fashion a criterion of Africanness on geographical considerations, he has my absolute sympathy.

The second challenge associated with the geographical criterion of Africanness is also untenable. Let us suppose that racial identification can easily be settled by any designated consensual principle. Besides, what would be the fate (in terms of identity) of science carried out by an African with dual continental citizenship? Does the knowledge the subject produces qualify to be designated with both continental citizenship identification? What about (African) investigators who renounce their legitimate citizenship of a continent? How would their science be described, individual science or just mainstream science? Supposing a court ruling which, by some newly found evidence, associates Albert Einstein to an African origin. On the ticket of the geographical criterion, we are forced to grant all his works particularly special and general relativity into mainstream African science when in fact nothing about the body of knowledge in question has changed. In all honesty, how does this new African identity (of say general relativity) make any relevant contribution to our understanding of the world? What the foregoing discussion points to is that scholars should be able to distinguish between the following; African mainstream science and mainstream science in Africa. The former seeks to advance the frontiers of knowledge by putting African knowledge systems at the centre and the features of mainstream science at the periphery to complement the perceived weakness of the African worldview. The latter instead contract the methodological protocols of mainstream science to the centre and draws the African connection through racial identification. The recommendation by Wiredu for constituting Africanness seems to be in line with the approach of the geographical criterion. The only difference is that Wiredu is unwilling to grant any label of science as African-oriented (Wiredu, 1980). The inspiration I take from his suggestion is that a knowledge system cannot be African if the property of

Africanness is not derived as a feature of the knowledge system in question. So, if the property of "Africanness" must be reflected in the knowledge systems, then the geographical criterion is of no reasonable effect. I should therefore feel obliged to sustain the several objections raised against it (Ogbonnaya, 2018; Uduma, 2014).

African science and the logic criterion

The logic criterion of Africanness makes an important improvement upon the geographical criterion. Recall that the geographical criterion of Africanness is not constructed as a central property of the knowledge system. Africanness falls outside the systems of scientific theorizing because it is constituted as the racial orientation of the investigator, not as playing any key role in the knowledge system propagated by the supposed Africans. Unlike the geographical criterion, the logic criterion tries to Africanize a science by focusing on the constitution of the body of knowledge itself and making the identity of Africanness an integral property of the knowledge system. A little bit of background information is pertinent. C. S Momoh, in his paper *The logic question in African philosophy*, is of the view that there are two exercises involved when it comes to logic. The first relates to the practical use of logic in ordinary discourse. This concerns people who knowingly or unknowingly apply logical rules in ordinary day-to-day discourse independent of whether they are able to justify the theoretical basis of validity. The second distinction relates to engaging logic at the theoretical level, that is the theoretical formulations of logical rules and inferences in pursuit of formal validity, particularly in symbolic logic. Momoh indicates that the evaluation of his data about the indigenous Africans does suggest that the indigenous African's orientation to logic is just about the application of same mainstream logical principles to evaluating the African worldview. In the last paragraph, however, Momoh indicates that the findings do not negate the possibility of developing an authentic African-oriented logic and he charges African philosophers to take up this gauntlet.

Uduma Oji Uduma seems to have hammered the gauntlet altogether as he launched a critical attack against the legitimacy of building an African-oriented logical framework. From his point of view, indigenous Africans employed mainstream logical principles, and the only thing lacking was the consciousness of the theoretical justifications of the principles in use. So, the indigenous African could infer “Q”, given that “If P then Q and P”. What the indigenous Africans had not mastered was the conscious effort to explain that the conclusion is a result of the entailment principle. Following a critical review of Uduma’s position, Chimakonam in his book *Ezumezu as a system of logic for African philosophy and African studies* formalizes two senses of African logic; culture restricted logic (called the apologist trend) and culture-inspired logic (called the system-builders trend). Culture-restricted logic suggests logical principles whose application and relevance are bound to a given group of people with which the logic is concerned. Udo Etuk’s work *The possibility of African logic* for instance is an example that seeks to lay a justification for the possibility of such logical frameworks. Chimakonam is of the view that even though the recommendation for such logical systems evokes sympathy towards cultural solidarity and identity, they are in substance very backward. He remarks:

> *The project of the ethnologicians is no doubt encouraging and academically interesting but I have serious doubt as to its usefulness. The challenge with this type of project is that at the surface emotional level, it tends to promote the feeling of cultural solidarity and identity but deep down, it appears backward looking. Cultural logic/ethnologic*

neither constitutes system of formal reasoning nor a solid and progressive discourse in philosophy of logic. It is more like a consolatory exercise (Chimakonam, 2019, p. 64).

In furtherance of this point, Chimakonam remarks that the point about African logic is the construction of mainstream logic systems inspired by the nature of African reality. Such is the nature of the African-oriented logical system he calls Ezumezu (Chimakonam, 2019).

The logic criterion of Africaness derives from Chimakonam's (2019) conviction that the Africanness of a knowledge system derives from the underpinnings of African logic. Thus, since the features of mainstream science take logic as one of its essential features (Dougherty, 2016; Mahner, 2007), African-oriented science would be to simply construct the features of mainstream science with the underpinnings of African logic. Suffice it to demonstrate the point with a similar example. Marxist philosophy's claim of scientific status is based on the presupposition that the theory is sustained by a veritable logic that explains the nature and course of society; the logic of dialectics. Dialecticians suggest that dialectics constitute a different logical system that expands the understanding of reality beyond what is provided for by traditional laws of thought (Trotsky, 2002; Engels, 1996; Popper, 1962; Novack, 1991). African science sympathizers then are seeking approval of mainstream African science because scientific theorizing has been shown to depend not on any single logical foundation. Indeed, some philosophers go a step ahead to assert that contrary to traditional logic, "Africans are more inclined to the dialectical conception of logic where everything is mediated, and therefore everything is itself and at the same time, not itself" (Uduma, 2020, p. 241).

Before I attempt an evaluation, it is important to secure the full details of a culture-inspired logic. To this end, Chimakonam further suggests that there are two categories of culture-inspired logic, namely; conventional logic and alternative logic. Conventional logic consists of a bivalent truth value system of enquiry as exemplified by Aristotelian logic. Under bivalent logic, when propositions combine with other propositions under specified rules of inference, one is restricted to conclusions which are either true or false. Alternative logical systems consist of a logical framework that commands at least trivalent values. African logic is precisely one of such alternative logical systems as it derives from trivalence truth value. In the trivalence logic, true and false are not exclusive as sanctioned by the law of excluded middle. So, the exhaustive values of African logic, it is claimed, comprise true, false and the inclusive sense of true or false called the complementary value. The complemented value is given as *onona-etiti* (Chimakonam, 2019; Agada, 2015). The motivation for trivalence logic is premised on the hypothesis that all there is to reality cannot be exhausted by the rather too-restrictive formalized bivalence logic. Scholars, through the analysis of related African languages, have proposed a supposed alternative logical system, indicating that such systems are not only possible but a desired framework required as a befitting analytic framework for dealing exhaustively with the metaphysical worldview of the African. In keeping with the dynamics peculiar to African ontology, African-inspired logic provides a flexible alternative to complement the limitation(s) before which bivalent logic is said to be handicapped (Ijiomah, 2020; Chimakonam, 2015a).

What are the peculiarities of the African worldview that necessitate an African-inspired logical system(s)? In his work *Harmonious monism: A system of logic in African thought*, Chris Ijiomah theorized African ontology as one that does not permit strict bifurcation between spirit and matter. Spirit and matter are conceived in the inclusive sense of "either-or". Each domain of existence needs the other for the purposes of maintaining a harmonious balance. This thesis, Ijiomah maintains, is called African ontological duality and is fundamentally in contrast with the (Western) ontological dualism as theorized by Descartes. In Robin Horton's (1967, p. 60) words; the point reads:

> *Both in traditional African cosmologies and European cosmologies before Descartes, the modern distinction between ' mind' and ' matter' does not appear. Although everything in the universe is underpinned by spiritual forces, what moderns would call' mental activities ' and ' material things ' are both part of a single reality, neither material nor immaterial.*

Humans can play a role to forestall harmony when the balance that unites the seeming opposite is violated and this would involve the activities of ritual sacrifices, libation, etc. African logic is therefore claimed to undermine the law of excluded middle. For the domains of reality permits a certain threshold where spirit does not exclude the physical. At this threshold, the categories of bivalent truth values, true or false in the exclusive sense do not apply. There is a complemented threshold, the third category of truth-value necessary to bridge the missing link between the unity of supposed contradictions. For that matter, Chimakonam (2019, p. 39) theorizes Ezumezu as trivalence logic which in addition to the three traditional laws of thought, postulates three laws of thought, namely; onona-etiti, Nmekoka, and Njikoka. Whereas the application of bivalent logic enacts strict bifurcation between physical and incorporeal, Ezumezu is a trivalent logical system because it is held accountable to additional ontology, that is, the transformation of the physical to the spiritual. The truth value of this logical system is accordingly given as "ezu" (truth), "izu" (falsity) and "Ezumezu" (the complement of truth and falsehood).

It is time to evaluate the prospect of universalizing African science based on the proposed criterion of African logic. I do so with particular reference to examples taken from Ijiomah and Chimakonam. Ijiomah for instance illustrates African trivalence logic according to his theory of harmonious logic with the following example. Take the premises

(1) If "A" perpetrates a crime against "B's", "A" would have to be punished.

(2) "A" has perpetrated a crime against "B's".

In the scheme of bivalence logic, the argument is a specific case of Modus ponens and the conclusion should read as:

(3) Therefore "A" would have to be punished.

According to Ijioma, contrary to bivalent logic, African trivalence logic does not necessarily elicit the same conclusion. The basis is that instead of "If P then Q, P, therefore Q", the African is said to be rather keen on

(1) If P in situation Q, then R,

(2) P in situation Q,

(3) Therefore R.

The point for Ijiomah (2020) is that "Q" represents a different context which significantly alters the supposed implications to be derived from the argument. For instance, "Q" could represent a context in indigenous societies in which "A" has a special relationship with "B", and such a relationship would not permit "A" to be punished for the crime committed. In a similar example, Chimakonam puts Ezumezu into action as follows:

(1) Every citizen of Umofia must join the queue to be served

(2) Unoka is a citizen from Umofia

From premises (1) and (2), Modus Ponens compels the truth of the conclusion

(3) Therefore, Unoka must join the queue to be served.

Like Ijioma, Chimakonam (2019) offers the following explanation. Supposing one substitutes Unoka with Ezeudu (in the narrative of *Things Fall Apart*), the conclusion is said not to follow because Ezeudu retains a title in Umofia which immunes him from joining queues as ordinary men would do. Thus, in African logic, the context under consideration represented by the variable "Q" is said to make a key difference. In contrast to formal logic, the point being suggested is that there is a place for the assumption that a given conclusion is both true and false based on the dynamics of the cultural context to which the formal rules are applied.

To be honest, African-inspired logic as espoused by Chimakonam and Ijiomah promised to be an interesting alternative system for mainstreaming African science until the examples were used to illustrate what is actually being argued for. To be able to illustrate the challenge associated with Harmonious monism and Ezumezu, we must go back and fine-tune the argument form, the rationale that necessitated such logical frameworks in the first place. The argument to me seems to be that:

1. The African ontological background is unique,
2. To be able to cognize such a unique background, one needs a logical framework that resonates with the unique properties of African ontology.
3. *Ezumezu* and harmonious monism are logical frameworks designed to cognize the uniqueness associated with African ontology.

4. Therefore, *Ezumezu* and harmonious logic are necessary frameworks for cognizing the uniqueness of African ontology.

The second and third premises are enough to make a case against the suggested African trivalence logic. The second premise suggests that we need a befitting logical framework to understand African ontology and the third premise suggests that *Ezumezu* is equipped to do just that (Chimakonam, 2019). It seems to me that this particular case of advancing a proposal for a distinct African logic is merely forcing a way to make a trivial contribution if it is ever needed. Indeed, revisiting the challenges posed by quantum theory relative to the nature of reality makes this quite clear. When quantum theory exposed the limitation of classical physics with particle-wave duality, several proposals were made to forestall order in physics (Carnap, 1966). Following the conviction that wave-particle duality is an opposing ontological concept, statements dealing with quantum logic faced difficulty in yielding to traditional bivalent truth values (Omnes, 1999). One of the proposals meant to surmount the hurdle was the attempt to reintroduce the use of three-valued logic (Jammer, 1974). Hans Reichenbach (1953) who pushed for such a proposal suggested that a middle truth value called indeterminate ought to be used to describe the state of a released electron before measurement. In this case, before the wave function of an electron collapses, we are allowed to describe propositions that seek to capture the momentum and location of the electron as indeterminate until the place of the electron is actually measured. Similarly, in Chimakonam's related example, we are told that one cannot determine the value of "Q" until further determinations, for instance, about the status of the object involved are clarified.

Under Heisenberg's uncertainty principle, the position and momentum of a released electron are jointly indeterminate until the associated wave function is collapsed by measurement. The point is that trivalence-valued logic had been invited when our understanding of reality met challenges. That is to say, the proposal for three-valued logic is not supported by the conviction of uniqueness relative to African ontology. If it were so, then subject to Heisenberg's (2000) uncertainty principle, quantum theory is rendered an African ontological worldview. The challenge Chimakonam and his cohorts need to deal with is the comfort of admitting quantum theory as African. To use Chimakonam's own expression, if Okonkwo's haircut (the conditions of supposed Western construal of reality that necessitated the call for three-valued logic) befits Okoye (the African worldview), why appropriate the hairstyle as Okonkwo's (Chimakonam, 2015a, p. 61).

The second criticism is that even in the context of African ontology, trivalence African logic is superfluous because no sufficient need has been demonstrated for it. Indeed, I owe this insight to Victor Nweke's paper titled *African Logic; A complementary reflection on the condition for its existence and non-existence*. In this paper, Nweke dealt what I consider to be an incisive blow to the cogency of African three-valued logic. Nweke did show that trivalence logic as exemplified in the examples thrives on a deliberate and blatant omission, meant to "prove" the distinctness of African logic. The specific case examples of *Ezumezu* and by extension harmonious monism provide specific cases of enthymemes just by suppressing one premise, and by doing so, it affords the syllogism the impunity to alter the necessary conclusion and makes the condition look like bivalence logic is inapplicable to the African worldview. As exposed by Nweke, Chimakonam omits the role played by status in the formation of queues, just as Ijiomah omits the role played by kinship in punishing offenses. Now, should such omissions be clearly stated as part of the premises, the argument would duly follow Modus ponens and the context would limit the application of truth values to either "true" or "false" just as required by bivalence logic. In such a case, we would have Chimakonam's argument addressed as

(1) Every ordinary citizen of Umofia must join the queue to be served.

(2) Unoka is an ordinary citizen from Umofia.

Therefore, Unoka must join the queue.

In this case, if one conditions someone, for instance, Ezeudu as a titled citizen, then his status cannot satisfy the antecedent of the major premise where a requirement is an ordinary man. This would make the substitution instance of the argument invalid in the first place. However, this does not mean that Ezeudu's condition calls for the introduction of a third indeterminate truth value as Chimakonam and his cohorts want us to believe. We simply have to readjust the language of the premises to fit Ezeudu's status and the problem simply vanishes. In this way, the appropriate premises would read

1. Any titled citizen of Umofia (as exemplified by Ezeudu) must not join a queue
2. Ezeudu is a titled citizen

Therefore, Ezeudu must not join a queue.

We can apply the same dynamics a thousand times to Ijioma's example too and the result will always vindicate the potency of traditional logic in such cases. No reasonable justification has been established for the need for African (trivalence). It rather omits a related context of an argument to prove that certain contexts in African ontology cannot be dealt with by bivalent logic. The examples we are presented with deal with very basic issues of how to formulate premises, and it is being made to appear as though there is a problem with the compatibility of bivalence logic and African trivalence logic. This corroborates Wiredu's concerns taken from the Akan proverb, "Nokware mu nni abra". This proverb which translates as "There is no conflict in truth" clearly suggests an invocation of the law of non-contradiction (Wiredu, 1998, p.21). So, contrary to the effort of Chimakonam, African ontology shows clear compatibility with traditional logic and there should not be any forced loyalty to trivalence logic without the demonstration of the need for it.

Indeed, in a book titled *The Logic in Yoruba Proverbs*, Ademola Kazeem Fayemi made an effort to organize the logical underpinning of Yoruba Proverbs on the anvil of formal rules of logic. And the notable conclusion is that African logic has not substantiated the need for distinct logical rules. Edwin Etieyibo's *African Philosophy and Proverbs*: *The Logic in Urhobo Proverbs*" is no less work in African logic. Yet, in this work also, what he does is a careful analysis and a demonstration of the conformity of Urhobo proverbs to the laws of mainstream logic. I, therefore, affirm the conviction of Uduma's earlier claim that African logic should not be forced to appear antithetical to mainstream logic. It is also clear why C.S Momoh (2020) suggests that the appropriate task of African logic is the application of conventional logic to the African worldview. African logic's claim to Africanness merits an unsubstantiated quest for uniqueness. This is why Innocent Asouzu (2020) cautions that when evaluating the Africanness of any subject matter, scholars must ensure critical distancing measures and not be bound by a blind commitment to Afrocentrism. This is not to suggest that what we have in traditional bivalent logic is adequate and a monopoly beyond a healthy "rivalry". Nonetheless, we cannot accept any alternative framework merely in the name of Africanness. Based on Bernasconi's dilemma, the call for African logic demonstrates no need and is therefore a typical exhibition of the malady of African chauvinism. It is an irrelevant and petty concept that cannot constitute a serious conditionality of Africanness. As I noted earlier Chimakonam is himself against logical systems whose only contribution is to evoke sympathy towards cultural solidarity. However, it does appear his contribution does not sit well with his intended message. Therefore, the application of the logic criterion for consideration as a befitting theoretical basis for mainstreaming an African-oriented science into the larger body of research programs is without merit and is accordingly rejected.

The ontology criterion of Africaness

Like the logic criterion, the ontological criterion also attempts to identify Africanness as a property of a knowledge system. The ontological criterion is the view that science is preconditioned by ontological foundations. Since the ontological considerations shape the epistemological modalities of knowledge in general and science in particular, then the Africanness of mainstream science should be a consequence of African-related ontological considerations.

First of all, it is crucial to justify the premise that science presupposes ontological foundations. For example, when Galileo pointed the telescope into the skies, he most likely did not expect to encounter nothingness. He definitely should be moved by the conviction that something whose peculiar features elude detection by the naked eye exists somewhere in the sky. Indeed, if science is said to explain, it is generally accounting for a phenomenon in terms of constituted relations and interactions that pertain to the underlying reality. So, the method of mainstream science simply yearns to capture the state of affairs as it is (Plantinga, 2001). Baas Van Fraassen’s challenge of this thesis is only meant as a reasonable objection against ontological realism, not the ontological assumptions of science in general

(Fraasen, 1985; Godfrey-Smith, 2003). For even empirically adequate knowledge (as his empirical adequacy thesis presupposes) invariably alludes to an idealist foundation. Science then, cannot be autonomous since it ought to be preceded by that which it seeks to capture; the underlying ontological relations (Duhem, 1991). One observes this clearly as Descartes' (2008) first rest point in his quest to lay a firm foundation for the sciences was to discover what is first of all primarily fundamental, the "I", in which absence, the whole commitment to accessing infallible truth is impossible. The application of the scientific method necessarily presupposes Being. Science presupposes ontology (Mahner, 2007).

I turn now to the supposition that ontology defines knowledge systems. The criterion was first proposed by Placid Tempels in his historic work *Bantu Philosophy*. In this work, Tempels suggests that the definitive characteristics of a people are traceable to their way of thinking about the thing(s) they consider as ultimate reality. In that way, he sought to draw some connection between the nature of ontology and the way a group of people organizes their lives. He writes:

> *If, in fact, primitive peoples have a concrete conception of being and of the universe, this "ontology" of theirs will give a special character, a local colour, to their beliefs and religious practices, to their mores, to their language, to their institutions and customs, to their psychological reactions, and more generally, to their whole behaviour (Tempels, 1959, p. 23).*

In recent times, the criterion has been defended by Lucky Uchenna Ogbonnaya as a necessary consequence of the logic criterion. The rationale he employs follows from the demise of the logic criterion of Africanness. He avers that if the nature of logic depends on ontology, then ontology is prior to logic. Therefore, ontology should take precedence in giving meaning to Africaness (Ogbonnaya, 2018).

An evaluation should begin with an interrogation about what ontology is been referred to as African in the first place. Supposing there is anything as such, a second difficulty philosophers have taken a keen note of arises, namely: given the diversities of over a thousand African cultures, how can we address such notion of Africanness to reflect such diversities without committing to regional reductionism (Janz, 2017; Abraham, 2010, Ramose, 2003)? This may be called the generalization problem of Africanness. Some scholars are actually of the view that such a task is very daunting and is therefore deemed an impossible feat (Wright, 1984; Agada, 2013).

There have been two suggestions regarding the way forward. The first suggestion comes from some philosophers of universalist orientation. They describe the demand of the generalization problem as mischievously silly. They suggest that in African philosophy, Africanness ought to be given a stipulative definition in which the term hitherto refers to sifted common elements in many (regional-based) African worldviews (Bisong, 2020; Chimakonam, 2019; Tangwa, 2017; Uduma, 2014). Nonetheless, when universalists make such suggestions, they only change the nature of the criticism instead of proffering a solution. For it simply becomes a problem of how many cultures are to be considered representatively enough for such generalization to be legitimately African? The second suggestion seems to deal with the regionalization problem to the core. The position has been that Africanness need not be a shared element across African cultures. So, it could even be the element of a very minority group of African cultures. However, it stands to be considered African if it can be defended on the basic features of African ontology (Chimakonam, 2019).

Yet, this suggestion is invariably prone to begging the question because it is assumed that when it comes to questions about ontology, African societies are all of a sudden homogeneous. If this assumption is true, then invariably, the bane of Africanness is crystallized in African ontology. However, before any conclusion stands, the question of how to find an antidote to deal with the generalization problem lingers.

To get past the challenge, scholars simply had to break the problem down into bits. What is the problem? The problem is about the prevailing diversity of cultures and how to locate a common trait of ontological perspective. Now, if the difficulty in latching on a common trait of ontological perspective is a direct result of the prevailing cultural diversities in African societies, then it seems reasonable to take a cursory look at the African past down to the primal societies where cultural diversity is at its lowest ebb. Now, since culture is a reflection of ontological ideals as suggested by Placid Tempels, we can now use their existing culture to flesh out an ontological perspective. Once this ontological perspective would be a common trait of the indigenous African societies, it would now suffice to be binding as an enduring criterion of Africanness. So whatever subsequent thesis is defensible along such African ontological lines, or is consistent with, merits an African identity. Indeed, these are the exact steps some scholars choose and what they arrived at was first addressed as the communalist definition of Africanness.

Let us again refer to the step, but now, with the concrete details. When we go down to the primal societies, indigenous Africans of this era believed in the ontological view called the duality thesis; a dual manifestation of a single entity in terms of both matter and spirit. Indeed, because the evolution of mankind began on the continent, Africans are most probably thought to be the first to have close contact with nature. From a close study of nature, the African extract observed behaviour and analyze it into humanistic values and these values become ideal cultural traits guiding their ways of life (Sithole, 2016). Clearer evidence is provided by Innocent Asouzu in his work *Complementary Logic*. In this work, he shows how the African form a complementary view about seeming opposites, such as the ontological conception of the duality thesis. He derives this principle from the Igbo culture, and he calls it the principle of complementarity. I prefer to illustrate it from a direct quotation in *Things Fall Apart*: "Let the kite perch and let the eagle perch too. If one says no to the other, let his wing break" (Achebe, 1986, p. 14). The principle suggests that when there is any interaction between two parties (of nature), and if any action of one party hinders the interest of another party, a natural order is breached. Now, to forestall this order, the offender would use whatever measure is available to him to invite equilibrium and by so doing, the propensity of the offending party to function optimally would be opposed and rendered increasingly difficult or even impossible.

The ontological principle suggests that spirit and matter crystallize into a single entity to the extent that these seemingly different realities symbiotically function to sustain the optimal function of both. This is the sense in which they are one. If we contrast that with the Cartesian picture in the *Meditations*, the spiritual domain is one thing, and the body is another, none of them needs each other to exist, let alone to function optimally, but they occasionally do anyway; a very problematic legacy that still perplex philosophers. So, in the African worldview, all living forces including the all-powerful God are not exempted from acceding to this symbiotic relation; an impotent deity is abandoned, and new ones that prove potent are adopted (Peek & Yankah, 2004; Nwala, 1985; Wiredu, 2010b; Appiah, 1992; Mosley, 2004;

Bascom, 1991). The ancestors multiply the harvest of the living and the living replenish the stock of food on the altar of the ancestors as a way of veneration. Should one party fail to honour his role in the complementary relation, order and peaceful co-existence are threatened (Wiredu, 1998; Middleton, 1960). Humans could reignite the relationship to establish equilibrium through compensations such as sacrifices, libations, and other rituals as recommended through divination (Ijioma, 2020; Wiredu, 1987).

From the foregoing discussion, it is clear that the indigenous African way of life is an extract from nature, and consequently prioritizes the means to sustain the existential bond. It is this very lesson that would compel the ideals of communalist living. Evidently, the interaction with nature was so important because it catered for basic things like food and shelter to sustain livelihood (Kautsky, 2000). These basic material needs impose on them the duty to organize their daily activities in a way that can sustain the satisfaction of such basic needs (Rodney, 1973; Shimp, 2009). Initially, rudimentary implements such as axes, bows, and sticks served as the major forces of production because higher forms of technology were yet to surface (Stalin, 1938). As the expanse of population ensued, it became apparent that individuals could not produce enough to fend for the livelihood of the ever-expanding population. This in the Marxist analysis would have to occasion dialectical contradiction which should lead to a readjustment in the mode of production. The survival of individuals was now hinged on coming together to produce enough for subsistence (Marx & Engels, 2000). Here, the complementary thesis comes into its own. Following what the indigenous Africans considered ideal (the principle of complementarity), they needed to come together to produce more to satisfy the growing needs of all stakeholder parties. By so doing, the necessity to survive coupled with the fundamental consciousness of complementarity bequeathed upon them a mode of being that birthed communalism. As a criterion of Africanness therefore, communalism describes the mode of production embodied by primal African societies following the principle of complementarity.

There is however a growing consensus that communalism is not exclusive to the evolutionary stages in the development of African society per se, but a universal attribute of all primal societies following the decline of hunting and gathering (Inusah, 2021; Mawere and Mubaya, 2017; Howard, 2002; Imbo, 1998; Wiredu, 2010). On that note, communalism would lack the supposed warrant for invoking any unique identity for African ontology. Again, generally, African societies are, by the compulsion of societies' evolution, moving beyond the communalist mode of production. Ngugi wa Thiongo's (1991) *Homecoming*, Julius Nyerere's (1968) Arusha declaration (that typified the institution of Ujamaa) and Amilcar Cabral's (1973) invitation for Africa to return to her source are all clear indications of which Gyekye (1997b) refers to as cultural revivalism. As Bodunrin remarks, communalism was sustained by the moneyless society, lack of urbanization, and the spirit of brotherhood. Since these conditions are fast diminishing, the insistence on communalist virtues as the basis of Africaness seems to be a utopian ambition, a disquisition that appears backward-looking in modern-day Africa (Bodunrin, 1981). The belief that the recovery of the past is an exercise worthy of pursuit is called the evaluative assumption of ethnophilosophy (Appiah, 1992). Addressing the evaluative assumption, several scholars are very dismissive of the practicability of such a thesis (Ani, 2020; Dodoo, 2012; Munoz, 2007).

Scholarly opinions suggest that in reconstructing Africanness, we do not have to necessarily copy the communalist system because that ambition is a sheer impossibility. The suggestion has been that we could make core doctrines of communalism a prime target for our contemporary society (Chimakonam, 2019). A section of philosophers, those to whom Wiredu (2010) refers to as African philosopher-kings, had already thought of this inspiration. They had the vision that the only way to replicate Africanness is to model societies according to the African ideals inherent in communalism. These African ideals require purging post-colonial Africa off the relics of socio-cultural disruptions occasioned by colonialism. The narrative has it that the inception of colonialism took Africa directly from the ideal Africanness (communalism) to the capitalist mode of production (Rodney,1973). As such, Nationalist ideological philosophers believe that the best interest of exemplifying Africanness is anchored on a decolonization agenda aimed at disinfecting Africa from the scars of colonialism (Lang & Ochieng Odhiambo, 2010; Ikuenobe, 1996; Uduma, 2010). So, communalism comes into the picture once again, this time, not as an embodiment of Africanness, but as that which imitation in contemporary times gives expressive meaning to Africanness (Agada, 2015; Nkrumah, 1969).

In *African socialism revisited*, Nkrumah makes a very salient distinction that clarifies the role of communalist organization in contemporary Africa. For him, we cannot reconstruct the anthropological features of communalist life in modern terms, such as the architectural or housing conditions, the technological tools available to indigenous Africans and so forth. However, what we can capture, and indeed worthy of capturing from such societies is the spirit behind such social structures; that is, humanism and reconciliation of individual progress with group welfare (Nkrumah, 1967). Africanness, then, is an expression of objective values or principles consciously fashioned out of such egalitarian values to protect the group welfare and humanist values. This African socialist perspective is given a formal expression in what is commonly referred to as the communitarianism thesis (Gyekye, 2010). In summary, Africanness is said to be exemplified by communitarianism because the latter locates the salient semblance of the complementarity principle as exemplified by egalitarian and humanist values that typified communalist living (Uduma, 2014; Kaphagawani, 1998; Abraham, 2010; Okafor, 1997). On that note, the Africanness of science would not be the methodological procedures per se, but the spirit or motivation behind the enquiry. Invariably, African science in contrast with mainstream science is supposed to be value-laden. On the ticket of the communitarian criterion, a science would therefore be African to the extent that it is brewed from the undergirding principles of humanism; that is, if is motivated by the interest or the spirit to safeguard the collective and humanist interest as enshrined in communalist living.

Evaluating the ontological criterion of Africanness

In the search for the criterion of Africanness, the communitarian criterion still focuses our gaze somewhat backward because it is same communalist ideals of the past that motivate the design of communitarian values (Ani, 2020; Lawuyi, 2017; Uduma, 2010; Oluwole, 1989; Momoh, 2000; Serequeberhan, 2015). Yet, this sense of backwardness is not to be automatically deemed negative. The real problem seems to be this. If communitarian values are said to be African because they derive from communalist ideals, then the latter must be African in the first place to warrant this deduction. However, there is a sense in which denying this premise is defensible. As I did remark, communalism is a shared historical epoch of the evolutionary stages of all societies (Rodney 1973). How, then, can one justify the conviction that a value common to all primary societies can be appropriated in justification of Africanness? Worst of all, there are scholarly traditions that trace communalist living as an organizational setting that began not even in Africa. In this regard, reference is made to the Natufian culture of the Middle East whose primal agricultural activities expose them to the likelihood of setting up a communalist living first (Bar-Yosef, 1998; Crabtree, 1990). This objection, however, seems to thrive on one assumption, that Africaness should constitute an exclusive invention by the people to whom it concerns. So even though all societies may have experienced the communalist mode of production before, in communitarianism, Africans (through the National Independence Leaders) make a conscious effort to constitute their society in consonance with such socio-economic order. Communitarianism is therefore owned as Africa's identity as a result of the choice to consciously live by the inherited communalist values, not because the communalist values being sought are exclusive inventions. Africanness then, becomes a matter of choice, not necessarily a unique set of values invented by the Africans.

Suffice it to pass, that communitarianism succeeds as a principle of African identity. Some philosophers typical of Uduma (2014) suggest that communalist values of communitarianism may be necessary, but not a sufficient condition for Africanness. The contention has been that there are compelling dynamics in social evolution that require occasional socio-economic modifications that cannot be sorely catered for by values typical of communalism (Bodunrin, 1981; Ani, 2020). The caution, therefore, has been that it is such an unfavourable prescription to consciously keep to communalist values all in the name of Africanness when society seems to be crossing the need for some of them (Wiredu, 1980; Imbo, 1998). It seems that there should be a form of reconciliation of the past with the present. So, Nkrumah (1967, p. 5) says "The way out is only forward" because as societies interact with one another "acculturation results in a balance of forward movement, a movement in which each society assimilates certain useful attributes of the other."

The interest here seems to be the advocacy for a more dynamic intellectual approach that embraces not only the past but also features of the present as equally important in the strife to be African (Bisong', 2020; Uduma, 2014). So, the advocates of this proposal also suggest that Africa must also accept as theirs, whatever concerns the existential well-being of the Africans, including post-colonial developments in social, economic, and political conditions. In respect of this aspiration, Abraham (2010, pp. 33-34) also notes "Today, there is a greater intellectual acceptance as something applicable to Africa, too, the fact that all national cultures are now syncretist, that this is an inescapable existential condition of modern viability". A similar view is held by Gyekye (2013) who seems not to see why cultural miscegenation should be ruled out in the quest to locate Africanness. Chimakonam (2015a) however expresses worry that the seemingly unguided freedom that may allow for cultural cross-fertilization may end up granting uncritical misappropriations as African. In furtherance to the point, Chimakonam (2015c) intimates that by dint of the call for a dynamic conceptualization of Africanness, a danger ensues if there are no distancing measures to keep the rate of cultural integration in check. Consequently, all cultures supposedly foreign, he says, may end up being characterized as African (Chimakonam, 2015c).

The ongoing challenge should remind us of the famous thought experiment on personal identity called the Ship of Theseus. Supposing parts of a worn-out ship are gradually replaced. Is there any point in the continuous replacement wherein the old ship is no more and rather gives way to a new ship (Scaltsas, 1880)? It may get to a time where the last part of the ship would have to be replaced probably after decades. If that is achieved, can we still maintain that the ship is the old ship and not a new one? The fear seems to be that if we should allow for a very fluid conception of Africanness, there is a danger the whole being of the African could be one day characterized by values supposedly alien to typical indigenous African culture. From education, politics, agricultural techniques, population increase, etc, it seems quite obvious that overwhelming social complexities would make it increasingly difficult to stick to fixated values designated as African (Nkrumah, 1967). Given the fact that societies hardly evolve in isolation and are bound to engage in cultural assimilations following the intensification of globalization, the reality of pure cultural tradition seems simply overrated (Gyekye, 1997b). A cross-section of scholarly opinions began a revolution which attempted to facelift the ontological criterion. They see the ontological criterion as at best insufficient and it is important to introduce their concerns in the discussion in the quest to make some progress.

Post-Modernist conditioning of Africanness

Generally, the postmodernists' orientation to theorizing Africanness begins with the advocacy for systemic cross-cultural synthesis (Owolabi, 2001). A very resourceful point of reference in accounting for the post-modernist responses is Kwame Gyekye in his work *Philosophy, Culture, and Vision: African Perspectives* and Kwesi Wiredu in his work *Problems in Africa's Self-Definition in the Contemporary World*. The crux of the argument begins by establishing a clear dichotomy in terms of what might be called cultural essentials and cultural non-essentials. Wiredu particularly explains that cultural non-essentials constitute values of identity that cannot be strictly judged in terms of truth values. Most importantly, such ways of life do not have any direct relation to human well-being. Thus, altering such cultural values "in preference to foreign substitutes" Wiredu (2010, p. 64) insists "is a sure sign of the loss or diminution of cultural self-identity". Wiredu (*ibid*) cites examples such as music, dance, and language among others. The type of language used by any cultural setting cannot be said to be truer than other languages, neither is the language used by a group of people a determining factor of their well-being. However, questions about which method of farming better ensures plentiful harvest is not defensible along cultural lines because (i) the output of such lifestyle methods can be quantified and compared with approaches used in other cultures, and (ii) such ways of life clearly concern the survival and well-being of the people. To these examples, Gyekye (2013) adds elements that affect basic needs for self-fulfillment such as human values, human rights policies and practices, technology, and free-market systems as cultural factors open to alterations by the phenomenon of globalization.

The point that seems to be attracting disciples is that it should not be made to appear shameful at all to borrow elements of identity that belong to other cultures (Asouzu, 2007; Bisong, 2020). Rather, sticking to a non-productive way of life (cultural essential) at the expense of better external alternatives all in the name of Africanness is shamefully disingenuous. Thus, culture can assimilate as part of the existing tradition and alien methods of farming that did not originate with them, and this knowledge synthesis should not be considered as having occasioned any identity crisis for indigenous subscribers. Once a tradition is accepted as a workable and useful part of an existing tradition because it makes do with important challenges associated with a people, those to whom such knowledge system concerns could claim it as part of their identity. In light of this conviction, we can now appreciate the rationale of Wiredu's (1991, p. 106) position on the basis according to which a knowledge system could warrant a particular identity:

> *For a body of thought to be legitimately associated with a given race, people, region, or nation, it is sufficient that it should be, or should become a living tradition therein. It is indifferent whether it is home-brewed or borrowed wholly or partially from other peoples.*

Peter Amato (1997) seems to share same sentiment with Wiredu as the former claims that ideologies across geographies do have unique contents, but those features that represent such uniqueness are amenable to and are worthy of cross-cultural influences, provided there are experts to foster such synthesis in the interest of whichever party the knowledge concerns.

Obviously, Wiredu's conditioning of identity seems to rip off the need for protecting unique branding of intellectual culture like African science, largely because science is obviously cultural-essential. This attempt at unique branding of knowledge system, Wiredu (2010) calls the fallacy of uniqueness. In the quest to achieve what similarly, Peter Amato (1997, p. 88) calls the "myth of uniqueness", a comparative analogy has been drawn by citing as an absurdity, a situation where a specific culture is asked to evolve anything like a unique physics. If we cannot restrain physics to a cultural milieu, then the postmodernist stance is urging us to focus on cross-cultural synthesis (Wiredu, 1980; Mawere & Mubaya, 2016). In sum, the central motivation for proponents of cross-cultural criteria is a commitment to relevance rather than uniqueness. So, to render a knowledge system as a living tradition for a given race, Wiredu (1991, p. 105) charges African philosophers to "achieve a synthesis of the philosophical insights of their (Africans) ancestors with whatever they can extract of philosophical worth from the intellectual resources of the modern world". In furtherance of the same opinion, Gyekye (1997b, p. 226) maintains that "A once alien idea or value that has been accepted by a different tradition as its own will in time mesh with the endogenous elements of that cultural tradition". Marxism then, renders itself as Russian to the extent that the corpus has become a useful integral part of Russian political tradition. Likewise, in Bisong's (2020) analogy, adding seawater to the river does not change the identity of the sea, same way cross-fertilizing cultural essentials does not alter the identity of the corpus.

Clearly then, post-modernist African philosophers are asking theorists not to be fixated on uniqueness but to shift their focus rather to what important ideologies, regardless of origin, could achieve for our societies if accepted as part of our identity. In all fairness, relevance is an important component of knowledge in general, and, in my view, should supersede all efforts at the unique formulation of ideologies. So, the fact that Wiredu's focus took into consideration this virtue in devising a criterion of Africanness is very much commendable.

However, for two main reasons, I submit that the post-modernist criterion is only necessary and requires some sufficient clauses to make it better. Wiredu (1991) thinks that African philosophy is about synthesis; cross-fertilization of modern knowledge systems with indigenous insights of indigenous Africans. Clearly, Wiredu does not answer the question of Africanness, he merely shifts the goalpost. For Wiredu (1991) and Gyekye (1997) seem to suggest that the mere fact that some group of persons lives with a certain ideology as tradition presupposes takeover and that the better way of asserting and appreciating ownership of a thesis is for knowledge systems to achieve synthesis with cultural-essential values from other cultures where necessary. Nonetheless, the question that has engaged the attention of scholars is about legitimacy; it is about the very systematic, non-arbitrary basis in virtue of which such a knowledge system is owned by any group of related persons in the first place. If we look at the question this way and seek direct answers, it seems the postmodernist concern, despite its insightful contribution, is surreptitiously evasive. It is necessary, at least for the purposes of progress, to keep a healthy dose of cross-fertilizing ideologies. Yet, when all is said and done, how does the cross-fertilized corpus become somebody's in particular? The best possible answer the post-modernist would give is that the resulting synthesis is African because it is put to use in resolving a problem related to Africa. Counterintuitively, however, the depth of this seeming nonsense is overwhelming. By common sense, using something to solve your problem obviously does not make it yours. Much more seems to be required to warrant any such appropriation.

The straightforward consequence of Wiredu's position runs us into a kind of Humean consideration where there seems to be no legitimate ownership of Africanness. For if the conditioning of Marxism as part of the Russian tradition renders Marxism Russian, then Marxism has as many identities as the related societies that make use of it (Wiredu, 1991). Perhaps, we could go back to Bisong's (2020) analogy. A mixture of lake and river is identifiable with a river. Yet, per the force of the same logic, why not regard the same mixture as a lake instead? By extension, the same syncretic strategy of cross-fertilization seems to set up a recipe for an identification crisis because, in virtue of cross-fertilizing intellectual resources, the resultant knowledge system is open to as many identifications as the origin of related intellectual resources.

It is better, therefore, not to take anything in the postmodernist effort as offering a direct answer to the request for a basis according to which a knowledge system takes up a certain identity. In substance therefore we can say that for the post-modernist, there is no exclusive right to Africanness. To be sure, Wiredu is just not enthused about leaving a mark that connotes specifically an African orientation of knowledge systems. And indeed, he comes very clear on that. So, what Wiredu (2010) particularly commits his subsequent effort in the entire concluding remarks is to trivialize the question of African uniqueness. Pursuant to this agenda, he argues that authenticity in identity need not imply any uniqueness. So, the postmodernist criterion indicates that the property of Africanness is a choice, not an exclusive invention. It is not important, Wiredu (*ibid*) suggests, to inquire whether a piece of knowledge is peculiarly African. Nonetheless, when the post-modernist sentiment goes this way, their view only lends itself back to the grip of Bernascomi's dilemma. If the "African" qualification as presented in African science is supposed to exact no peculiar features, then it is expected of us to rid such qualification off and to keep the rendition of "African science" simply as science. My discomfort is this very consequence. For when we approach African science this way, then we are not necessarily addressing concerns that intend to complement her supposed weakness, we are instead opposing her legitimacy and recognition by advocating for a rather unmeritorious synthesis. In the wake of a conversation with the features of mainstream science, African science should have no such obligation to lose itself, particularly if there are alternative ways to complement its weakness without violating the means to its identity. This is the gap exploited by the conversationalist thesis.

Mainstreaming African science: The conversationalist approach

Suffice it to say that my sympathy lies with the cross-cultural criterion as proposed by postmodernist thinkers. However, the very timing of this call makes it a challenge and African philosophers must feel hesitant to ignore it. To be sure, African conversational science is meant to be a thesis achieved on cross-cultural knowledge synthesis. Nonetheless, other traditions of knowledge systems, particularly Western philosophy, have enjoyed a vibrant existence for over two thousand years, a situation that has inured to the benefit of nurturing numerous concepts (Agada, 2015). So, if African philosophizing is approached by solely synthesizing her relatively meagre traditions with other intellectual cultures, then we are only restricted to turning what we already have into mainstream ideologies. The sole focus on mainstreaming knowledge systems would impede the liberty to nurture peculiar themes in the name of Africaness. Why should this supposed impediment be regarded as a problem in the first place? If one observes, Wiredu's (1991, p.105) task for modern African philosophers in terms of focusing on critical synthesis could only be realized if there were in his own words "philosophical insights of their (Africans) ancestors" in the first place. Accordingly, even in mainstreaming knowledge systems through ideological synthesis, the quest to nurture such philosophical insight of ancestors must come first, because they have salient roles to play as primary worldviews pending analysis and synthesis (Ramose, 2003; Teffo & Roux, 2005). So, the first intervention of conversationalism is the following. Even though conversationalism is not against the goodwill of promoting ideological synthesis, it also encourages the effort that aims at nurturing themes that may be peculiarly African (Chimakonam, 2018).

The second issue concerns the nature of complementarity (between supposedly African themes and intellectual resources of other cultures) that could warrant an African identity. Knowledge itself is something that evolves through a dialectical process. First, mainstreaming an ideology requires that the concerned themes are about concepts that cut across societies or cultures (Wiredu, 1998). So, when mainstream science makes claims about, for instance, a man, it is not the Chinese or the African man. It is about humanity in general. This conviction about man did not, however, begin as a universal concept. It came from perplexing experiences related to a certain cultural space and time. So, concept formation invariably has close tie connections to cultural settings; it is particularism in foundation (Ramose, 2003; Gyekye, 2004; Agada, 2013). From a cultural setting or the particularist footing, knowledge could further be engaged at the level where it seeks approval across cultures to be accepted as a general concept, and success here is based on how well the concept can sit with argumentation. At this dialectical stage, knowledge is considered to occupy the domain of mainstream philosophy (Rickles, 2020; Owolabi, 2010). Concepts here are accessible through the application of logical principle and the rigour of argumentation, and to establish their consistency thereof with the theoretical orientations of other cultures. From the status as (mainstream) philosophical corpus, some of these knowledge systems have the potential to be formally tested against empirical observation. This is the domain of mainstream science. Mainstream science gives that opportunity for empirical testing for the purposes of confirming or falsifying beliefs that have graduated their walk through the initial dialectic protocol systems of belief formation (Unah, 1998; Horsthemke, 2017; Hodgson, 2005).

It seems to me, however, that the opportunity for an African worldview to be tested by the methodological protocols of mainstream science does not undercut the former's cultural ties. It rather seems to reinforce it. Take the role of observation in scientific theorizing for instance. Scholars have argued that the phenomenon of observation is fraught with interferences of the subjective state of the observer. Immanuel Kant had already advanced a foundation of the philosophical rationale for this view in the *Critique of Pure Reason*. Kant divides the processes of cognition into two; sensibilities and a priori intuitions. The former consists of receptacles related to the sensual faculties, the avenues through which the mind accesses the supposed external world. The former represents an active faculty. This faculty organizes data received by thinking about them under concepts. One without the other is blind, the complementary effort of the two yields what he calls understanding (Kant, 1998). What Kant achieved, for the purpose of this discussion here, is the active role played by the mind, as it solicits aid from conceptual schemes to make sense of the observable world. Kant's effort related these conceptual themes to abstract realities like space and time.

Further empirical studies have advanced Kant's concerns and the consequences are interesting. It seems that not only does the mind solicit help from mere abstractions, but it also taps into concrete experiences that have deep ties with our cultural settings; observation is theory-laden. Both Thomas Kuhn in *The Structures of Scientific Revolutions* and Norwood R. Hanson in *Patterns of Discovery* have tabled a cogent motion for the consideration of this phenomenon. In an argument that seems obviously motivated by Hanson, A. F. Chalmers in his work *What is this thing called Science*?, the latter compares the observational functioning of human observers with that of an ordinary camera. However, unlike a disinterested or rather neutral camera, the brain uses background experiences as conceptual schemes to conceptualize the information of a diffracted light from an object for an observer's appreciation. This position has been addressed as the famous optical-illusory argument, with one of the famous examples drawn from the rabbit-duck pictograph. The core of Hanson-Chalmers' position is that the brain, however, does not perform interpretations in a vacuum. It seems that people who have once experienced a duck but lack experiences like the rabbit are constrained to interpret the duck-rabbit pictograph as a clear case of a duck. Several other pictographs have been used to champion the confirmation of optical illusions which indicate that the phenomenon is very real. Since the optical illusory image being observed does not change, the obvious conclusion is that it is the interpretational schemes that determine the meaning of what is being observed (Bauer, 1994).

As Chalmers indicates, the results of experiments involving people whose culture excludes customs of certain experiences would have a limited sense of interpretational schemes. The argument suggests that the experience we gather from our way of life predisposes us to appreciate our visual experiences in certain ways. Accordingly, in an experiment, the investigator is always testing a visual experience appreciated from the perspective of his cultural predispositions. He may be performing a test with visual experiences we have no imaginative clue of. The greater challenge is that there are no clearly objectified means of comparing the states of our intersubjective experiences. Called the argument from inverted spectrum or the-beetle-in-Wittgenstein's-box, we are confronted with a condition where we could be using the same naming systems in reference to completely different observational experiences and we may not even notice these quale differences through behavior (Wittgenstein, 1972; Feyerabend, 1993; Osei, 2006;

Hossack, 2007). So, the situation makes it possible for a group of the scientific community to use the same naming systems in reference to possibly different sensory precepts because the interpretational schemes of the scientists could be exemplifying different cultural experiences. So, mainstream science, as D. A. Masolo, (2003) indicates, does not necessarily nullify local connections in terms of cultural practices and belief systems. Conversationalist African science only goes a step further to suggest that this local connection is to be formalized as the ontological basis to constitute an identity criterion for Africanizing scientific theorizing.

Conclusion

As we noted, we may classify (mainstream) science as knowledge whose application cuts across borders. Nonetheless, it is worthy of note that this supposed universality does not necessarily extend to its philosophical underpinnings; the founding principles of the systems of science. Because it is not open to science to find justifications for using those principles, science is never complete as a system of enquiry. Only when mainstream science could justify those principles would philosophy prove futile (Omnes, 1999). This gap which mainstream science cannot fill all by itself, conversationalism suggests, is the avenue that offers the opportunity for Africanizing the discipline. Since the underpinnings of theoretical systems of mainstream science have been shown to derive from specific cultures, conversational African science satisfies the particularist demand by engaging the underpinnings of mainstream science as a consequence of the African ontological worldview. On the ticket of conversational philosophy, science is considered African because it is underpinned by ontological assumptions typical of the African worldview.

CHAPTER FOUR

MAINSTREAM SCIENCE AND THE AFRICAN WORLDVIEW; TOWARDS A CROSS-CULTURAL SYNTHESIS

Introduction

In chapter three, the conclusion is such that science is African-oriented if it is supported by the ontological underpinning that reflects the African worldview. This criterion for conceptualizing the "Africanness" of science invariably opens another challenge. Indeed, this challenge has for long been referenced as the nuance that hinders the prospects of streamlining the methodology of African science in terms of a discipline whose relevance cuts across different cultures. To explain further, a dominant tradition construes the ontology of African science as whose essence is given by (personal) entities typical of spiritual agencies (Brown, 2004; Westerlund, 2006; Peek & Yankah, 2004; Appiah, 2003; Dukor, 1989; Appiah, 1992; Nimoh, 2014; Appiah, 2005). To illustrate the position, Placid Tempels suggests that if you show an African the physical cause of a phenomenon, you have not resolved his actual curiosity. You have only shown the physical matters emanating from the cause. So, "The true and underlying cause, the metaphysical cause would nonetheless remain for them in terms of their thought, their traditional ontological wisdom" (Tempels, 1959, p. 30). In a related account, an Akan spiritualist generalizes the art of medical practitioners saying: In this process (of delivering medical help) "we the akɔmfoɔ [traditional priest] will pass the matter through our elders, the abosom [gods], by way of consultation to help me to cure the disease" (Konadu, 2007, p. 70). In summary, a medical practitioner in mainstream science is trained to focus his art on repairing a physical system that malfunctions in a patient. The African scientist also exercises medical intervention by dealing with physical deficiencies, but in doing so he/ she also extends his arts towards the appeasement of spiritual entities. This dualized approach of dealing with healthcare delivery is often called wholistic therapy because it embodies both physical and spiritual (Emeagwali, 2016).

One might say, as Wiredu's (1980) critique of Horton (1967) suggests, the significant difference between mainstream science and African worldview is like comparing a typical religious thought system with science. In terms of ontology, the former emphasizes the centrality of personal forces, and the latter considers material forces. In the foreword of Krauss' notable work *A Universe from Nothing*, Richard Dawkins notes "Theologians may speculate about angels on pinheads or whatever is the current equivalent. Physicists might seem to have their own angels and their own pinheads: quanta and quarks" (Krauss, 2012, p. 185). Ostensibly, the gods, ancestors and other supposed spiritual entities are to African science as electrons, quacks, neutrons, etc. are to physics or as viruses, bacteria and germs are to biology (Gyekye, 1997b; Asouzu, 1998; Alem, 2019; Etim, 2013; Carnap, 1966; Mosley, 2004; Akpan, 2010; Wiredu, 1980; Horton, 1967; Bascom, 1991; Evans-Pritchard, 1976). Consequently, a formal relationship is often exploited as a response to clarify the difference in respect of African and mainstream science. Godwin Sogolo (2005) for instance refers to the difference as the primary versus the secondary causes. Segun Gbadegesin (1991, p. 116) labels the same difference as "explanations of level I" and "supernature explanations of level II" respectively. The central idea presupposed by the distinction is that the specific nature of African science is designed to extend the application of science into dealing with aspects of reality before which the methodological protocols of mainstream science lack the required tools to deal with (Teffo & Roux, 2005; Mbiti, 1970; Mawere & Mubaya, 2017; Brown, 2004; Selin, 2003; Bodunrin, 1981; Gyekye, 2009; Appiah, 1992).

It appears that the role assigned to African science (as dealing with matters mainstream science lacks jurisdiction over) should clarify its place and role and should therefore put to rest doubts about the legitimacy of the discipline. Interestingly, it rather introduced what may be called a kind of Hume's fork (between African science and mainstream science). In other words, this way of approaching the relation between both worldviews grounded a demarcation that appears as if both knowledge systems are inconsistent, and hence irreconcilable with one another. Typical of this friction, it is as if science cannot prove the nature of beliefs to which for instance the Akan is concerned (Majeed, 2017). Following this sort of conflicting perspective, Moore and Sanders (2004) suggest, African science called for answers of different nature compared to the narrow ones mainstream science offers. So Gyekye (1997b) for instance indicates that on the one hand, the study of the natural world should be an exercise meant for mainstream science, and the African worldview, on the other hand, should be committed to theology. Sometimes, even the tone of comparison implies discrimination against the African worldview. Observe one example:

> *The metaphysical worldview of Africa is an alloy of mythology, supernaturalism, religiously and theocentricism of the pre-critical (or prescientific) ages… anti-science worldview; it breeds and cultivates uncritical, unquestioning, irrational, adventuring, fetish and other attendant cultural traits that hinder the development and application of scientific knowledge (Inokoba, Adebowale & Perepreghabofa, 2010, p. 28).*

From the quotation, the only way to make sense of why the acceptance of one (mainstream science) should frustrate the application of the other (African science) is to regard each as championing a course irreconcilable with the other. It is also interesting to add Rudolf Carnap (1966) who claimed that explanations that put agents behind the occurrence of a natural phenomenon are not just pre-scientific, but it is also altogether a means of relieving emotional stress. In other words, the implication of such a view put in place a kind of false dilemma in which African science and mainstream science are pitched against one another. It is as if the two disciplines are two horns of parallel worldviews competing with one another to make an impression. In this supposed competition, African science is condemned as struggling from miles behind to catch up with mainstream science (Akpan, 2010). There are mild insinuations that imply same conviction of conflicting motifs between the two worldviews. Ashforth, for instance, concludes that witchcraft force is simply fearful speculations about extra physical forces as a result of the risk poverty and material insecurity expose people to. So, he thinks if everyone is safe and financially secure, the idea of entertaining witchcraft force would become a personal psychological related problem rather than a challenge that faces society at large (Ashforth, 2004). Based on the context of these criticisms (brought against African science), I am suggesting an alternative approach for rethinking the worth of the discipline in ways that challenge the status quo. Between the two worldviews, there is no contradiction but synergy, there is no backwardness but diversity.

I must indicate that the two worldviews (mainstream science and African science) do not need to be consistent with one another to make sense to their respective subscribers. However, the preliminary discovery that drives my motivation here is that the kind of service mainstream science renders in support of

African science is by far appreciated when academic considerations begin to take a closer look at both worldviews in terms of their consistency. So, I am in to foster a rethinking of the African worldview towards this agenda. The exercise is not, therefore, in any way forcing a unity between both worldviews, for they are already united by a sense of commensalism. Rather, the chapter discourages efforts that persistently force the path of both disciplines into opposing each other. So, I am driving an exploration to put across what I see to be an essential relationship that restores the worth of African science. Indeed, this exercise ties in with Anthony Appiah's (1992) suggestion that there are ways to cross-fertilize such knowledge systems if scholars bother to explore more pieces of evidence. Therefore, by advancing a harmonious relationship, the chapter is intended to challenge a trend of academic views that perpetrates an unfounded competition between both disciplines. I intend to stimulate a conversation that leads to our appreciation of how particularly, developments in mainstream science advance the understanding of its supposed opposing worldview, African science. The argument is supposed to substantiate Moore and Sander's (2004, p. 1) conviction that "…science and [African] spiritualism – far from being simple opposites – were conjoined investigators". In doing so, I am compelled to explore evidence from comparing the nature of ontology presupposed by the domain of both knowledge systems.

Why should the effort to show the harmony between the two disciplines be premised on analysis that concerns ontology? Generally, the mandate of science is to explain phenomenal experiences in terms of how fundamental realities are actually organized (Godfrey-Smith, 2019). This is why Duhem (1991) concludes that physical science is precisely subordinated to metaphysics because it lies in the mandate of the latter to theorize the essential nature of reality. Yet, as a method of enquiry, mainstream science is selective when it comes to the ontology it investigates. So, if a scientist aims to get his/her explanations of any aspect of the universe right, he/she must first be mindful of the ontological underpinning of the phenomenon under study (Mumford, 2008). That is, the success of the scientific method derives from how adapted it is to the fundamental properties of the world it intends to cognize. For if the method of science has no deep connection with the way reality is organized, then science would just be a fanciful puzzle whose successes Putnam (1975) explains, would be a result of tremendous coincidental miracles. Thus, to trigger a cross-fertilization of both worldviews, it is important to first explore the degree of consistency between the ontological presupposition of both worldviews. All along this exploration, my central point has been that there is no disagreement between the worldview presupposed by science and African ontology. Therefore, instead of looking at both worldviews as exemplifying a contradiction, a conversationalist rethinking suggests both disciplines as consistent efforts from diverse cultures aimed at expanding our understanding of the universe in particular and the borders of scientific theorizing in general.

I shall begin by first analysing the nature of the worldview admissible under the framework of mainstream science. Following the concerns for building a harmonious co-existence, I shall use a concept typical of theoretical reductionism to show how the theory of the African worldview sits well with the advances made in science so far. In triggering this cross-fertilization process, I shall engage a sample of the worldview that represents the background of African science, the ontology of witchcraft force and ancestorhood. Subsequently, I shall solicit proof from developments in quantum theory to further the course of demonstrating the concordance therein.

The Worldview Presupposed by Mainstream Science

A popular philosophical tenet called methodological naturalism (henceforth referred to as MN) insists that the appropriate framework for cognizing reality should be continuous with the methodological features that characterize mainstream science. A radical version of the thesis presupposes a metaphysical implication that prohibits science from employing non-physical entities in rendering explanations (Smith, 2019; Krauss, 2012; Ruse, 2001; Plantinga, 2011; Mahner, 2007; Brown & Ladyman, 2019; Feigl, 1953; Morvillo, 2010; McMullin, 2001). This view (by which naturalism coincides with reductive physicalism) has come to be called ontological or metaphysical naturalism (Rea, 2007; Gasser & Stefan, 2007). However, to maintain a distinction I will point out later, I prefer to call it "radical methodological naturalism" (henceforth referred to as RMN). As a methodological principle, RMN enjoys a status as an orthodoxy and it gathers support as the official doctrine from the most prestigious scientific community in the United States of America, the National Academy of Science (Johnson, 2001; Stenger, 2009; Gasser & Stefan, 2007).

Ideally, RMN imposes sanctions on mainstream science such that the universe is understood through a reductionist (metaphysical) thesis called physicalism (Feigl, 1953; Melnyk, 1994; Rae, 2004; Brandl, 2007). Reductionism is primarily a theoretical orientation for cognizing something by translating those facts about the phenomenon, theory or ontology into an approximate description of another phenomenon, theory or ontology (Garfinkel, 1991; Searle, 2004). So, a reductionist thesis works by eliminating supposed differences in two phenomena by gathering evidence to show that an observable difference has an inextricable link with the characteristics of another fundamental phenomenon, and therefore the former should be accounted for in terms of the properties that define the latter (Aggazi, 1990). According to the core tenet of physicalism, reality is constituted as typical physical properties (Ells, 2011).

There are variant conceptions of the "physical" (Markosian, 2000). However, the dominant reductionist view is what may be referred to as the "physics-theory account of the physical". According to this (reductionist) view, an object is physical if its properties are made up of the sort of things that feature in physics (Inwagen, 2009; Demircioglu, 2011; Klinge, 2020; Osei, 2006; Papineau, 2013; Birsch, 2002; Levin, 2004; Hodgson, 2005; Niiniluoto, 2002). However, there has been the need to make precise this definition for two main reasons. Firstly, there is a potential circularity problem because it seems one is required to know what physics is about before understanding what the "physical" entails. Yet, physics is also conventionally defined in terms of the same (physical) entities. Secondly, as Penrose (2004) indicates, some scholars are of the view that numbers have no independent existence, but are simply imaginative ideas found to be trustworthy in theories about the universe. On the physics-theory account of the physical, the ontological status of numbers generates the Platonist controversy of whether to regard supposed abstract numbers also as physical since they feature in physics. Therefore, a precising definition, I suppose, comes from one popular concession that within the framework of physics, a given entity is of a physical essence if it is a potential occupant of space (Markorsian, 2000; Carnap, 1966; Appiah, 2003; Strawson, 2008; Engmann, 2010).

Even so, from the Cartesian categorization of substances, matter is also endowed with spatial properties. So, there are often times when "physical" and "material" are found in use interchangeably (Inwagen, 2009; Meixner, 2005;

Armstrong, 1968; Dennett, 1991; Crane, 2003). Technically, the two are not the same and analysis of the sort the chapter pursues should therefore try to clarify the boundaries. Materialism is not necessarily a monist thesis. Otherwise, when materialism defines reality in terms of the ability to occupy space, it supposedly dismisses the reality of entrenched beliefs about things like anxiety, love, and hatred. These appear to be things one cannot pin down to any specific space. Rene Descartes tried to pin such mental properties down to the pineal gland, but the numerous criticisms climaxing in the mind-body problem is just an indication that his effort is simply unconvincing. So, in its effort to ensure that a philosophical theory does not run into conflict with common-sensical beliefs, materialist takes steps to advance a thesis that is compatible with a less radical version of dualism; particularly property dualism. As such, materialism is a broader ontological scope that accommodates entities that do not typically occupy space, provided that they are ontologically dependent on objects that exist in space and time. So, a materialist would ordinarily admit that desires and affections are real if the existence of these phenomena is tied to an entity (matter) that primarily occupies space (Papineau, 2013; Osei, 2006; Priest, 1991; Markosian, 2000). In other words, the materialist thesis is tolerant of incorporeal entities, but not their autonomy (Brown & Ladyman, 2019). In so far as materialism brought common sense in sync with our deeply ingrained convictions about the reality of our subjective consciousness, it reinvented same challenge facing typical substance-dualist position. If one grants that mental states are material to the extent that their existence is dependent on material entities, then one must go ahead to demystify the nature of the dependency relation. How is it possible for properties that are not space-time bound to, so to speak, depend on properties associated with space-time (material) substances?

Physicalism walks into the discussion as a thesis aimed at dissolving this problem materialism runs into. To achieve this, physicalism limits the domain of reality to entities in physics and these entities are strictly properties that have a direct effect on space-time. This dynamic concept also presupposes that reality extends to things which lack the kind of solidity associated with typical material entities. A typical example is an electric field; a space in which waves of oscillating charges can induce phenomenal properties like light. This "empty space" lacks solidity but it is considered as real as the stone because it can exert influence on objects within its bounds (Genz, 1999; Osei, 2006; Wallace, 2012; Kaku, 2008). Einstein's notion of space (which can twist, stretch, undulate, curve, be flattened or even be closed) and all manner of waves will count as physical even though there is no solidity to them (Brown & Ladyman, 2019; Krauss, 2012; Dawkins, 2012). A fundamental property of a physical entity is that it sustains contact through a mechanical flow of energy that circulates among only entities of the same (physical) essence (Conforth, 1978). As Fernando Sanford (1899, p. 20) says: "for if a single atom in the universe can be moved by any force whatever, either mental, moral, or spiritual, except by the transference of energy from some other atom, then is it not physical universe".

Given the physicalist framework then, reality is organized as forces and energy whose fundamental mode of being is motion through space (Zukav, 1979; Walker, Halliday & Resnick, 2014; Blin-Stoyle, 1997). Motion in micro-level ontology is where all the actions which explain the character of macro-ontology take place. These fundamentals, then, constitute the cumulative set of the physical and they include postulates like hadrons, quacks, mesons, leptons, electrons, positrons, neutrinos, antimatter, black holes, dark matter, field forces, and energy among others (Pennock, 2001; Dennett, 1991). This means that because everything is supposedly a combination of the elements of this set in motion, physics which is the theoretical framework that studies these entities, also merits its place as a fundamental discipline underpinning the higher sciences (Klinge, 2020; Maudlin, 2019; Trout, 1991; Heil, 2004a; Melnyk, 1994; Rae, 2004; Reynolds, 2002).

Physicalists construct the complex dimension of the universe according to what is called upward causation. By this proposal, everything consists of the interactions of and could accordingly be explained by reference to micro-physical entities and the fundamental laws of physics. By virtue of these interactions, subatomic particles combine to form an atom, atoms combine to form molecules, molecules combine to constitute cells (including neurons of the brain), and the operations of the brain elicit consciousness (Gasser & Stefan, 2007; Goswami, 2009). From the physicalist point of view, the universe is a product of an initial cosmic expansion that had been occasioned by an explosion from a dense primeval atom precisely at an age of 13.72 billion years ago. From the explosion emerged clouds of dust and light gases. Some stars created from dispersed gasses began to acquire colonies of galaxies. From the galaxies, gasses further combine, and in their cooled state, the earth emerges. Life itself supposedly came from the fusion of proportional gases retrieved from a stellar explosion as helium combined with other gases to form carbon and other heavy elements. Organic compounds were formed out of the complex configuration of carbon atoms and in Darwin's "little pond" life emerged through a further combination of complex compounds (Feynman, 2011; Colson, Hallinan & John, 2014; Trotsky, 2002; Cornforth, 1978). In light of this development, the physicalist thesis seems unquestionable; every aspect of the universe seems explicable from the ontological view which says that things are constituted of atoms acting per the laws of physics.

Galileo Galilee is reported to have once said “count what is countable, measure what is measurable, and what is not measurable, make it measurable” (Colson, Hallinan & John, 2004, p. 43). This presupposes that science is quantitative in orientation. That is, science deals with entities whose properties can be expressed in basic quantities like length, mass, and time and this is why mathematics is an essential component of the discipline (Blin-Stoyle, 1997; Dougherty, 2016; Feibleman, 1972; Walker, Halliday & Resnick, 2014). On the contrary, the mind is one and complete. How many measures can one put on the feeling of headache or the quest to drink apple juice, and by how much can I divide the measure of this quest to suppress my desperation for it (Descartes, 2008)? If physical ontology is true- that everything is literally about the motion of subatomic particles- then the physicalist thesis had to deal with the telling hard problem of how to capture in her framework the phenomenal properties of experience (Chalmers, 2004; Osei, 2006; Fodor, 2004; Forrest, 2004). If these phenomena cannot be explained by entities that exemplify qualities rather than quantities, physicalism would at best be incomplete. At worst, it would be palpably false.

The physicalist adopts a host of theoretical orientations to deal with the critique typified by the phenomenal properties of experiences. These approaches are exemplified in theories such as Behaviourism, Central-state Materialism, Token physicalism and Materialist Functionalism among others (Faye, 2019; Priest, 1991; Meixner, 2005; Stapp, 2009). The physicalist claims dominion over all these theories because such theories have ultimate reference to theoretical terms ultimately reducible to, and explicable in terms of physicalist ontological postulates like waves, and atoms in motion (Priest, 1991). So, concerning say economics, the consumer’s frame of mind is considered a function of behavioural psychology. Psychology would also be reducible to the laws governing neurobiology, neurobiology reduces to chemistry and chemistry ultimately reduces to microphysics (Heil, 2004b; Rosenberg & McIntyre; 2020; Feynman, 2011; Spence, 1953; Armstrong, 1968; Fodor, 2004; Putnam, 2004; Watson, 1913).

The pressing issue for physicalism in particular and the sciences in general relates to the hard problem of consciousness and it is a hard one for a good reason. The problem expects theorists to capture in objective terms, something which is by its nature a subjective property. So, perhaps, the most attractive feature of consciousness from philosophy's point of view is the former's promise to elude capture in scientific terms, perhaps, forever (Dennett, 1991) Generally, consciousness is regarded as the awareness of an experience. It consists of our awareness of the supposed external world through sensations, awareness of our internal state (without excitations from without), and awareness of affectations or emotions (Dennett, 1991). Consciousness entails at least three main features; (i) it is about something (intentionality) (ii) it is subjective and (iii) it is qualitative (Heil, 2004a). Consciousness entails a host of mysteries. Psychology and neuroscience have had a fair grasp of some of these problems, for instance, the distinction between dream state and awakened state, controlling awareness over behaviour, focus of attention, etc (Chalmers, 2004). However, the seeming unsurmountable challenge for physicalism relates to the very feature of the conscious state; the phenomenal properties of subjective experiences (Chalmers, 2004; Heil, 2004a).

Consciousness creates a problem for physicalism because the latter cannot deal with ontologies that do not lend their supposed qualities to analysis purely in quantitative terms. Since, from the physicalist point of view, everything consists of properties of physical (measurable) quantities in motion, how does the collection of sentient neurons generate a qualitative feel as experienced from the first person's point of view (Faye, 2019; Osei, 2006; Chalmers, 2004; Fodor, 2004; Forrest, 2004)? The challenge features in a lot of works, particularly in Thomas Nagel's *What is it like to be a bat?* and Frank Jackson's famous "Mary's room argument" as found in his *Epiphenomenal qualia.*

For Searle (2004), the reductionist thesis can work for concepts such as heat because the interest in the said phenomenon is simply about unearthing the ontological structure "beneath" the phenomenon but mental terms like pain drive our interest deeper into the phenomenal experiences that follow, for instance, heat burns. Several responses have sort to redeem the physicalist thesis. Using the Kantian kind of distinction between the noumena and the phenomena, Peter Forrest (2004) thinks that the qualitative essence of experience is a thing in itself whilst the physiological properties of the brain are the appearances thereof. Yet, this concession, Hirst (2004) insists, should not be a shortfall of physicalist attempts to capture consciousness because the supposed difference in the "noumenal" properties and the "phenomenal" properties is only a matter of differences in the modes of access. U. T. Place adopts a similar line of reasoning in response to the hard problem of consciousness. As he says, the physical facts and the subjective experience of consciousness simply constitute different modes of cognizing the same reality. Therefore, the expectation that knowledge of physical facts should be of the same qualitative essence as subjective experiences is tantamount to what he calls the phenomenological fallacy (Place, 1956; Hossack, 2007).

The physicalist sought to demonstrate that reality is just physical facts about piles of atoms operating according to the laws of physics. Ironically, the supposed defence given by the "mode of access response" summarizes an undercurrent concession that intrinsic phenomenal properties of experience resist capture in typical physical properties. Given Hempel's Dilemma, therefore, physicalism has proven to be false. Yet, it can only admit revisions if it is rendered compatible with the seeming unsurmountable question of consciousness. If physicalist presupposes that one day the thesis will be able to exhaust the properties of consciousness, then physicalism, as we have now, is at best incomplete and hence trivially true (Hempel, 1980). Either way, the worldview presupposed by science (ie. the claim that the world is entirely explicable in terms of facts about physical properties) is unable to conveniently stand the test of philosophical scrutiny. It appears that the reality of something extra-physical seems a plausible implication.

The Worldview Presupposed by African Science

Relative to African background, the question "What is Being?" resonates with the conviction expressed by Tempel's (1959, p. 51) study of the Bantu; "Being is force". The essence of an African force does not have the kind of solidity associated with ordinary matter. Usually, the closest analogy the indigenous African use in clarifying the essence of the Force is a shadow cast by an object (Mbiti, 1970; Middleton, 1960; Evans-Pritchard, 1976). The impression this comparison creates could be misconstrued because a shadow is not a thing, instead, it is a phenomenon observed when the path of light is blocked by something impenetrable by the former. On the contrary (as we shall see), the African force has a substantive place in our world and it is by virtue of this essence that it is capable of interfering in the affairs of the world. Didier Kaphagawani (2004, p. 335) calls the mode of being in African metaphysics the "Force thesis" and he further indicates that the thesis is one vested with imprecision even as far as Bantu languages are concerned.

Indeed, comparing the logical implication of the concept of the African force with what is known about the role of physical forces in our universe brings sufficient clarification to the former. Applying the modus tollens rule to the Bantu expression "Being is force" suggests that something that does not intrinsically exude a force cannot have a place in existence as Being. For if it is Being, then it is essentially a force. Physicalism theorizes the building block of macro-objects in terms of sub-atomic particles and their properties. A chunk of the mass of an atom is concentrated in the nucleus of an atom. Quarks are found in both protons and neutrons. The strong force holds these particles together in their respective bonding. Given the force of electrostatic repulsion between particles of the same charges, protons should resist bonding in the nucleus because neutrons have neutral charges. This would make the formation of nucleons impossible. Without the strong attractive force, the constituents of the core of an atom, from the quarks to the bonding of protons and neutrons, should fly their ways apart and therefore quash the very possibility of having an atom formed in the first place (Rae, 2004; Scranton, 1993; Allday, 2017; Birsch, 2002).

The strong nuclear force exists to negate such repulsion between (positively charged) protons and the (neutral) neutrons and is therefore responsible for the sustenance of the atom's core. Now, beyond the nucleus of the atom, the bond between positively charged protons in the nucleus and the negatively charged electrons in orbit around the nucleus is kept in place by a relatively weaker force called the electromagnetic force (Scranton, 1993). It is therefore by the electromagnetic force that the opposite charges of electrons and protons maintain a "peaceful" cohabitation (Walker, Halliday & Resnick, 2014). The same force then, plays a crucial role in the bonding of atoms to form molecules. Without molecular bonding, macrocosmic reality would not exist in the first place (Morvillo, 2010). When molecules have bonded to form large-scale objects, gravity takes over. According to Isaac Newton's first law of motion, force is required not to bring about motion but to change it. For that matter, but for the checks of gravity, the earth, planets and moons for instance, would continue a linear motion instead of their known elliptical orbits (Newton, 1846; Feynmann, 2011; Shankar, 2014). As heavenly bodies are left in continuous motion, complete disarray would ensue as planets would run into other bodies in the solar system, and the earth's continuous linear motion would drift it apart from the sun (Kaku, 2008). Consequently, with the further drifting apart of the sun, life of this form we enjoy on earth today could not have been initiated.

From the very heart of microcosmic reality to the macrocosmic world order, the relentless occasion of fundamental forces of physics; nuclear forces, electromagnetic force and gravity, are at work to keep the world and its constituents from disintegration. These forces are fine-tuned into scores of pillars whose slight alteration will dissipate life on Earth. The propensity of such fine-tuned forces in the exact proportion required to host life on Earth is called the anthropic principle (Kaku, 2008). Consequently, the guarantor of all phenomena in existence, from the very core of the atom to the fine-tuned macro universe is the handy work of physical forces in action (Sanford, 1899; Perkowitz, 2011). As such, we cannot set Force and Being apart, for the existence of Being presupposes the attribute of force. To be sure, the (indigenous) Bantu probably did not understand these forces at work precisely in the way described by contemporary physics. However, as the force thesis indicates, there is also no doubt that Bantu have acquired precise knowledge about an ineliminable role played by invincible fundamental ontological forces in sustaining the kind of universe whose architecture is conducive for hosting life. Tempels echoes an ultimate conviction of this sort when he intimates that "There is no idea among Bantu of 'being' divorced from the idea of 'force'". Without the element 'force', 'being' cannot be conceived" (Tempels, 1959, pp. 50-51). Far from asserting any contradiction, advances in physicalism should instead render our understanding of the force thesis much more appreciating. In earnest criticality, the two disciplines simply assert diversity, not opposition.

The Africans see all forces culminating into a singular Being. However, like the physicalist rank of forces, the forces of African ontology are hosted as delegated powers of the Supreme Being and are manifested in different degrees or capacities according to the host of agency or the medium it occupies (Konadu, 2007). The Forces rank in descending hierarchy as follows: celestial or terrestrial forces, humans, animals, vegetables and mineral forces (Tempels, 1959; Lajul, 2017; Mbiti, 1970; Teffo & Roux, 2005).

Beyond Temples' effort, one of the earliest attempts at characterizing the ontological underpinning of African science came from Robin Horton in his work *African Traditional Thought and Western Science*. Horton draws a kind of similarity between physicalism and the African Force thesis where both frameworks require theorists to link observed effects to causes that transcend the grasp of common sense. Horton further notes that even though the theoretical entities typified by the force thesis are not observable, it is far-fetched to consider their essence in terms of spiritual entities. In Horton's view, the African exemplifies dual-aspect monist; even though the force thesis exemplifies two contrasting features, the supposed irreconcilable properties are two aspects of a neutral underlying reality (Benovsky, 2018). Because of this, Robin Horton (1967, p.60) notes categorically, "Although everything in the universe is underpinned by spiritual forces, what moderns would call ‘mental activities’ and ‘material things’ are” to the African “both part of a single reality, neither material nor immaterial”. In what appears to be a similar explanation, some scholars also indicate that the natural-supernatural distinction has no basis in the African worldview (Gbadegesin, 1991; Teffo & Roux, 2005). So Ntuli intimates (2002, p. 56) “Where Europe conceives of Body and Mind, we [Africans] see Mind-body”. However, let us note with all the clarity it deserves that double-aspect theorists typically shy away from specifying the particular underlying ontology that gives rise to the mental and physical states. Now, the premise of absolute neutrality (of dual aspect theory) presupposes an ontological inclination towards neither spirit nor a physical entity. As such, the thesis merely reinvents the mind-body challenge because of the difficulty in reconciling how a supposed neutral postulate, devoid of any determinate property gives rise to typical entities that appear to have either physical or incorporeal properties (Osei, 2006). This unclarity, Priest (1991) concludes, is just as serious as the mystery that surrounds mind-body interaction.

Focusing on Akan ontology, Kwasi Wiredu has advanced a conceptualization of the “Okra” in ways that expand alternative ideas on the nature of the ontological underpinning relative to the African worldview. This is about the quasi-physicalist thesis. In support of Wiredu, Kwame Safro (2004) is convinced that quasi-physicalism typifies an ontological description whose generalization has interesting consequences for the African philosophy of mind in general. Evaluating the quasi-physicalist thesis, Hasskei Majeed (2013) indicates that it provides a perspective that unearths salient comparative features relative to physicalism. Wiredu understands a quasi-physical entity to mean one whose property is not straightforwardly physical (Wiredu, 1987; Kaphagawani, 2004). To say that an entity is "not straightforwardly physical" presupposes that it is ultimately physical although this truth does not come at easy glancing. This seems a very radical thesis especially because it invariably suggests that a deeper analysis exposes the Akan reality as ultimately made up of physical properties. Kwame Safro seems to entertain a moderate view. So, in what seems to be a clarification, Safro's view is such that properties of African ontologies have more in common with physical properties. As Wiredu (2010b, p. 140) reiterates "It is not of identically the same type as the material body, and yet it is not of a diametrically opposed category".

On the basis of significant mentioning, the use of the expression "not identically the same" implicitly suggests some existing keen similarities. On any day, quasi-physicalists would therefore show greater commitment to physicalism than to any idealist thesis even though they acknowledge the limitations associated with their position and this constitutes a notable feature that separates quasi-physicalism from dual-aspect theory. Indeed, Hasskei Majeed (2013; 2017) describes a quasi-physicalist as a disguised physicalist. As one advocate noted; "(if we have to choose) it is better to say that the susuma [Ga concept of the soul) is a physical thing than to say that it is non-physical" (Engamnn, 2010, p. 171). As Safro further notes, the quasi-physicalist is already inclined to physicalism but refuses to rule out other ontological possibilities because of epistemic modesty. All the properties that limit a physicalist's confidence about his/her position are, to quasi-physicalist, not physical per se. However, to say it is "non-physical" does not imply an incorporeal postulate either. For "as our discovery of physical laws proceeds and our scientific knowledge increases, we may come to accept some or all the quasi-physical objects as bona fide physical objects" (Safro, 2004, p. 346). Peter Inwagen

(2009) particularly calls such entities "amalgam". It seems to me, therefore, that the soundness of quasi-physicalism waters down to hopes about how the future would one day vindicate their stance. However, as Majeed (2017) indicates, failure is an important consideration in any hopeful event. So, what if scholars never chance on the supposed vindicative evidence? I suppose, then, the greatest disservice of quasi-physicalism is to base a determination on the nature of reality on expectations.

Yet, the reason we might be content with the "hopeful" plea is that if we give incorporeal ontologies any chance to explain the constitution of our universe, there would be another conflict where all that we know about physicalism would need serious revisions. How can one determine any specific law of spiritual causation when nothing about length, mass, momentum or any other quantifiable property can be attributed to the working of such entities? This sort of opportunity cost gives a sufficient reason to grant the quasi-physicalist's stance on the fringes. The doctrine of quasi-physicalism derives from two principal characteristics (i) physicalist properties; which are the properties that give a physicalist impression about Forces and (ii) exceptional gap(s); anomalous properties of Forces that defy capture in typical physicalist framework even though they do not suggest spiritual ontology at play. The thesis seems to hold the key to dispelling not only the mystery that surrounds African ontology, but it also provides an adequate basis for conceptualizing how African ontology is compatible with what scientific knowledge currently holds. I prefer, therefore, to consider delivering the analysis of African ontology in the quasi-physicalist framework.

The conformity of quasi-physical properties with the worldview of science finds expression in Gbadegesin (1991) who notes that the notion of the supernatural among Africans meant the demonstration of extraordinary feats that defy known laws of science. His conviction is again corroborated by a relevant observation. Among the Maasai (in Southern Kenya and Northern Tanzania), when a fellow is sick, the first point of call is to treat it using the ordinary medication associated with such symptoms. However, when those medications have failed, they now see the need to make it a case to suspect spirituality at work (Westerlund, 2006). Therefore, a spirit in the African context seems to suggest a phenomenon that defies the grip of ordinary experience, not necessarily incorporeal entities at work.

In Richard Dawkins's (2012, p. 168) *Magic of reality*, one sub-heading reads, “Today’s miracle, tomorrow’s technology”. Indeed, with time, several advances have been made in science. So, what might have seemed yesterday as typical mysticism relative to the African worldview may have the backing of today’s mainstream scientific principles. I am therefore inspired that given the progress in mainstream science, a lot of explanations can demystify the supposed spiritic essence that confers the mystery tags, particularly on the African worldview. As such, one’s acceptance of mainstream science must not necessarily occasion displeasure for the African worldview because science offers aid rather than contradicts the fundamentals of the African worldview. In advancing the course of harmony, I will draw data from two very entrenched ontological postulates of the African worldview which is often considered to exemplify African science in action; witchcraft force and ancestorhood (Ashforth, 2005; Munyonga, 2020; Akpan, 2010; Emedolu, 2015).

Indeed, the phenomenon of witchcraft continues to hold a lot of significance across several African cultures (Janz, 2015). In sub-Saharan colonial Africa, the phenomenon of witchcraft had remained an integral part of magic until the 1930s when scholars began to look at it as an independent phenomenon, and an expressible avenue of an African-oriented science. I scrutinize the anatomy of witchcraft force in particular because of the attendant increase in abuses of people, several accusations, retaliations, and the rise of prevailing attention and belief the phenomenon has attracted even in contemporary times (Moore & Sanders, 2004). Apparently, it is not a belief system reserved for precolonial Africans. In post-colonial Africa, despite the growth in the influence of education and technology the belief in witchcraft force is in wide currency, people across various African backgrounds believe their lives are affected by it, both literates and illiterates (Dirk, 2007; Westerlund, 2006; Essien & Falola, 2009; Mawere & Mubaya, 2007). Again, witchcraft force appears to be a major belief system under attack when African tradition comes face-to-face with modernity. It does appear that the belief system provides an easy comparative avenue for those who are quick to rubbish the soundness of African science (Ashforth, 2004; Niehaus, 2004). As such, Wilson (1967, p. 135) notes:

> *No person with a background in Western science can admit the reality of witchcraft or the 'breath of men' as defined by the Nyakyusa. . .The only solution is to kill the belief in witchcraft. As we have shown, it is somewhat weakened by elementary education and Christian teaching; and we believe that its disappearance turns on increased technical control, particularly in the field of disease, on scientific education, and on the development of interpersonal relations.*

To be sure, I do not in any way suggest that the descriptions I gather from literature relative to the nature of African forces are true, and I do not have the resources to deny it either. My key focus is to demonstrate that the description concerning such forces is not inconsistent with the advances in scientific knowledge.

So, there is an appreciable sense of co-existence in which mainstream science stands as a conceptual tool that demystifies the nature African worldview rather than negates it.

To achieve this end, I explore the nature of African ontology via the method of reductio ad absurdum. So, I advance arguments by assuming that the incorporeal view of African ontology is rather false. An option available, then, is to presuppose as William Abraham (1962) hints, that the nature of the African force thesis is rather typically physical. In compliance with the method of reductio ad absurdum, I will proceed to analyse and deduce the consequences of this presupposition. If the nature of the African worldview is fundamentally different from the presuppositions of the physicalist conception of reality, I should expect to encounter contradictions.

Across several African cultures, witchcraft force is not a human person. In Zandeland and Ibibio in particular, it is a perceived vested potentiality contained in a substance found at various parts of the body (Offiong, 1983). Among the Azande, witchcraft force is contained at the edge of a person's liver. It is also said to be a special gland and sometimes a serpent resting in the stomach (Westerlaund, 2006; Bennett & Scholtz, 1979). It may also be contained in a handy object just like charms and amulets worn for protection, and in such cases, those objects must be surrendered before the cleansing of witchcraft can be successful (Parrinder, 1956). It is important to note that even though the force is known through its operations in the material medium, the latter is conceptually distinguishable from the former. The person whose body the substance is functionally present is described as witchcraft-possessed. So, a witch-possessed fellow on the one hand is a biological system in possession of a force. The force on the other hand corresponds to innate power that commands mysterious capabilities, invoked at will by the possessed, usually to cause social disaffection through harming or destroying communal bonds, security and progress of the entire society (Bongmba, 2001; Middleton, 1960; Ashforth, 2001; Niehaus, 2001).

The principle of causal closure presupposes that because everything is simply a product of matter in motion and therefore nothing can impact the physical unless it is itself constituted by physical properties (Brown & Ladyman, 2019; Sanford, 1899). Typical of physical processes of (biological) inheritance, Azande and Nupe believe that a mode of acquiring witchcraft force is by inheritance through birth. This is why people could grow up possessing the force without prior awareness. A man acquires it from his possessed father and the woman acquires it from his possessed mother. Ashforth (2004) indicates that inheriting witchcraft force is simply about bitterness passed down from the parent to the child about someone else, or even the indoctrination of the child about the use of secret knowledge to cause social disaffection. In a related case, witchcraft force is also said to be transmitted to one another through food, drinks, bodily contact or through the anus (Niehaus, 2001; Offiong, 1983; Essien & Falola 2009; Westerlund, 2006; Mbiti, 1970). However, merely acquiring characteristic traits from ingested substances is not incompatible with typical physicalist assumptions. So, the mode of transmission of witchcraft force suggests no mystery that undercuts typical physicalist assumptions about the nature of reality. Between mainstream science and the African worldview, there is no contradiction but diversity.

In Einstein's special relativity theory, time is a physical property because of the ineliminable relation it has with the dimension of space (Kaku, 2008; DeWitt, 2010). So indeed, the physical essence of witchcraft force finds another corroborating evidence when one considers the impact of time on the potency of the force. So, among African societies like the Azande and Yoruba, the witchcraft substance is believed to grow as the physical body (that contains it) grows, and this is why old age is believed to render witchcraft force even more potent (Ashforth, 2005; Mbiti, 1970; Westerlund, 2006; Falen, 2018; Evans-Pritchard, 1976; Niehaus, 2004). Among the Lubgara in particular, a man can be bewitched only by an older man, never a younger fellow (Middleton, 1960). So, since old age is a function of a biological system's evolvement through time, and time is a function of spatial properties as Einstein indicates, then the ascription of witchcraft force to typical immaterial substance seems an obvious misnomer. For the features typical of spiritual substances part ways with properties of space-time.

Typical physical entities have restrictions in terms of the occupancy of a particular space at a particular time (Markosian, 2000; Armstrong, 2001; Birsch, 2002). Affecting the same idea of imposed restrictions, Zande witchcraft has limitations in operating beyond certain spatial boundaries (Evans-Pritchard, 1976). Beyond a specified distance, for instance, a victim is safe from bewitchment. This explains why witchcraft force is believed to operate mainly among a neighbourhood or clan since the indigenous settlement was largely motivated by proximity among kinship (Teffo & Roux, 2005; Westerlund, 2006; Konadu, 2007). For the Lugbara in particular, witchcraft force has generally no power over members of another tribe (Middleton, 1960). In *Things Fall Apart*, Ekwefi's two children died in infancy. Upon further consultation with the oracle, Okwonkwo is told that the dead child is "ogbanje", or what the Akan also refer to as "awomawuo"- an evil child tied to cycles of rebirth. To avert the phenomenon from reoccurring, the oracle did advise Ekwefi not to sleep under the same hut when pregnant. She was to keep a distance by moving away to stay with her family as a measure to elude making contact with the destructive force of witchcraft (Achebe, 1986; Majeed, 2017). No typical spiritual entity can have its activities frustrated by distance because the occupation of space and its attendant limitations thereof is a property of physical entities. Far from yielding any contradiction, the force thesis typical of African ontology, again, is given a clearer articulation to by developments in mainstream science. So, scholars have no business forcing disunity between the disciplines. For there is no contradiction but diversity.

Witchcraft forces make conscious efforts to guide their patrols in search of the location of their victims for at least two reasons (i) a targeted victim may escape detection by the force simply by journeying farther. For the farther one is away from his home, the safer he would be from his prey (witchcraft force) (Evans-Pritchard,1976) and (ii) witchcraft force would also want to avoid crashing into barriers like natural hills, large trees and bridges when it is dispatched to execute a given task (Mavhungu, 2012). Witchcraft forces sometimes journey to have meetings at identifiable locations, for instance within huge trees like the Iroko or Baobab (Falen, 2018; Mavhungu, 2012). Some verses in the recitals of Ifa divination instruct sacrifices to be placed at specific junctures like a cross-road, market centers, river banks, and deep forests. The reason is that depending on the occasion, those places are regarded as the haunt of Eshu, the messenger god who delivers the sacrifice to God (Bascom, 1991; Frisvold, 2016). As I noted earlier, under the spatial location account of the physical, conceptualizing an entity with geographical constraints invariably puts the object down to a physical entity. A typical incorporeal ontological substance cannot be up (in a Baobab tree) or down, it cannot be here at the market crossroad or there at the river bank, for these are connotations typical of dimensional properties of space; a typical incorporeal entity is simply incapable of occupying space. There is no mystery here at all, at worst, the physicalist worldview rather accords the African worldview with considerable appreciation, not opposition.

There are other notable features of witchcraft force usually classified as paranormal experiences because such a mode of existence appears to defy what is commonsensically conceivable. Consider the widespread phenomenon commonly described as the "Evil Eye". This is a phenomenon characterized by action at a distance. According to the power of Evil-Eye, an act of a stern direct gaze is believed to induce harm to the supposed target victim (Mbiti, 1970; Middleton, 1960; Westerlund, 2006; Essien & Falola, 2009). The predominant use of apotropaic amulets (intended to ward off any such unforeseen consequences) is a testament to how well the belief in the phenomenon of the Evil Eye is well patronized (Peek &Yankah, 2004). The same mechanism underpins witchcraft telepathy where the force is said to be vested with extra-sensory potencies that enable it to communicate with or pick up information from other supposed spiritual media without any physical contact (Hallen & Sodipo, 1986; Tart, 2012; Niehaus, 2001). Therefore, it seems that witchcraft force is clothed with inexplicable extra-sensory powers in ways that can exert impact on objects at a distance (Wiredu, 2010b). In *Homegoing*, Big Man suspected Little Dove of possessing witchcraft force because the latter is entertaining information to which his ordinary senses cannot be privy (Gyasi, 2016) Indeed, para-physical phenomena have entered laboratories for investigation, and the stunning result indicates that humans are capable of action at a distance (Diop, 1991). For instance, it is within the laws of physics for trained people paralyzed in bodily communication mechanisms to use their subjective mentality to manipulate electronic devices through electroencephalographs. As such, people could type on a computer screen or control wheelchairs by their thoughts alone (Kaku, 2008; Gross, 2020).

From the physicalist point of view, one can make sense of this phenomenon (Evil-Eye) by comparing it with a notable experiment conducted by Albert Einstein, Nathan Rosen and Boris Podolski (EPR). The results of the finding were published in a famous work *Can quantum-mechanical description of physical reality be considered complete?* It turns out that the intended position of the authors was to demonstrate the flaws in claims about the uncertainty principle relative to the quantum world. They intended to use such supposed bizarre consequences to conclude that quantum mechanics is at best an incomplete theory. In my case, the work is important for the contribution it makes to appreciating the discussion, particularly as it provides some basic clues to demystifying experiences typical of actions at a distance.

Einstein, Podolski and Rosen's experiment worked on two quantum particles brought together to interact for a while and as such, their quantum states were synchronized to vibrate in unison. This wave's synchronization of the quantum states maintains a mysterious link that continues unabated even when one of such photons is kept at one point in space and the other transported to the far edge of the universe. Because the particles are said to maintain connection, measuring the state of one particle sends information that affects the quantum state of the other particle at a speed beyond the speed limit of any physical object. So, for instance, when one measures the spin of one entangled photon here and the result indicates upward spin, the information gathered about the quantum state forces an instant definite momentum on the other entangled photon because it would necessarily be spinning downwards. This phenomenon is called quantum entanglement and Einstein described it as a spooky action at a distance (Kaku, 2008).

The point about entanglement is such that the features of one entity are made to depend on factors decided by measuring another distant entity (Darling, 2005). For that matter, it is possible to acquire information about one entity without disturbing the other situated at a distant location simply by observing the spin of one electron. One would have to merely depend on the law of symmetry that requires electrons to necessarily demonstrate opposite spins at all material times (Diop, 1991; Gribbin, 2013). Again, in recent times, neuroscience is making physicalist advances with technologies like Electroencephalograph (EEG) and Magnetic resonance Images invented to pick out brain signals and help in interpreting them through a catalogue of such signals (Goswami, 2009; Kaku, 2008).

By this comparison, I do not necessarily imply that witchcraft force's participation in telepathy or any other analogous description typifies the principle of entanglement in action. Indeed, drawing such implications would constitute an anachronistic fallacy. My point is that the scope of any explanation will be poorer if one assumes that the African force orchestrates the same phenomenon using the essence of spiritually endowed powers because one cannot explain the phenomenon based on any known spiritual laws. Physicalism on the other hand appears to rather open us to possibilities that can simply articulate same phenomenon in ways that dispel the mystery of the African worldview. In other words, a superstitious phenomenon and its attendant mysteries constitute events that do not avail themselves to rational analysis given available theoretical tools and lenses (Dennett, 1991; Brandl, 2007; Wiredu, 1980). On the contrary, the concept of witchcraft force is rendered rationally explicable given the advances in the framework of science. So, my contribution is to urge scholarship to rethink its stance on looking at them as competitive opposites, especially when any such differences readily dissolve into concerns of cultural diversity. This is why, views as Churchland's (1999) which suggest that the advances in modern theories eliminate witchcraft force from serious ontological discussions come to me as a bit of a surprise. It seems to project a conflict as though accepting mainstream science forces one to do away with beliefs typical of witchcraft force. As I explained under the functionalist perspective of African science, an agent can be led by urgency and survival instinct to bring to bear certain potentials or traits without necessarily knowing the theoretical basis by which the event or technology is possible. However, especially without any logical backing, the sort of ignorance that leads to such creativity cannot be put down to spirituality when physicalism makes complete sense of same phenomenon. So, mainstream science could simply be acknowledged as a theoretical lens that renders an appreciation of the African worldview better, it does not in any way eliminate it. Scholars have no business inciting a contradiction into place. For there is no fundamental contradiction but diversity.

Again, witchcraft force is believed to be capable of altering the physical state of an entity under an unimaginable space of time. During the day, witchcraft force prefers to occupy an animal so that it can unsuspectedly stray through the area of the target victim to cause evil or cause an attack under a hidden identity (Niehaus, 2013). Indeed, the host of forces created by Olodumare included animals, and Olodumare led them to a junction to see their departure into this world. Thus, it appears that as the creator of all the forces, and as all-powerful as he is, the ultimate responsibility for all harm and death caused to humanity by any of God's creatures rests on God (Westerlund, 2006). Because God supposedly does not endorse the perpetration of evil deeds, witchcraft force is believed to have been created by God for good especially when the force is also capable of deflecting misfortune and attracting blessings (Essien & Falola, 2009). As Akator (1988, p. 12) indicates, witchcraft force translates from the Akan root expression "ɛbɛyɛ yie", which translates as a promise of well-being. The inherent power is therefore God's assurance of well-being for mankind. Important office holders like chiefs, indigenous healers, and hunters of wild animals require a dose of powers inherent in witchcraft force to function optimally and only human nature like greed, and hatred, it seems, corrupt the force (Westerlund, 2006). This is the reason Moore and Sanders (2004) propose that rather than use the term "witchcraft" which often carries negative connotations it is preferable to use more neutral terms like "occult forces" which leaves open the possibility of using the force either for evil or good deeds.

The Zande in particular are therefore never worried about witchcraft possession of someone because it is a normal force that is to be accommodated and anyone at all could be one. Elders who wield authority have doses of witchcraft force to bring punishment on kin-members in socially approved measures. Witcraft force degenerates into anti-social force and hence attracts serious hunt-down attention so long as it is actually causing a misfortune against socially approved protocols, especially for selfish gains (Evans-Pritchard, 1976; Middleton, 1960; Ashforth, 2004; Appiah, 2003). So, according to the Yoruba, before animals, especially the deadly ones, as well as other forces, were ushered into the universe, God committed them to a pact called "ayajó" (Gbadegesin, 1991). Ayajó is a pledge made to Olodumare by all forces never to cause harm to humans. My point is that it is difficult to put forth an explanation beyond the accusation of false cause if one should link the killing of a supposed witchcraft animal to the death of the supposed counterpart human. In the absence of such evidence, it makes much sense to limit the explanation of witchcraft force to the activities of the animals alone. On that note, witchcraft force need not be a mysterious spiritual being; an animal that decides to break the agreed pact by fiercely attacking humans could just be as unfaithful as to have corrupted its force. So, such an animal will require a name that associates it with the known bunch of corrupted forces, hence the label witchcraft. On this count, witchcraft force is not any extra physical entity. It is a qualification associated with an untoward act of physical creatures in a way that exonerates God from carrying the ultimate responsibility for strange and wrongdoings (Wiredu, 1998).

In *Things Fall Apart*, an interesting scenario may be required to advance my point further. We are told that snakes were referred to at night as string because they were believed to hear their names when called and would consequently attack the offender. As Horton (1967) indicates, the same idea of immediate reaction to one's name is associated with calling out the name of the gods at any time of the day. This is why the real names of gods are kept away from strangers since an unwarranted invitation is likely to create unsolicited mayhem. Even if snakes really heard their names, why were their responsive attacks accustomed to the night? Achebe's (1986) explanation is that at night dangerous animals appear more uncanny, vicious, and sinister. Apparently, the night fetches a naturally conducive environment that is prone to dangerous animals to an attacking instinct. So, this simply shows that it is inconsiderate and weird for even dangerous animals to launch a fierce attack in broad daylight. A similar idea is found among the Lugbara as animals like the tortoise who depart from their natural habitat at unexpected hours are regarded as manifestations of witchcraft forces (Middleton, 1960). So, if any untoward phenomenon, disaster or injury is in any way linked to any of such unexpected appearance of an animal, the misfortune need not be the working of a typical spiritual entity at work. The animal involved has simply defied odds that should guide its expected social order. In that case, the animals attract a description to match the contempt it deserves among social beings. Witchcraft force, then, need not be of typical spiritual essence. So, there is no mystery here to warrant any tag of superstition.

However, in a seemingly mysterious case, a very popular tradition ascribes to the force an experience regarded as out-of-body travel (Westerlund, 2006). A body may lie down in a sleep state as the witchcraft forces are flown out to deliver its mission and return to inhabit the body (Pavanello, 2017; Mbiti, 1970; Niehaus, 2001; Rattray, 1927; Offiong, 1983; Falen, 2018; Teffo & Roux, 2005; Parrinder, 1956; Middleton, 1960). Again, there is a wide range of behavioural patterns of witchcraft force that fit under what Mbiti (1970) describes as homoeopathic magic, a kind of activity in which an object at hand is made to represent another human entity usually located at a distance. So whatever physical harm is meted out to the object at hand, a corresponding harm affects the fortunes of that which is represented by the object (Gbadegesin, 1991; Mbiti, 1970; Offiong, 1983). In a similar circumstance, a human being dies simultaneously if an animal that bears the former's witchcraft force is crashed to death (Niehaus, 2001; Mavhungu, 2012; Parrinder, 1956). The idea is the same for the killing of "the beast of ancestors", which is the killing of an animal to hasten the death of a sick person whose persistent pain the family wants to terminate (Mbiti, 1970). Another example seems to be exhibited when witchcraft forces purportedly transform a victim human into an animal after which it is cooked and feasted upon (Falen, 2018; Westerlund, 2006). Homoeopathic magic clearly indicates that vital forces have mysterious connections with the bodies they supposedly represent. Yet, this supposed mystery dissolves when we look critically at the sort of things typical physicalist worldview permits. It is important to explain why.

To be sure, the idea of flying out of the body by witchcraft force indicates traversing through a distance because the body from which it departs is literally situated at one point in space and time. Apparently, witchcraft force is demonstrating a phenomenon that should be unusual for incorporeal substances. For it is typical of spirits to defy restraint to any specific point in space. So, if witchcraft force is claimed to be omnipresent as Mavhungu (2012) suggests, it cannot imply that the force is literally everywhere at the same time. For this would make no sense of the need for movement as presupposed by the activity of witchcraft's flight through space. There are even reports that as spirits fly, their supposed wings sometimes create noises as it flaps against the roof (Achebe, 1958). Lugbara ancestors are sometimes heard grunting and muttering when they hold meetings at shrines to discuss the living (Middleton, 1960). Occasionally, bad ancestors call out to kinsmen and here, children are urged not to put a direct response of "yes" or "no" to callings at night since bad ancestors may drag victims with the latter to the grave (Achebe, 1959). Clearly, witches bear typical electromagnetic properties as they shed of visible light during some night activities (Engmann, 2010; Middleton, 1960). Light and sound are physical properties exemplified by the behaviour of waves. Thus, it is rather tenable to suppose that the accolade of "witchcraft omnipresence" means witchcraft force is a concept that pervades every society, not that a particular witchcraft force is simultaneously everywhere. It may, however, be rebutted as claimed by the Ga that the mode of transit used by Forces does not require physical motion through space. So "flying through space" would mean a metaphorical description of the force's ability to disappear and materialize at another point in space, in ways that defy laws of motion and impenetrability (Engmann, 2010; Wiredu, 2010b; Wiredu, 2012).

Understood this way, distance does not mean much to a witchcraft force who lives far away and wants to cause harm to her victim (Parrinder, 1956; Offiong, 1983). Yet, all this makes perfect sense with physicalism because of a physical phenomenon that happens all the time in physical space; the spontaneous emergence of Higgs' field from empty space and the collision between particles and antiparticles. From Paul Dirac emerged the discovery that for almost all fundamental particles of nature, another particle with the exact opposite properties is required for the former's existence. This fundamental property bearing the opposite property became known as the antiparticle. Now, when for instance, electrons and its antiparticle (positrons) collide, their pair annihilate out of space. Their energy heats the vacuum and as the heat decays, other real particles called virtual particles pop into existence again from nowhere and without any prior causes (Krauss, 2012; Morvillo, 2010; Genz, 1999; Aspden, 2005). Besides that, much more sophisticated physicalist support may be to draw some inspiration from the phenomenon of the quantum leap. In Niels Bohr's view, electrons are predisposed to movement along a specific order. The absorption or emission of energy (quanta) is a consequence of an electron leaping from its orbit to another. Since this leap happens at a rate faster than the speed of light, the phenomenon grounds a conclusion that the atom failed to travel between the spaces in between the orbits (Perkowitz, 2011; Goswami, 2009; Frank, 1957; Gribbin, 2013). In the physicalist framework, it is no mystery at all for an object to vanish at one end of space and materialize at another point in space without traversing the intermediate space. So, mainstream science cannot be said to render the African worldview unacceptable, it rather dissipates the mystery surrounding the latter and further restores our appreciation of diversity in different cultures. Far from asserting any contradiction, mainstream science vindicates harmony and hence restores a deeper appreciation for the African worldview. So, there is no contradiction but diversity.

Physicalists' best opportunity to make sense of the activities of witchcraft force, particularly as it relates to the capacity of an entity to transit from one point to the other without supposedly going through the intermediate points is the phenomenon of teleportation (Gisin, 2014). Teleporting sub-atomic particles is permissible in the EPR experiment. Indeed since 2007 when Anton Zeilinger first confirmed the reality of teleportation, several experiments have followed up to actually teleport different quantum particles (Perkowitz, 2011). Yet, the feasibility of teleporting physical entities does not include large-scale macro-ontology typical of humans. Steven Bloom's work *The Physics and Astronomy of Science Fiction* spells out the difficulties in teleporting a macrocosmic entity of the size of more than 1000 times smaller than a newborn baby. First, there is the problem of amassing the needed enormous amount of energy to break the solidity of trillions of atomic particles that constitute sub-atomic constituents of the babies. Indeed, it had not been possible to split just a single atom until it was first done by Ernest Rutherford in 1919. There is also another technological challenge in terms of reassembling the teleported quantum state information to constitute the same copy of the original baby (Gisin, 2014; Dawkins, 2012; Colson, Hallinan, & John, 2004). The difficulty faced by technology is made even more difficult by Heisenberg's uncertainty principle. Teleporting an object requires precise knowledge of the position and velocity of every constituent which is in flagrant violation of the uncertainty principle (Darling, 2005; Kaku, 2008).

Again, in Bloom's work, questions about personal identity have come to the fore because it is suggested that even the most perfect construction from a teleported entity down to the last sub-atomic particle may leave out replicating an identical consciousness of the original entity. This is why telekinesis associated with witchcraft force may be a weird phenomenon. It is however important to reiterate a difference. The force that animates the witchcraft potencies is clearly distinguishable from the carrier which happens to be the macro-scale human container. Therefore, the supposed transit from one point in space to another with such an unusual speed by witchcraft force is not inconsistent given the physicalist frame of reference.

An advanced method of the use of entanglement for teleportation comes from what is ironically called classical teleportation. When a form of matter called "Bose-Einstein Condensate (BEC)" is cooled to the barest minimum temperature, all the constituent atoms vibrate in unison. A beam of matter is caused to react with the BEC. Through the reaction, both entities share any excess energy, and this energy is transported through a fibre optic cable to another BEC system created at a distance. Because the transported light contains all the quantum information of the beam of matter, the other BEC could convert the incoming light into an exact copy of the beam of matter (Kaku, 2008). Physicalism does not contradict the supposed inconceivable speed typical of witchcraft activities. Per the harmony vested in the two theses, physicalism rather seems to make the appreciation of the African worldview even better.

To further explain the homeopathic magic supposedly demonstrated by witchcraft force, we have to once again visit the EPR experiment where two particles are supposedly entangled and hence, measuring the state of one instantaneously determines the state of the other. The Copenhagen interpretation of quantum mechanics in particular suggests that when a particle is in a state of superposition, it virtually does not exist until it combines with a measuring apparatus required to collapse the associated wave function (Rae, 2004; Goswami, 2009). So, if two entangled photons are in a superposition of states, they act as a human agency entangled with say a doll in hand. According to the laws of quantum mechanics, measuring one instantaneously affects the state of the other. Apparently, if the measuring apparatus is responsible for collapsing the superposition of state, and the measuring apparatus is a function of a conscious state as Eugine Wigner (1961) argues, then, according to quantum laws, it is possible for actions or conscious state in one corner to impact another physical state at a distance without any direct means of physical contact. By this clarification of the possibilities in the quantum world, the supposed magic of homoeopathic connection is not unusual and rather happens all the time. As Arthur Clarke (1962, p. 217) remarks, "Any sufficiently advanced technology is indistinguishable from magic".

Through the physicalist worldview, science offers a hand in explaining witchcraft force. To the ordinary Lugbara, the conviction about witchcraft force at play is not a question to which direct observation can provide answers. Technically, the seeming spiritual entities must have been inferences conceived as primary causes underlying the happenings of the macrocosmic universe (Middleton, 1960). So, whilst explaining the nature of the evidence available to the Zande about the activities of witchcraft force, Evans-Pritchard (1976, p. 25) notes:

> *A Zande perceives how they [misfortunes] happen just as we do. He does not see a witch charge a man, but an elephant. He does not see a*

witch push over a granary, but termites gnawing away its supports. He does not see a psychical flame igniting thatch, but an ordinary lighted bundle of straw. His perception of how events occur is as clear as our own.

So, clearly, immateriality, if it exists in the Zande thought, is simply the kind of cause which are believed to elude detection by the naked eye. In support of this claim, African forces are said to elude detection by the naked eye except under the intervention of medicinally enhanced perception (Wiredu, 1987; Wiredu, 2012). The same idea finds expression in Mbiti's (1970) claim that spirits are invincible unless they intend themselves to be visible to human beings. If, as Mbiti indicates, the people of Abaluyia construe the spiritual realm as a geographical continuum of this world then the significant distinction between the inhabitants of the spiritual realm and the inhabitants of the physical world is simply a difference in terms of what can be seen with the naked eye and what eludes the naked eye (Mbiti, 1970). This explains why Ga conceives of the essence of spirit as properties that are not encumbered by a visible body (Engmann, 2010). So, it appears that to the indigenous Africans, the senses play a key role in demarcating the physical world from what they conceive to be spiritual. Does this in any way render the African worldview an opposition to the way science attempts to understand the universe? Certainly not!

If there is anything so basic in the lessons of physics, it is simply that lack of detection by the naked eye does not make an entity less physical. There are many examples of such, ones that cannot even be discovered by the best of scientific technology like the light microscope and electron microscope (Feynman, 2011; Dawkins, 2012). As I noted earlier, the physicalist admits of entities such as atoms, quacks, neutrons, electrons, etc, all of which proof of existence does not come from direct observation. The same reason why one could believe these entities should render the belief in African force even more appreciable. In circumstances like the case of atoms, science uses what is called a model to assert proof of existence. In scientific theorizing, a model is simply a mental picture put out by a theorist to help organize and understand a given empirical data or observation (Morvillo, 2010; Hergenhahn & Olson, 2001). Models enable the scientist usually to hypothesize some kind of unobservable state of affairs in which the event that requires explanation is construed as an effect of such primarily unobservable causes. From the hypothesis, some consequences are predicted and accordingly subjected to a test. Relative to atoms, therefore, the evidence is not backed by directly observing one, but by inferring its existence from testing a prediction from an imaginary model. If the success of the experiment can be explained by positing an ontology with the presumed properties of atoms, then there is indirect proof for the unobservable in question. In other words, atoms are simply hypothetical entities conceived in a manner that would render observations intelligible (Godfrey-Smith, 2003, Zukav, 1979; Wallace, 2012).

Typical experimental demonstrations of the model effect include the jiggling of colloids in water (Brownian motion) as well as the structural organization of crystals (Feynman, 2011; Bohr, 1961; Rae, 2004). Same can be said of Gregor Mendel's "observational model" from which he postulated the reality of genes (Dawkins, 2012). Mention can also be made of black holes, regions in space-time where stars have shrunk to a critical radius in ways that allow nothing including light to escape from its core, the event horizon. Since light is held by the event horizon from escaping, this exact place in space-time is not open to direct observation. Its existence is therefore inferred as the best explanation of how other directly observable things associated with that region are affected by the intensity of the gravitational impact from the region (Hawking, 1989). Again, when Fred Zwicky used Newton's laws of motion to analyse the motion of stars in Coma galaxy, he realized that the rate of dispersion is to destroy the cluster unless there was more mass in excess of 400 times to exert gravitational pull in the galaxy than what the stars could readily account for. He postulated dark matter to explain the excess mass (Krauss, 2012; Colson, Hallinan, & John, 2004). This way of inferring the nature of unobservable entities by observing the behaviour of something else is technically referred to in science as indirect observation. The term "observation" is used simply because the final determination finally rests on what is actually observed after testing the predicted consequences of the supposed unobservable (Feibleman, 1972).

The indigenous African could not have had the benefit of technology, but he/she certainly had the benefit of intuitive insight to suspect a complex ecology of existence beyond the observable realm. It is important, however, to tread cautiously in identifying the African primary causes as incorporeal ontology. For a similar procedure used in asserting the proof of atoms is at play when the African makes a pronouncement about the force thesis. So, Forces, as Evans-Pritchard notes, are not typically spiritual agencies, they simply represent a model or framework that allows the Africans to explain the inexplicable (Evans-Pritchard, 1976; Moore & Sanders, 2004). There appears to be no better way to describe this than Middleton's (1960, p. 239) concern:

> *Empirically, witches as Lugbara describe them do not exist. What does exist are the situations in which Lubgara assume witchcraft to be*

operating, the belief in witches, and the responses that are brought into play as a consequence of the events which Lubgara explains in terms of witchcraft.

Perhaps, the notable way of conceptualization that invites an immaterialist interpretation of African ontology comes from the belief in post-mortem existence. So, among the Ibibio, witchcraft force for instance is believed to continue its operation even after the body of the witchcraft-possessed perishes, and it does so until necessary rituals are followed by autopsy to remove the witchcraft substance from within the possessed dead body (Offiong, 1983; Evans-Pritchard, 1976).

To place the discourse within a larger context, I want to extend the discussion to cover the nature of another force whose existence is very much entertained across several African societies, ancestorhood. Among the Akan, the ontological entity responsible for kindling life in an organism is identified with the Okra (Wiredu, 1987). The force that animates humans is credited with the powers of immortality. The okra is believed to be immortal because it is a speck of God's essence (which is credited with immortality) deposited in man to make life possible and this further explains why the soul of the Akan (Okra), the Ga (Kla) and the Kung (of Southern Africa), for instance, are said to return to God after the body perishes (Majeed, 2017; Gyekye, 1978; Engmann, 2010; Westerlund, 2006). This view is also very much consistent with Dogon's worldview (Griaule, 1965). Among the Ife, the life-giving force already lives with God as an ancestral guardian soul and is summoned before God to be ushered into a new body after his/her destiny is negotiated (Bascom, 1991; Gyekye, 1978). The Akan further claims that its name is already decided by God. Therefore, among the Akan as well as the Ga when the force is born into the human realm, it is named after the day of the week it enters the universe. This is called by the Akan as the "natal name" and it is by this name that God and the gods know the Akan (Akesson, 1965; Gyekye, 1978; Konadu, 2007).

To be sure, Gyekye invokes a major premise from the African (Akan and the idea extends to the Yoruba) thought which suggests that on one hand the abode of the soul (Okra or Ehi) after bodily death is construed as an immaterial habitation. Therefore, as he says, it would constitute an inconsistency for us to suppose that the inhabitant (Okra or Ehi) on the other hand is anything other than an incorporeal ontology. The argument seems to rest on an implied invitation for the followers of his side to avoid committing African ontology to the mind-body problem. As such, the impression is that it would constitute a categorical mistake to suppose that the "housing" (of the soul after bodily death) is immaterial but the supposed "inhabitant" is physical (Gyekye, 1978). Even so, Gyekye's point fails to prove that both okra and its place of habitation should be incorporeal. His thought only implies that the "inhabitant" and the "housing", should bear the same ontological properties and one of the options that still satisfy Gyekye's equation is to regard both the "inhabitant" and the "housing" as physical. So, Gyekye's argument is inconclusive, it merely depends on which ontological position one presumes as the major premise.

To deconstruct any sense of confusion, a complementing need of effort of science comes into its own. The Akan and the Sakuma believe that people who die as honourable members of society resume the same status in the "other" world (Wiredu, 2010b; Westerlund, 2006). This simply tells us that the supposed other world must have the on-going activities so much in common with this world in ways that render any continuity in status an easy fitting. In Sudan, some ancestors live earthly lives as animal incarnates (Essien & Falola, 2009). Indeed, generally, the affairs of the spiritual realm look so indistinguishable; the gods, could marry, make children, eat, etc (Peek & Yankah, 2004). For the Ga, the arrival place of the dead is known by a name of geographical location sited at the exact location where the River Volta flows into the Sea (Engmann, 2010). Moreover, among the Abaluiya the supposed spiritual world is a mere extension of this worldly geographical space. The Lubgara are very specific, it is simply extensions into the underground, when there is a need for contact, ancestors move temporarily to relocate to mundane locations such as the huts and shrines (Middleton, 1960). This is the reason why the transition into the other world for some Africans is believed to be a journey with specific landmarks like rivers that have to be crossed. So, for the Chagga in particular, the afterlife is a journey that is supposed to last nine days (Mbiti, 1970). Indeed, time is of a huge essence in such a way that among the Ga, the supposed entity that outlives bodily death hurriedly travels to a river bank to which it must cross to make it to the other world. In the same way, if certain supposed remedial actions are taken rapidly (on time) such as burning pepper in the room, the departed life force may be brought back to life (Engmann, 2010). Ancestors are usually said to be awake at night, so they are believed to be "closer" to our physical realm than daytime (Peek &Yankah, 2004). This explains why Teffo and Roux (2005, p. 200) note that "When it comes to immortality, at no stage does mortal life or immortal survival involve absolute immateriality". The point which Mbiti (1973) indicates and for which Wiredu (2012) reiterates suggests that the African does not conceptualize reality in the absence of properties known to typify physical objects; space-time.

There is no contradiction between mainstream science and the African belief in immortality and the beauty of this proof is that nowhere else is the compelling evidence found than advances within the corridors of mainstream science itself. First of all, the law of conservation of energy suggests that energy never gets annihilated, it only gets transformed. When I throw a coin, the energy I use is not destroyed, it is conserved by the coin and transformed into another form, kinetic energy (Blin-Stoyle, 1997). Observe the synergy in both worldviews. Tempels clearly notes that the African forces cannot be annihilated or made to cease existing, but only its degree of effectiveness could be diminished or halted by a superior force owing to the application of specific rituals or medicine. The reason is that a force originating from God can only be annihilated by God, not by the activity of any other creature of His (Tempels, 1959). This presupposes that when a witchcraft-possessed is exorcised by a Babalawo for instance, his separation from the force merely renders the force impotent, but it cannot revoke its right to existence. This is why Offiong (1983) observes that "even if all the living witches were to be eliminated, witchcraft force would still exist practiced by the dead". Now, if all forces are created by God, and if only God retains the right of termination of forces, then the crux of the post-mortem existence only suggests that no operational effort of physical activity can entirely annihilate reality. Assuredly, in a world governed by physicalist presumption, it is impossible to transform from being to non-being and this is the basic impression presupposed by continuity of existence relative to beliefs in ancestorhood. To the indigenous African, this transformational state means that the energy exuded by a living thing is not exterminated by death but is conserved and is therefore expected to be expended to assist the course of the living. The indigenous African goes one step further. He/she is prepared to devise innovative appeals like sacrifices and libation to reach out to prevailing forces and to maintain some kind of relationship with this supposed transformed energy state. Science may reject the possibility of forming a personal relationship with the supposed personal energy.

Yet, as I shall demonstrate later, there is every good reason by which such an idea is reconcilable with mainstream science. The point, however, remains that belief in post-mortem existence does not undercut the fundamental connection between the African worldview and the very extolled principle canvassed by physicalism. One culture (mainstream science) may call such state of being "energy", another culture (the African setting) deems it as Mbiti (1972, p.32) would say: "the living-dead". What I sense is simply cultural diversity that speaks to the same fundamental principle; everything transforms, and nothing really perishes totally.

It is time to evaluate the scientific merit of the belief that the forces which constitute the African worldview are personal beings (Wiredu, 2012; Westerlund, 2006; Appiah, 1992). The belief implies that the force typical of the African worldview is not only conscious of its own existence, but it is also capable of belief formation based on external circumstances (Engmann, 2010). First, it is important to draw out evidence from instances of a belief that show African forces in capacities as consciousness agencies. In respect of consciousness, the ontological forces express emotions of worry, pain and joy. Among the Yoruba, a witchcraft force may simply be an aggrieved ancestor (Ayegboyin & Jegede, 2009). Again, they have a kind of awareness that enables them to contribute to the welfare of the society to which they are concerned (Majeed, 2017). As such, ancestors are generally believed to punish wrongdoing and reward good behaviours. This presupposes the ability to engage in complex mental exercises since apportioning punishment and rewards is a function of the capacity to evaluate the behaviours of those concerned (Wiredu, 2010; Peek & Yankah, 2004).

Additionally, by virtue of the awareness of their physical environment, forces, particularly witchcraft forces are noted for being very cunning, deceptive and/or elusive (Engmann, 2010; Middleton, 1960). They can commit to keeping information, and when they do, they hardly yield any secrets about their operations. Indeed, they are credited with the potency to even mislead the rituals of medicine men meant to deal with or expose their activities (Achebe, 1986). So, on many occasions, even after pursuing all the physical evidence to expose witchcraft force, the evidence obtained is treated as a prima-farcie basis for suspicion and not as a sufficient ground of confirmation (Parrinder, 1956). As such, societies that entertain the belief in witchcraft force often put other validating measures in place to avert abuses. They may accordingly confirm the suspect's innocence by summoning him/her before a competent oracle. Even positive confession constitutes the surest means to unearthing the identity of witchcraft force because if it were not true, the person in question would be unlikely to subject himself to the dangers and public ridicule that come with that status (Ashforth, 2004). Even so, there are cases of confession where confirmation is necessary. For given their sense of awareness granted to them by a supposed conscious intelligence, witchcraft forces can impersonate innocent people to "confess" wrongdoings. By so doing, the real culprit is simply dispelling suspicions that would link them to a misfortune under investigation (Bennet & Scholtz, 1979; Mavhungu, 2012).

In support of the belief in the conscious agency, African ontological forces are believed to be capable of exercising at least a considerable autonomy in terms of free will. An action is considered a product of free will if, in the next instant, there are no guaranteed rules by which one can predict the sort of outcome that would be elicited by the entity in question (Frank, 1957). This is why, depending on the circumstance, the (African) forces in question may require compromises, threats or persuasions to regulate their decision. So, during a sacrifice, a Yoruba often reserves a portion of the offer meant for God in the custody of Eshu, the messenger god, to persuade him to deliver the rest of the sacrifice to God (Bascom, 1991). The conviction that the forces are conscious agencies endowed with free will seems to run into conflict with the worldview presupposed by science since the latter has difficulty in admitting the reality of consciousness as typically incorporeal.

Nonetheless, why in the first place, does mainstream science keep a distance from admitting properties typical of conscious free will? It is all because science seemed overconfident following the contribution that traces from Copernicus to the father of modern science, Sir Isaac Newton (Morvillo, 2010). Newtonian (1846) laws of motion and gravitational force provided a firm basis for precisely inferring planetary motions. Not only that, from the motion of the planets to a falling pencil, everything seems a consequence of the same physical laws as stipulated by Newtonian mechanics (Rae, 2004; Kaku, 2008; Conforth, 1978; Frank, 1957; Genz, 1999; Gribbin, 2002; Hawking, 1988; Zukav, 1979; Gribbin, 2013). The metaphysical implication of this advance in classical physics stood as a welcoming endorsement that evidences a physicalist ontological underpinning of the universe. It was a great indication that, if every single "move" in the world is governed and predictable strictly by physical laws, then entities that feature in the physicalist framework truly summarize all there is (Kuhn, 1996; Dougherty, 2016). Accordingly, it was indirectly a strong indication that there is no capricious willpower capable of directing any affairs anywhere (Brown & Ladyman, 2019; Krauss, 2012). All entities that cannot be expressed in terms of typical physical laws, the development suggests, had to be eschewed from scientific theorizing.

The development in classical physics inspired the conviction that the totality of reality is co-extensive with nature (Collin, 2011). Thus, an entity whose properties cannot be expressed in terms of purely naturalist terms implies that it is capable of violating the order of natural laws. By this argument, spiritual entities are often viewed simply as science stoppers, or better still, detractors of scientific theorizing. The point is that science thrives on the keen search for regularities which are formulated as laws with the help of logical and mathematical language (Dixon, 2008; Mahner, 2007; Dougherty, 2016). Because a spiritual entity is by definition outside the scope of natural laws (that regulate objects of our known world), such entities constitute a threat to uniformity in behaviour, a key attribute required for proffering rational predictions (Smith, 2019; Dawkins, 2012). So, an entity whose properties are fraught with indeterminacy seems simply inconsistent with scientific theorizing (Pennock, 2001).

In support of same concern, Thomas Sukopp (2007) suggests that allowing non-physical characters into science would create an easy avenue for explaining virtually everything, a situation Pennock (2001, p. 90) refers to as a "One-size-fits-all explanation". Where laws actually fail the test of observation, the challenge would simply be brushed off as an exercise of the will of the conscious forces involved. Kelly Smith (2001) designates these kinds of ontological postulates as mysterious entity thesis. According to the presumptions that define the character of such ontologies, it would be utterly impossible to stipulate an overriding set of conditions that clearly disconfirms or falsifiers their relationship with physical happenings (Pennock, 2001; Hodgson, 2005; Horton,1967). This, again, is why proponents of RMN suggest that in scientific theorizing, no room should be given to entertain the operationalization of non-physical entities.

Another principal argument suggested as a challenge to the compatibility of the African force thesis and science derives from the fundamental principle of causal closure. The principle derives from the first law of thermodynamics and it is a simple mathematical postulate. It requires one to calculate the amount of energy in a given system. Leave the system to undergo a series of alterations resulting from physical and chemical changes. Calculate the energy available in the system again. The result would always be the same (Ayer, 1998; Feynman, 2011). This presupposes that energy only circulates strictly within a given system. So, if anything can affect the system, it must have been a contiguous energy state (Dennett, 1991; Mahner, 2007; Klinge, 2020). It appears that an entity that can impact physical states cannot be outside the realm of the physical world without violating the terms of physical engagements. For such an entity would be vested with a certain freedom to bend and hence, interfere with the existing quantum of energy in ways that cannot be reasonably accounted for (Ruse, 1994). This is the rationale that inspires RMN to distance non-physical entities from scientific theorizing.

African ontological forces, however, are believed to (i) take decisions from their Will and (ii) have those decisions impact the physical realm. So, for instance, the anger of ancestors is considered a sufficient occasion for social unrest (Mpofu, 2016; Achebe, 1958; Horton, 1967; Dawkins, 2012). The Ko (of South Western Botswana) believe lesser gods are the most common agents of diseases (Westerlund, 2006). Indeed, they ought to be capable of interfering in nature with their supposed free will, for without such fundamental presumption, African science breaks down. The reason is that, unlike science whose underpinning is a material force, the ontology of African science operates through the establishment of personal relationships. So, the African scientist aims to appease, placate or manipulate the will of the forces to his advantage (Appiah, 1992; Mbiti, 1970; Achebe, 1958;

Horton, 1967). And, if the forces are neither conscious of the relationship nor free to act in favour of the client who seeks their help, then the forces become mere extensions of material forces whose decisions are invariably preconditioned by purely mechanical processes.

On the contrary, African forces are believed to have the willpower to make a decision that can alter the affairs of the physical world even though they are regarded as residing beyond the realms of physical law (Inokoba, Adebowale & Perepreghabofa, 2010; Wiredu, 2012). Eshu for instance, wields a scepter of authority by which he can change the course of physical affairs in defiance of physical laws (Gbadegesin, 1991). It is better therefore, as Gbadegesin (*ibid*) further notes, to call African forces as forces in nature as opposed to forces of nature. The latter implies a force that emanates or operates when the natural conditions for its materialization are set in place. The former, then, corroborates Plantinga’s (2001) contention that there could be laws but not everything is at least entirely governed by them. So, forces in nature imply an entity in space and time which can impact the physical world but it also reserves the right to actions from free will and can therefore defy the grip of known laws. In a related example, when sodium and chlorine are added in the right proportion, the mixture is expected to yield salt in every possible universe. However, African forces, as Hamminga (2005) notes, can acquire different awareness and different intentions from time to time and this can alter expectations when called to action. So even under the same conditions, you cannot expect the reaction of forces to conditions of yesterday to replicate the same result today.

If the physicalist view rejects entities whose property cannot be accounted for in terms of typical physical laws, it seems African science is a manifest contradiction of science. So, in the interim, the decisive distinction between the ontological foundation of African science on the one hand and mainstream science on the other hand reduces to this basic contention. Whilst science rejects quasi-physical properties because they appear to be inconsistent with the properties presupposed by the worldview of science, African science is founded on the principle that reality consists of conscious entities that can interfere in the affairs of the physical world. It appears then, that these two worldviews are incompatible, and therefore the acceptance of one must lead to the rejection of the other. As Krauss (2012) reiterates, if immutable laws operate in the physical world, not only would gods be impotent, but they would also lack the free will to interfere in the proceedings of the universe. However, given the developments quantum theory unveils, it seems all these supposed frictions dissipate to restore the harmony there is between mainstream science and the African worldview. It is therefore compelling to further the effort at synthesis in the light of such developments.

Quantum Theory and the African Force Thesis

Indeed, since Arthur Eddington used implications of sub-atomic physics to support the belief in free will, quantum theory has been exploited as opportune grounds in defence of particularly indigenous religion and ethics (Frank,1957). Following this development also, many of the scholars who think a non-physical property is compatible with a deterministic account of the universe championed by mainstream universe take quantum theory as a good opportunity to advance that impression. The reason is that quantum mechanics seems to give non-materialists so much confidence that physics has opened mainstream science to a threshold of ontology beyond the material world (Stenger, 2009). So, for instance, in introducing his view on why mainstream science has a place for non-physical entities, Amit

Goswami (2009, p. 63) describes quantum physics as this, “In 1979, I had found my happy physics: the quantum measurement problem…”. There is an important reason backing why inference from quantum theory is often exploited as key premises in settling contentions of this sort. So, before any evidence is adduced, the discussion should provide room in defence of why quantum theory exemplifies compelling evidence in such contentions. Recall, the father of modern Western philosophy, Rene Descartes, sought to lay a firm foundation for the sciences, particularly in the Meditations. Through the method of logical deductions typified by a priori abstractions, Descartes arrived at what he regarded as the principal foundation of the sciences, the existence of the thinking thing. Descartes’ problems began from this first principle as it became increasingly difficult to deduce anything about the nature of the empirical world from a reality whose sole essence is to think. It appeared that the limitations of using a priori conceptual schemes typified by Cartesian metaphysical discourse are very much glaring.

Advocacy emerged, and traces of it can be linked to one notable spokesperson of 20th-century naturalist tradition, Van Willard Orman Quine (Rea, 2007). A section of his work *Ontological Relativity* and other essays admonished the annexation of the method of philosophical enquiry by natural sciences. By this call, Quine did for philosophy what John B. Watson achieved for psychology. For Watson, psychology can be termed as science if it aligns its procedure with that of the method of science; it must use quantitative data to draw conclusions (Evans-Pritchard, 2009; Hergenhahn & Olson, 2001). Relative to same concern, Quine suggests that the evidential basis of the picture we have about the world is given by simulations of our sensory receptors coming from external reality. For him, then, in constructing knowledge, the focus should be to investigate the dynamics of sensory impartations by external realities. Why not surrender traditional epistemology (typical of the Cartesian approach) in favour of psychology, he quizzes? Quine particularly titled this business as epistemology naturalized.

Quine's motive, then, was to make epistemology continuous with psychology. Invariably, Quine's prescription motivates an epistemological conviction called naturalism. Its basic concern resonates perfectly with the prescription of the logical positivist against the credibility of a priori reasoning (Appiah, 2005). As an epistemological doctrine, naturalism generally extolls the following tenets (i) philosophical reflections exemplified by typical a priori abstractions must avoid holding themselves as foundational to the sciences (ii) philosophical problems that concern deeper questions about the nature of the universe are to be answerable or conceptualized with recourse to or within the limits of scientific knowledge, particularly physics, and not by using pure abstract deductive axioms or first principles (Rosenberg & McIntyre; 2020; Appiah, 2003; Godfrey-Smith, 2003; Bird, 2008; Sukopp, 2007; Krauss, 2012; Brandl, 2007). Even though the assumption has gained currency in terms of shaping the limits of philosophical discourses, this seeming radical call has not gone unquestioned. For instance, science requires the assistance of a priori principles to prove why its assumptions are truth-assuring in the first place (Carnap, 1966; Appiah, 2003; Rosenberg & McIntyre; 2020; Mumford, 2008; Sankey, 2008).

In the present case, I am going to assume its validity not because I think all valid proof must be a consequence of the use of scientific proof. Rather, in an effort to dispel any uncertainty relative to the compatibility or otherwise with mainstream science, I am simply presenting African science with as many challenging admissibility tests. The task ahead, then, is like staging a "comeback" against an "opponent" in a contest in which the venue, rules and referee are all set by the very supposed opposition, mainstream science. At last, because (i) quantum mechanics is deeply acknowledged as the most advanced, well tested and accurate scientific feat of the 21st century, and (ii) quantum mechanics brings typical metaphysical doctrines in bed with mainstream science, the theory comes across as an interesting framework to explore the place of African ontology in a world that seem governed by typical physical laws (Zukav, 1979; Osei, 2006; Appiah, 2003; Wallace, 2012; Stenger, 2009; Plantinga, 2011; Miller, 1987; Hawking, 1989).

I will state my argument for suggesting that mainstream science supports the view of conscious free will associated with African forces after which I will proceed to defend the premises. The argument is this. The logical conclusion of developments in quantum theory suggests limitations on physical laws. This supposed limitation on the application of physical laws compels theorists to undertake a conceptual revision relative to the fundamental properties of the worldview presupposed by mainstream science. To restore order, it is compelling to grant that the fundamental properties of conscious free will are compatible with physicalist presumptions in a space-time continuum. Therefore, developments in mainstream scientific theorizing simply validate the very properties typical of African forces. As such, the notification this validation brings should bear out the earnestness of compatibility, not opposition. I should proceed now to show evidence backing the first premise.

As far back as the atomists, an optical phenomenon was understood as particles in motion. Newton's optics upheld the implied corpuscle view of light and the proof came from (i) the phenomenon of light refraction and diffraction and (ii) the impact of light particles on solids (Omnes, 1999; Kuhn, 1996; Perkowitz, 2011;

Gribbin, 2013). Thomas Young and later, Augustin Fresnel, however, demonstrated that contrary to Newton's corpuscular view, light is a wave. Henceforth, an interesting controversy erupted because when one takes sound for instance, the waves are known to be produced by the pressure and density occasioned in the medium, be it water or air, through which the sound is propagated. So, when light started giving the impression that it is a wave, the situation was quite shocking and it instigated the curiosity to unearth what (substance) exactly is "behind" the waving properties. This led to the postulation of ether as a presumed underlying transparent medium pervading all of space so that light waves would be understood as electromagnetic waves propagated as vibrations of the ether. However, the famous Michelson-Morley crucial experiment disproved the reality of ether (Blin-Stoyle, 1997; DeWitt, 2010; Kuhn, 1996). Indeed, more anomalies began to discredit the wave conception of light. Two of the very famous blows were that the wave theory of light could not account for the phenomenon of blackbody radiation (emitting and absorption of light in chunks called quanta) and the photo-electric effect (metals ejecting electrons when exposed to lights) because only particles are expected to exhibit properties of this nature (Stenger, 2009; Genz, 1999; Dougherty, 2016; Zukav, 1979).

By the beginning of the twentieth century, the American physicist Arthur Compton had studied the photoelectric effect, which seems to indicate that not only does light (X-ray) conserve energy, but it could actually splash off electron particles with a packet of quantized energy of discrete values (Pain, 2005; Scheck, 2007; Rae, 2004; Zukav, 1979). Because literally, the property of nothingness cannot causally impact something, the fact of light knocking off electrons presupposes that the ontological postulates involved in the experiment should bear the same properties, physical properties for that matter (Forrest, 2004; Berkeley, 1901; Osei, 2006). On that note, some physicists reverted to the particle-view of light because it seems that light has something keenly associated with typical physical entities; momentum (Gribbin, 2013). This crisis invited the intervention of philosophers to analyse and proffer interpretations about which concept of reality best fits the reports so far.

To be sure, a wave is a disturbance that travels as a result of an agitated medium. In other words, when you disturb any medium, mechanical interactions within the medium create properties called waves. Mechanical waves, such as sound waves and water waves travel through a given medium but other waves like electromagnetic waves, following the revocation of ether by the Michelson-Morley crucial experiment, do not require any physical media for their propagation (Blin-Stoyle, 1997). On that note, a wave is not identical to its medium. Waves in water for example are not the motion of the water, it is the properties the water particles create as a result of the perturbations therein (Shankar, 2014; Birsch, 2003).

So, a wave is not a substance in itself, it is a mathematical property that underlies or guides the movement of energy (DeWitt, 2010; Engmann, 2010). Waves demonstrate two interesting properties. These two outstanding features of wave phenomena are "interference" and "superposition". The principle of superposition holds that linear waves moving along the same medium result in an algebraic summation of the individual wave pulses. This means that traveling wave pulses can interfere with the affairs of each other and produce specific consequences. The interference patterns can either be constructive or destructive. The interference propensity of waves presupposes that mechanical wave pulses can meet each other and both would literally occupy the same space at a given time. As they collide head-on, they either cancel each other when a trough coincides with a crest, add up in "strength" when both troughs and crests coincide, or pass through one another, and go separate in their respective directions as though there had been no contact before (DeWitt, 2010; Maudlin, 2019; Blin-Stoyle, 1997).

Because of the interference property of waves, they are not discrete, but rather, they do spread out in existence (Nambu, 2004). This means that even though they are actually measured from a particular point in space, they literary spread out their existence within a certain probability range. As the experiment demonstrates, we cannot tell with precision where the physical energy it carries actually is until we try to measure the wave's existence (Reichenbach, 1953). Even so, waves by their nature distribute their existence, so there are places where the energy could be felt more (peaks) and there are places they could be felt less (trough) (Perkowitz, 2011). On the contrary, the classical view of a physical substance renders it as an entity that occupies a given space at a given time (Lovejoy, 1930). If its space has to be taken by another physical entity at the same time, the existing physical entities ought to clash head-on, and the one with greater force "bullies" his way by knocking the other off its way. The position of space occupied by physical substances never overlaps because each is impenetrable (Heisenberg, 2000; Weyl, 1949). In contrast, when two wave pulses of which one is inverted are traveling in the opposite direction, they give rise to what is called destructive interference; the interference pattern is such that the resultant amplitude cancels the existence of each other leaving no traces of any contact (Pain, 2005; Perkowitz, 2011; Hawking, 1988). So, given Leibniz's principle of identity, the concepts of waves and particles are simply inconsistent with one another (Strawson, 2008).

Louis de Broglie deepened the problem with a mathematical contribution that won him the 1929 Nobel Prize. He showed that not only can waves be expressed as a particle, but that, particles are likewise expressible in terms of waves. De Broglie further demonstrated mathematically that against common sense, one fails to observe the wave-like character of macro-objects such as houses and plants only because the visibility of the wave-like property is counterbalanced by the relatively large mass possessed by such entities. Because such macroscopic elements have high levels of energy, their waves have higher frequencies and therefore the corresponding wavelength is far too small to be observed under the naked eye and hence negligible (Gribbin, 2013; Rae, 2004; Gribbin, 2002; Carnap, 1966; Pain, 2005; Zukav, 1979). Three years after Louis de Broglie's effort, Erwin Schrodinger was inspired to develop a boost for a quantum theory of atom, a mathematical picture that conceived of atoms as a standing wave. This view actually undermined determinism as presupposed by classical physics because the effect of quantum laws is shown to affect the scale of macro-size ontologies. Following enormous double-slit experiments, it was observed that if electrons were indeed particles, their state must come with definite predictions in accordance with the laws of motion (Shankar, 2014; Zukav, 1979; Saunders, 2002). Instead, fired electrons create an interference pattern in accordance with wave functions. It was as if once an electron is released, it spreads out in existence according to the associated wave function, and the chances of locating it are the probability distribution according to Schrodinger's wave equation. The world of quantum theory presupposes a deeper realm of existence in which the supposed control of everything by physical laws must hold with some reservations. Therefore, quantum mechanics poses a limitation on the deterministic presupposition that comes with classical mechanics (Feynman, 2011; Omnes, 1999).

To my second premise then, the limitation on physical laws as shown by quantum theory seems to consolidate a meaningful basis for restoring free will (Frank, 1957; Gribbin, 2013). Because light cannot be a wave and a particle simultaneously, the question of the fundamental essence of reality seems answerable in terms of which experimental results one opts for (Perkowitz, 2011). If one chooses to measure a wave property of light such as interference, one shall opt for the double-slit experiment and end up with a wave view of light. If one measures a particle property such as a definite position in space, then one shall opt for the photoelectric effect and end up with a particle view of light. Indeed, we can measure the joint properties of both particle and wave features when the subject of investigation adopts the Compton scattering experiment (Osei, 2006; Zukav, 1979; Bohr, 1961). The indeterminism of the physical, Railton (1998) reiterates, seems unquestionable. Called the wave-particle duality, the seemingly opposing views are regarded as correct in their own right because each view agrees with the experiment (Hawking, 1989). The supposed duality is therefore a concrete indication that by the naturalists' own method, reality cannot be at least entirely understood from a typical physicalist point of view alone. For the determination about the nature of reality depends first of all on the necessity of choice (Stenger, 2009; Saunders, 2002). As Zeilinger (2004, p. 5) noted "We decide, by choosing the measuring device, which phenomenon can become reality and which one cannot".

This picture (of quantum reality), Thomas Dixon holds, (2008) cannot be said to exist without a role for free will. In other words, between a particle (view of reality) and a wave (view of reality), the choice is the only real thing because it is the only trigger that decides between the competing conception. However, choice only makes sense if there is a place in reality for free will. So, as Krauss (2012) says, in classical physics, Newton's laws dispensed with non-physical properties. However, quantum mechanics does not only bring back non-physical elements typical of free will, it also endorses the position that free will can be accommodated in a world governed by typical physical laws. As Carnap (1966, p. 218) urges, "To restore meaning to 'choice' therefore, it is necessary to look toward the indeterminacy of the new physics".

It may be argued that the limitation on physical laws is being blown out of what is reasonably permitted by the argument from particle-wave duality. Strict laws may not apply in determining the behaviour of an electron, but the double slit experiment does not also show that a fired electron has the free will to land anywhere it wills. The argument which takes support from the Copenhagen interpretation of quantum mechanics suggests that fired electrons are particles traveling and only dissolve into a wave to traverse the double slit. The electron, upon settling at a location, resumes its status as a particle whose place in space is strictly restricted in accordance with Schrodinger's law constituted as a wave equation. So, for instance, Schrodinger's equation tells us where one is more likely to find the electron, and it also forbids the electron completely from settling at some locations (Morvillo, 2010; Zukav, 1979; Gribbin, 2013; Bohr, 1961). As a response to unsettling the argument for free will, this rebuttal is prone to another serious difficulty.

The first flaw is that the world of quasi-physical properties does not presuppose outright suspension of physical laws. Since quasi-physical properties are part of spatiotemporal reality, the argument is that the laws of physical determinism are compatible with an African ontological force believed to reserve the right to free will. As Saunders (2002) makes the point, "physicalism still leaves room for the reinforcement of free will by a certain aspect of nature; albeit, within the limit set by the wave function". As I understand it, Peter Ells makes a very strong case in defence of this compatibilism. If within the probability wave function, there is no reason why an electron should settle here rather than there, then the choice is the best inference to explain the behaviour of a fired electron. So, Ells notes the conclusion in terms that I rather prefer to quote:

> *A free choice made by the photon in the light of its experience determines the spot on the screen where it lands... An experimenter can calculate a probability distribution that describes the propensities for particular locations on the screen to be chosen. The fact that this distribution exists does not explain why this particular photon landed on this particular spot on this particular occasion. The choice made by a particular photon is still a legitimate explanation as to why it landed on this particular spot on the screen. An individual photon can make a free choice despite the fact that the collective pattern is random. This is because the probability distribution does not constrain each individual free choice made by each photon; instead, it does no more than describe the collective pattern of these choices* (Ells, 2011, p. 123).

The second flaw relates to the argument inferred from the participatory anthropic principle. At the core of the Copenhagen interpretation of the quantum theory is the concept Niels Bohr calls the complementarity principle. According to this principle, it does not make sense to ask which of the two (the particle view or the wave) views of light is right. Both views are right because they are inferences from well-served different experimental outcomes. So not only are they correct in their own right but also, they are complementary aspects of a fundamental reality

(Bohr, 1934; Frank, 1957). The complementary principle, however, implies that the essence of reality is not independent of the observer because it depends on the interaction with systems of observation to show up either as a wave or a particle. If the principle of complementarity is correct, then the next step in the argument is inevitable; properties (such as solidity or the fuzzy wave), do not belong to entities in themselves. However, as the famous critique of Locke by Berkeley indicates, taking away the properties of an object simply ends up denying the reality of the object itself. This would presuppose that reality is a function of the percipient by whose observation the properties of any reality are known. In mainstream scientific theorizing, the view of an observer-dependent world is what is sometimes referred to as the participatory anthropic principle (Corey, 2003; Zeilinger, 2004). The implication of this view certainly rids reality of the grip of objectivity because the constitution of reality seems to depend at least partly on the percipient (Morvillo, 2010; Zukav, 1979; Dougherty, 2016).

If complementarity implies the participatory anthropic principle, then as Bohr (1934) emphasized, there really is no light without the subject of investigation. The threat of this implication to physicalism is that it is forced to accommodate reality as properties of our subjective causal interactions. A cause is subjective when its supposed phenomenal effects require a percipient to be instantiated (Lovejoy, 1930). Under classical mechanics, a falling particle obtains a momentum assigned to it by the laws of physics, whether or not there is somebody there to observe the state of affairs. Yet, ontology under quantum physics seems to be defying the narrative. As such, it is not physical laws perse that determine the properties of realities because the wave function suggests only possibilities relative to the electron’s momentum. Physical laws come in only when an observer elected to interact with them; but even so, the knowable properties of reality are subject only to probability laws (Wallace, 2012).

Clearly, the ramification of the participatory anthropic principle has an interesting bearing on the African understanding of reality. In the Conversation with Ogotemmeli, the Dogon as with other African societies like the Akan and the Igbo believe death splashes the soul away from the body and as a result, the soul is said to obtain irregular motion. In such an irregular motion, the soul loses connection with a particular space because it has lost hold of a material body that pins it down to a specific place. It is therefore literally nowhere and metaphorically everywhere. This irregular motion is exemplified in social crises which are curtailed through an organized burial ceremony to render a smooth transition from the world of the living to the world of the dead (Majeed, 2017; Konadu, 2007; Achebe, 1986; Bascom, 1991). It is as if to suggest that hitherto, the soul of the dead is in a state of superposition. Now, it seems therefore that the African makes an effort through a kind of observer-dependent activity to collapse the wave function of the ancestor's force. In this activity, the African may be seen to be exercising a related art of measurement by way of putting up a favourable setting for engagement. As the belief holds, the wandering soul returns as an ancestor, in other words, his wavy wanderings collapse when an alter pot is erected for him to drink from (Griaule, 1965). As the implication demonstrates, there is no fundamental disagreement between the African worldview and science. Only the art of diversity stands between the two worldviews.

The attempt to reinstate objectivity in scientific theorizing led scientists to pursue experiments intended to disprove causal subjectivity. The physicist, then, got closer to monitoring electrons as they are fired through a double slit. The physicist designed a monitoring method that enabled the experimental set-up to detect which one of the slits any electron in motion is led through. Physicists achieved this feat by attaching a lighting system to each of the slits. A flash of the lighting system is to serve notice that depending on which slit an electron moves through, a definite determination can be reached at all times with regard to specific spatial properties of an electron in question (Maudlin, 2019). Yet, nothing can lend its properties to be known by an observer unless such an object is illuminated by light rays that bounce off it (Perkowitz, 2011; Dawkins, 2012).

Now, before any point-sized subatomic particles can be observed indirectly, the light shining on it must be blocked from bending around it and by so doing, the ensuing shadow created by the particle would expose the exact place of the object. Nevertheless, this also means that the light waves to be used to monitor the electron all along its travel through the slit must constitute a relatively smaller wavelength so that it could be blocked by the electrons which await exposure (Carnap, 1966). Ordinary light in a microscope, however, does not have the requisite wavelength. Gamma rays have the shortest wavelength and are therefore fit for purpose. As it turned out, when gamma rays are shined on released electrons, the interference pattern vanishes, indicating that electrons are indeed particles. However, if the experiment is replicated with the gamma flashes of lights turned off, the interference pattern returns (Feynman, 2011).

Scientists observed that the presence of the gamma light makes all the difference in the outcome of the experiment. Plank's constant indicated that the level of energy contained by electromagnetic waves is dependent on their frequency such that the smaller the wavelength, the higher its frequency (Blin-Stoyle, 1997). What that means is that if physicists needed a light with a smaller wavelength capable of being blocked and reflected by the tiny released electron, they can only work with a light whose corresponding wavelength is relatively high. Yet, with such a high frequency, gamma rays invariably conserve a level of energy whose interaction with a moving electron can alter the latter's state of being. Thus, when gamma rays are shed on a fired electron, it knocks the electron's wave out of the state of superposition, and a concrete electron shows up (Hawking, 1988; Lovejoy, 1930; Zukav, 1979).

Apparently, the experiment does not exemplify the actual behaviour of the electrons because the observation is a direct result of interference coming from the collision between the atom and the (high) energy vested gamma rays. In other words, the very act of reality's exposure to the sort of light capable of exposing the momentum of the electron also serves as a manipulative device that alters the outcome of the experiment. In effect, scientists are back to the same earlier conclusion. If you apply gamma rays in order to follow the momentum of a released electron, you will obtain a particle-like answer. If one takes out the gamma-ray effect to minimize artificially interfering with the electron's momentum, one will obtain a wavy-like behaviour (Feynman, 2011, Scheck, 2007; Hawking, 1988; Gribbin, 2002; Rae, 2004; Zukav, 1979; Stapp, 2009; Kaku, 2008). At the very core of reality, determinism simply wobbles. Nevertheless, the more interesting aspect of this development is that it seems at any stage, the electron is demonstrating awareness of the experimental conditions put in place to pin it down to strict physical determination. In response, it seems to be declining any such invitation all along with a very evasive report. It appears that some level of self-awareness is required by a fired electron to achieve this feat.

Alvin Plantinga (2011) focuses on the spontaneity of the Big-Bang theory to drive home a view of how non-physical property typical of pure consciousness can interfere with the affairs of physical laws. However, Michael Ruse (2001) and Feynman (2011) both assert that the basic laws of physics are understood in ways that do not require the interplay of non-physical causes in the Big-Bang. I prefer, therefore, to sideline the context of Platinga's argument that concerns the subject matter. However, one similar motive is captured by a famous thought experiment launched by Erwin Schrodinger. Called "Schrodinger's cat", the thought experiment is intended to showcase the absurd consequence presupposed by the implications of the observer-effect in quantum theory (Darling, 2005; Osei, 2006). However, it ends up also as proof of how scientific theorizing lends support to ontological properties typical of consciousness.

A cat is sealed in a box. A certain gas is contained in the box which can only be triggered when a radioactive decay occurs. As a quantum phenomenon, radioactive decay is a random process that defies having a connection with any prior physical event and hence, its manifestation is only subject to probability (Railton, 1998; Plantinga, 2001; Gribbin, 2003; Pietroski & Rey, 1995; Carnap, 1966). When the decay occurs, a poisonous gas is released and the cat in the box dies from the poisonous substance. In an unobserved state, there is no way of telling whether the decay has taken place or not. So, the only state known for sure is the probability function of the wave associated with the radioactive decay. Yet, this mathematical conditioning of the associated wave function makes it impossible for us to tell whether the decay has actually occurred or not because all alternatives are permissible probabilities. So, if the observer effect is the requirement to trigger the collapse of the radioactive decay, then the fate of the cat invariably coincides with all the probabilities associated with the wave function of the radioactive decay. So, as the radioactive decay hangs in the superposition of states, so is the fate of the cat; it can only be said to be half-chance dead and half-chance alive. The only way to tell the definite state of the cat is to open the box and look at it because it is only by looking at it that the wave associated with the radioactive decay collapses (Schrodinger,1980; Miller, 1987; Omnes, 1999; DeWitt, 2010).

First of all, the randomness of radioactive decay lends quantum theory as compelling proof of a deeper threshold where causes elude complete determination by known classical laws of physics (Appiah, 2003; Anjum &Mumford, 2018; Morvillo, 2010; Stenger, 2009; Diop, 1991; Colson, Hallinan & John, 2004; Zukav, 1979). Accordingly, the radioactive decay is itself held in the superposition of states until an observer elects to measure the state of the cat. So invariably, the observer does not merely discover the state of affairs involving the cat, but he actually contributes partly to creating it as he/she observes proceedings inside the box (Osei, 2006). For before the observation, reality constituted all the possibilities under the given circumstances; the cat is either dead or alive.

It would be recalled that the renowned empiricist and idealist George Berkeley (1901) once remarked that to be is to feature in perception. And since that which is encountered in perception are ideas and ideas require a mind wherein (they subsist), Berkeley invariably left us in a solipsistic world, where only subjects of perception and their ideas exist. As ephemeral as things would be, Berkeley (1901) employed what Bennet (1965, p. 208) calls “the continuity argument” to ground the continuous existence of the world in the absence of finite minds. According to the argument, there is an infinite mind that continually perceives and hence guarantees the continued existence of the state of affairs when finite minds are absent. Since physicalism implies that the electron is in a superposition of states until an observer measures it, and measurement involves observation, then the method of scientific theorizing seems to be exposing a gap in physicalism. For the physicalist thesis logically supplies the evidence that the supposed physical features of the universe are indeed properties of conscious experiences. Henry Stapp (2009, p. 250) describes this view by saying:

> *It is worth noting that the physically described aspect of the theory has lost its character of being a "substance", both in the philosophical sense that it is no longer self-sufficient, being intrinsically and dynamically linked to the mental, and also in the colloquial sense of no longer being material. It is stripped of materiality by its character of being merely a potentiality or possibility for a future event. This shift in its basic character renders the physical aspect somewhat idea-like, even though it is conceived to represent objectively real tendencies.*

One effort to interpret quantum theory in ways that seek to deny the role of consciousness in the constitution of reality is the use of the principle called decoherence. The point about decoherence suggests that a fired electron does not earn its properties from the act of being observed by pure consciousness. The theory attributes the collapse of the wave function to the electron's interaction with its environment through a complex network of physical processes such as the emission and absorption of energy among other properties of physical entities (Morvillo, 2010).

Keen subscribers of this view include Werner Heisenberg (2000) and Yu and Nikolic (2012). A typical example that substantiates the principle of decoherence traces back to Hans Reichenbach who sought to show that quantum theory cannot be used as dress rehearsals to bring back into scientific theorizing what he considered to be dead idealist-motivated ontology. Elsewhere, such attempts may be referred to as "spooky science in the service of religion" or god-of-the gaps technique; which all boils down to the strategy of using incorporeal or divine theoretical postulates to fill in the challenging gaps which science may one day resolve (Frank, 1957; Plantinga, 2001; Krauss, 2012; Saunders, 2002; McMullin, 2001; Ruse, 2001; Gasser & Stefan, 2007). Reichenbach's approach to dealing with the problem is a simple rationale. Since the idealist assumptions gain prominence from the role appropriated for observation in collapsing the state of superposition, then Reichenbach's intervention sought to save physicalism by accounting for measuring systems in a way that does not appeal to consciousness. With particular reference to the radioactive decay in Schrodinger's cat experiment, a conscious observer can be replaced with for example attached photo-electric cells which would use signals to record and consequently draft a written report as reference. The implication is that the observer would only engage indirectly with the happenings in the quantum space by direct acquaintance with the written report from the photo-electric cell. Now, it seems obvious to conclude that the scientist observing the paper report would actually obtain the same result he would have known if he had observed the experiment directly.

Again, the observer's engagement with the data recorded by the photo-electric cell paper cannot alter any ongoing quantum processes since the scientist's reading of the report is excluded from the quantum processes. And even where an observer has to measure the quantum proceedings, he/she only obtains the measurement by way of the recorded data and this interaction pertains between macro-state ontologies (the paper recordings and the observer). Yet, as Plank's constant implies, the higher one goes on the macro-scale of ontologies, the more negligible the associated wave function becomes. So, as the observer interacts with the written report, there is no room nor need for a collapse of any wave function. As such, all probabilities associated with the wave function of reality are all the time-displaced by the constant engagement of other entities of the environment, leaving observers with a particle picture of reality. The accuracy of physicalism seems restored (Reichenbach, 1944; Carnap, 1966). RMN thesis seems to have gotten it right, everything science talks about is down to typical physical properties. Since the year 2004 when Anton Zeilinger first encountered laboratory evidence for decoherence, the explanation has garnered some interesting support (Darling, 2005). It appears nothing other than entities that exude typical physical properties is worth the foundational role in scientific theorizing.

To draw any conclusion, there is a need to analyse the logical force of Reichenbach's point. It seems much more reasonable to attribute the collapse of the wave function to the gamma-ray or any non-conscious measuring apparatus excluding the conscious observer. If this is so, then clearly there is no confusion about the constitution of reality in the double-slit experiment, it is purely an affair between physical entities. Light only knocks the wave function of the released electron, hence, giving it a definite location. Consciousness is therefore required not to interfere with the state of affairs whose record is taken intact by the photo-electric cell, but it only discovers what has already been determined by physical laws. If it were not so, then before shining the gamma rays on the released electrons, we have to suppose that the electron never existed in the first place. The seeming resulting absurd consequence is that throughout the double slit experiment, the gamma rays would have been directed on nothing but smeared mathematical wave-function from which an entity could just pop out into existence. The photo-electric cell kept monitoring the supposed pure mathematical chances until a conscious agency measures the proceedings by way of observation. All of a sudden, as Lovejoy (1930) describes it, the observer's interaction with proceedings collapses a fuzzy mathematical probability into a particle with definite spatial properties; an absolute breach of common sense it seems!

Eugene Wigner is a notable advocate who popularized an idea initially proposed by famous physicist John von Neumann (Yu & Nikolic, 2011; Goswami, 2009). The position commits us to the conclusion that the admissibility of non-physical properties is a necessary consequence of quantum theory. By Neumann's argument, it is in the very interest of mainstream science to have her ontological foundation immune from typical physical laws. If his position turns out very convincing as I suppose, then the place of quasi-physical entities in a world that appears physical is indeed non-negotiable. Suffice it to analyse his intervention in the light of Schrodinger's cat-in-the-box thought experiment. To get the best of Eugene Wigner's critique, we must first adduce a gap-bridging premise from some scholars who argue that the macrocosmic world cannot be insulated from the operations of quantum laws. In other words, since quantum laws govern quantum realities, and all the macro-entities are constituted by quantum realities, then quantum laws ought to ripple up to the macro-scale of existence (Krauss, 2012).

If upward causation is initiated by subatomic particles, then as subatomic particles come together to constitute macro-entities, we expect the result to constitute a compendium of superposition network, not a macro-entity immune from superposition (Osei, 2006; Goswami, 2009). For each subatomic physical structure is governed by quantum laws of superposition and there seems to be no specific point on the ladder of transition from the quantum particle to macrocosmic ontology where the quantum superposition of states ceases its operation (Heil, 2004b; Miller, 1987). Known as the moderate measurement-dependent interpretation of quantum mechanics, the view suggests that macro-scale objects are all potential entities of superposition. Such scholars are therefore skeptical about how macro-scale monitoring systems like photon detectors could be deemed fit for collapsing quantum superposition of states. The logic of their sceptical attitude is such that any substitute for a conscious observer (which intends to be used to bring about the collapse of a wave function) is itself a candidate to be held in a superposition of states because it is also ultimately constituted by same subatomic properties that form a quantum system (DeWitt, 2010). If quantum superposition ripples to the macro-level as presupposed by the moderate measurement-dependent interpretation, then there are some other cogent reasons (s) why superposition is not experienced at the macro-level and this is where Eugene Wigner's argument comes to its own.

Among others, Eugine Wigner argues that if any measuring system such as the photo-electric cell is placed in Schrodinger's box in the former's capacity as a physical entity, then the monitoring device cannot be arbitrarily insulated from quantum laws. For it would likewise be subjected to a superposition of states. This would mean that another monitoring device is required whose measurement of proceedings will collapse the wave-function of the first monitoring device because it is impossible for a supposed wave-function to trigger her own collapse (Goswami, 2009). If one should attempt collapsing the superposition of state of a previous wave function by additional monitoring devices, we should expect compounding the situation as we merely aggregate the superposition of states, a challenge that seems bound to proceed ad infinitum (Hodgson, 2005).

To get rid of the chain of superposition of states, it is compelling that the back (of all the chain of superposition of states) should ultimately stop with a foundation whose basic property is immune from being held in the superposition of states. The collapse of the wave function, thus, seems to compel a certain decision. For something involved in the measurement process to make a difference, its ontological makeup ought to defy the grip of the laws of physics; it should be capable of avoiding being held in the superposition of states (Ney, 2021). Since Schrodinger's equation is supposed to affect all participant physical structures, the obviously fit candidate for halting the regress of otherwise multi-web superposition of states resonates with properties typical of a conscious agency (Wigner, 1961; Osei, 2006; Kaku, 2008; Feibleman, 1972; Miller, 1987; Omnes, 1999; Darling, 2005). So, Zukav (1979, p. 102) concludes that "without perception, the universe continues, via the Schrodinger equation, to generate an endless profusion of possibilities". In effect, science presupposes that not only should the regress stop with conscious agencies but again, such agencies must themselves be unaffected by typical physical laws. In consciousness, therefore, is the potential that grounds the actuality of any concrete existents. The only requirement to render its existence compatible with physical reality is to grant the immunity of consciousness against physical laws.

Hugh Everett proposed a novel and famous interpretation of the measurement problem in ways that sought to deny the role of consciousness in the collapse of the associated wave function. His proposal, originally called relative state but popularly referred to as the multiverse thesis, hypothesizes a larger context of alternative histories in the world. Our universe is only one of many. The values exemplified by the probabilities of the wave function relative to a superposed electron never collapse. Therefore, measurement, and by extension observation are not required to collapse the wave function but only to usher the percipient into one of the existing histories associated with the probabilities of the wave function. This implies that even though reality remains a potentiality in accordance with the wave function, measurement focuses observers on just one aspect of the relative states. When a superposed electron manifests as a particle in our world, all other alternative states also follow a different evolutionary path by splitting into a different co-existing branch of realities. Incidentally, the mere fact of becoming part of one of the possible worlds locks the opportunity to access any experiences in parallel universes. Any conscious entity in any of the parallel universes, then, regards his experiences as all there is (Ney, 2021; Zukav, 1979; Morvillo, 2010; Stenger, 2009). As such, superposition states are touted as real, and all manifestations of the available alternatives actually instantiate as different universes running simultaneously. The dead cat in Schrodinger's thought experiment would be living happily in a parallel universe just as one's existence here may be the worst possible version of one's nobility in another world. The multiverse interpretation of quantum theory was a bizarre suggestion when it was introduced. However, years down the line the thesis has proved to be one of the most straightforward logical consequences of quantum theory. For relative to the measurement problem, it requires no further assumptions about the need for postulating a condition for collapsing the wave function, Schrodinger's equation is all it takes (Everette, 1973; Wallace, 2012; Jammer, 1974; Krauss, 2012).

To be sure, the multiverse thesis raises several inconvenient questions for the physicalist thesis and, as I remarked, these questions can be answered only when mainstream science concedes the foundational role of conscious free will in scientific theorizing. First, the multi-verse thesis is a gross violation of respect for simplicity. Since measurement of quantum states happens all the time, the multiverse thesis presupposes that the split of parallel universe and evolutionary histories piling up till this very moment is just too overwhelming to warrant any meaningful analysis (Darling, 2005). This implies not only a duplication of universes but also of related conscious beings whose awareness corresponds to the parallel universes thereof. The further resulting counterintuitive consequence is personal identity crises since each of the duplicated conscious states could lay what each may deem a legitimate claim to the same identity (Osei, 2006). As Wallace (2012, p. 43) indicates "Why attempt to solve the measurement problem in this (extraordinary, extravagant) way when there are so many other solutions available to us which remain decently confined to a single universe"? Again, by what mechanism is a percipient a subject of say world A rather than world B? If there are no compelling answers to this question then one cannot guarantee that his experiences in a particular world are analogous to the experiences of others (Wallace, 2012)? Clearly only a concession that conscious freewill is an integral aspect of the universe clears such a problem off the table. Therefore, the gaps in the worldview presupposed by mainstream science bear out an appreciation of the underpinnings of conscious free. If African science throws its jurisdiction over a realm typified by such properties, it is only a genuine instance of harmony and collaboration. So, between the African worldview and the mainstream science there is no contradiction, neither should scholars force one into place. In their respective duties, they both exemplify cultural diversity, not competition.

Conclusion

Incidentally, the various developments in quantum theory compel a genuine opportunity to reconsider the ontology admissible in mainstream science. Indeed, in response to this puzzling development (in quantum theory), one of the proposals that surfaced is the suggestion to review the language of physics particularly to include in her framework new terms, phrases and in some cases special revisions (Feigl, 1953). Following this, it appears that as Paul Thagard (1998) indicates, a lack of physicalist foundation does not nullify the scientific status of a theory. We have come to a juncture where hiding behind RMN to dismiss diversity in scientific theorizing is a blatant show of academic intolerance. This is the sort of motivation that leads Brandl (2007) to the revision of RMN to a version he proposes to be called modest methodological naturalism (henceforth referred to as MMN).

Unlike RMN, MMN insists on distancing science from the imposition of ontological commitments (Brandl, 2007). Following this proposal, the implied mandate of MMN conceptualizes science in general as having the right to disengage any form of explanation when there is sufficient proof of violations on grounds of methodology not ontology. So long as a worldview appeals to the general methodological procedure (particularly the use of the method available to the natural science) for conducting an enquiry it is worth the label of science (Giere, 2008; Smith, 2001). Tiddy Smith espouses this thesis at length in his work *The Methods of Science and Religion*. In the said work, Tiddy Smith argues that the proper mandate of methodological naturalism is not to prescribe the sort of ontology mainstream scientific theorizing ought to pursue. In my view, this call has become necessary because quantum theory connects the methodology of science to a world full of possibilities. Accordingly, mainstream scientific theorizing can only bar any ontology, and in this case, quasi-physical properties not because the entities in question do not exude typical physical properties, but only if the procedure used to inquire about these entities concerns procedures other than the one available to natural science.

As Tiddy Smith (2019) remarks, the methods such as faith, divine intuition, or divination are what remain antithetical to scientific theorizing not the nature of the ontological underpinning of a worldview. “Methodological naturalism,” he says, “is a restriction on ways of knowing, not on the metaphysical commitments of theories” (*ibid*, p. 50). Indeed, quantum theory evolves mainstream science from its sole restriction to physicalism. It leads the community of scientists towards a more comprehensive scope of reality, a development Collin Finn (2001, p. 2) calls “scientization”; the spread of empirical science into areas of knowledge that was hitherto typically a preserve of theology and philosophy.

Again, Tiddy Smith’s (2019) view suggests that if RMN focuses on baring entities rather than methods of cognizing those entities, mainstream science would have wrongly prejudged some insightful contribution to our understanding of the universe even before one gets the chance to weigh the substance of the available evidence. Besides, no idea is ever examined in terms of all of its ramifications at any point in time (Feyerabend, 1993). Indeed, some of such ramifications may not even be known because there may not be available tools both conceptually and technologically to achieve a comprehensive evaluation within a given time (Lakatos, 1998). What this means is that there should always be an open room to revisit the worth of ontological postulates that had been ousted by mainstream science. The inspiration to rethink African science stems from this gap. Rethinking African science in respect of its consistency with mainstream science offers a genuine opportunity towards expanding the borders of scientific theorizing in general. African science does not compete, it recognizes the gaps in the good advances mainstream science has achieved. Thus, to rethink African science is to acknowledge the limitations of mainstream science and to appreciate a genuine collaborative will, intent and readiness of both disciplines towards expanding our understanding and control of the universe. There is no competition but laudable co-existence, there is no backwardness but cultural diversity.

In David Chalmers' paper *Why isn't there more progress in philosophy*? He adduced one Darwinian answer worth the attention of those who accused African science of backwardness. According to him, humans may not have evolved to easily understand the fundamental issues typical of philosophical questions. To him, there were no pressures on survival instincts that required any need to nurture the depth of thoughtfulness about deeper questions of existence (Chalmers, 2015). Chalmer's point is that humans did not evolve to readily understand every aspect of reality. For some insight into aspects of reality, one may have to move away from the comfort zones given by one's intellectual ability. African science may not be achieving the sort of progress associated with mainstream science. However, this concession should mean no disrespect to African science. For humans, as Chalmers indicated, may not have evolved to make do with such deeper aspects of reality that characterize the African worldview, especially on a silver platter. Slow but sure, African science is a meaningful body of knowledge to the good people who subscribe to it. So, scholars do not have to measure its worth by setting it up in competition with mainstream science.

Clearly, the nature of hostility claimed to exist between the African worldview and mainstream science is not substantial because scholars have no business looking at the two disciplines in terms of competing interests. The supposed friction is not only empty but a forced dispute that is easily clarified by tolerance for a cap that fits cultural diversity. To be sure, African science is not without imperfections. Nonetheless, these challenges do not legitimize a window for competition between the two disciplines. An effort worth the intent for progress should aim at constituting a method that helps to evolve the discipline from any associated challenges. Because there is no need for competition, constituting this method could be achieved using the assistance of the methodological protocols of mainstream science where applicable. This is the agenda set for the final chapter. For after all, mainstream science has its own limitations too. So, there should be no desire to instigate any competition but complementarity, there is no backwardness but diversity.

CHAPTER FIVE

AFRICAN SCIENTIFIC THEORIZING; IN SEARCH OF A METHOD

Introduction

For a better appreciation of the core objectives of this thesis, the first part of the conclusion compels the chapter to begin with a summary of the salient points from the previous chapters. In chapter two, I examined African science from three different perspectives; functionalist perspective, metaphysico-religious perspective, and critical rationalist perspective and exposed the weaknesses associated with all three orientations in the conceptualization of African science. It became obvious from that discussion that surmounting the associated limitations requires African science to take issues of methodological reorientation very seriously. In chapter three, I set the foundation for a methodological reconstruction of African science by first seeking an appropriate criterion that defines the African orientation of the discipline. In the answer to that question, the preferred criteria for conditioning the "Africanness" of science is said to derive from the nature of ontology presupposed by the method of science. However, on the one hand, African ontology is claimed as spiritual ontology (or non-physicalists), on the other hand, the worldview presupposed by the scientific method is physicalist-oriented. From this categorization, a major problem is just forthcoming – for it appears one might commit a category mistake to trigger a cross-fertilization of ideas between two worldviews that do not agree on the fundamental essence of reality.

So, in chapter four, I examined in detail the nature of African ontology. It turned out that the essence of typical African ontology is inconsistent with typical spiritual ontology. In proof of this, I showed the harmony that exists between both worldviews by establishing theories and principles of science as a pivotal framework for understanding and appreciating the African worldview. One essential property of the African worldview appeared to be inconsistent with the worldview of science. This is the property that characterizes African reality as personal agency; the properties typified by consciousness. Following the tenets of what Joyce Engmann, Kwesi Wiredu, and Kwame Safro classify as quasi-physical entities, I used advances in quantum theory to show that the essence of reality presupposed by science corroborates properties typical of conscious-freewill. Consequently, the indication is that there is no fundamental contradiction that requires one to reject the African worldview upon accepting mainstream science. For their differences is only a matter of cultural diversity, not a disagreement about the fundamental essence of reality. The kind of existing unity between the two disciplines implied at least two clarifications in terms of the character of the African worldview. First of all, it demystified the indigenous African worldview as it clarified African spiritualism with a more dynamic concept of reality (quasi-physicalism). This rethinking of the African worldview lays a foundation for appreciating the unity that comes with diversity. The reconciliation brought forth by the analysis means the rendition of African science as backward is of no effect.

This chapter continues the narrative from here as the agenda to rethink African science still rages on. Accordingly, the second aspect of the chapter is to conclude by drawing support from the summary of African worldview to constitute an African-oriented method for scientific theorizing. The third aspect is to put forth some recommendations for further studies on the basis of findings advanced by the study. To accomplish the second feat, the focus is to infer a hybrid (methodological) framework that renders the methodological protocols of mainstream science an integral part of African scientific theorizing. This, then, invite the need to say something in defence of why an agenda to build an African-oriented scientific method should end up engaging resources from the methodology of mainstream science.

It appears that unlike typical African worldview, mainstream science limits its operations to a realm of concrete ontology (physicalist worldview) whereby compelling empirical results, precise progress in knowledge can be readily verifiable. As I noted in the problem statement (of chapter one), there are scholars with notable concern about the concept of African ontology. A cross-section of scholarly opinion suggests that methodological modalities under which the typical indigenous African tried to understand how the universe works hinder the effort at achieving progress in knowledge inquiry. Indeed, this very concern about engaging a supposed mysterious worldview is blamed for the stagnation of the discipline (Wiredu, 1980; Evans-Pritchard, 1976; Akpan, 2010; Asouzu, 1998; Gyekye, 1997b). Despite my advocacy to discourage the need for any competition, it is equally important to take the call to reorient the method of African science seriously. For as ample evidence also shows, the way the indigenous African goes about accounting for explanations is not all rosy; it comes with striking imperfections.

It appears as often suggested that early Western anthropologists, particularly the missionaries, lacked an in-depth understanding of the customs, traditions, and belief systems typical of indigenous Africa (Moore & Sanders, 2004). In *Things Fall Apart*, a hint of same idea comes across. Yet, this should not suggest to us that all accusations against African science are a result of unmerited criticism stemming from ignorance. Interestingly, in (same) *Things Fall Apart* the narrative further notes that in themselves, not all the African subjects who understood African knowledge systems regarded their beliefs as completely free from salient challenges. Indeed, some indigenes had grown weary about what they considered to be deep-seated problematic aspects and manifest contradictions associated with the indigenous worldview. As Wiredu explains, between mainstream science and religion, the lack of empirical evidence associated with religion may force a kind of imbalanced evidence that would favour the choice of mainstream science. In such situations, conditions that may lead one to choose religion (over science) may be associated with faith. However, when it comes to religion, the common requirement for accepting the related worldview in question is faith. Yet, if faith is all that is required, then it should be difficult to decide between two competing religious faiths without regard for other considerations. This is especially so because it does not make sense for one to let go of the "bird" in hand in anticipation of a similar fortune in the bush for no compelling advantage (Wiredu, 1889). Thus, one is forced to take the challenges facing the worldviews typified by indigenous religion as an important consideration that best explains why some indigenes rejected aspects of their cultural beliefs as negative in favour of the Christian faith. So, to escape what they probably considered as one "evil", a cross-section of indigines fell for the alternative worldview offered by the missionaries (in the name of Western religion) despite probably, the similar or worse untold consequences (Achebe, 1986; Niehaus, 2013). My point is that even the indigenous people themselves could not have found the African worldview so fit for purpose beyond the need for rethinking.

In terms of specific related examples, there are, no doubt, several concerns that fit the bill. A few familiar ones, however, strike one immediately as premises that justify why the call for reorienting the method of African scientific theorizing cannot be brushed under the carpet. First of all, to the African, speech is like light (in the Western sense) and words are its photons, so, as Hamminga (2005b, p. 86) further notes, “The speaker sends them to hit you, and they change your energy level”. Some practitioners of African science do communicate particularly harmful predictions quite vaguely, usually devoid of specific targets. This is very particular with the idea of curses which are often regarded as a powerful tool that can interfere directly with the welfare of those to whom it concerns (Nkulu-N’Sengha, 2008; Westerlund, 2006). To give some examples, “Your enemies will not see the light of day”, “Peace shall elude your foes” etc. (Bascom, 1991, p. 75). So, these pronouncements of harm have several targets spread across varieties of beings such as perceived witches, thieves, sorcerers, etc. (Evans-Pritchard, 1976). In circumstances typical of such predictions, nearly all deaths that occur in the related cultural milieu are one way or the other, confirming observational evidence of the vague prediction presupposed by a curse. The bottom line is just as Appiah (2005) rightly notes, for every prediction made, evidence seems to abound everywhere.

Among the Lugbara for instance, a man who often sits all alone is a suspected witch because he is likely to be brooding over his wrongdoings and evil thoughts. So, people try to be chatty, and sociable. Then again, a person who appears sociable without apparent reason is a suspect of witchcraft force, trying as hard as he/she can to delude his victims into having a false sense of security (Middleton, 1960). At one time, death could confirm a ritual aimed at vengeance in whose case the victim may be regarded as a witch behind an identified misfortune. Meanwhile, for another family, the same death would suggest the victimization of an innocent being by a suspected witchcraft force (Evans-Pritchard, 1976). Among the Kongo, medicine could be administered to expose witchcraft forces. If it works, the potency of the medicine is confirmed. If it does not, it confirms the ingenuity of the witchcraft force that eluded efforts at foiling its powers (Westerlund, 2006). Truly, evidence seems to abound everywhere.

At all costs, it appears a welcomed gesture to interpret any phenomenon as evidence for one thing or the other. In *Things Fall Apart*, every clan or village had an extension of thick vegetation called the Evil Forest. It is a burial ground for people who died of supposed abominable diseases like leprosy. It was therefore believed to be a home that hosted all manner of sinister forces. When the missionaries first arrived in the village of Mbanta, they were given the Evil Forest to build their church in expression of the fact that the missionary was not welcomed in their land in the first place. As such, the Evil Forest is an offer that no right-thinking member of the society is expected to accept because occupant forces would strike dead any inhabitant (in this case the believers) latest by the end of the fourth day. To the surprise of Mbanta, the missionary sect was very pleased with what they (the missionary) considered to be a heartfelt charitable gift of land. They finished building the Church without a scratch on their skin. However, the people of Mbanta took the occasion as a further confirmation of another belief they were equally very much certain of. This was the belief about the occasional patience of ancestral powers even to the extent of entertaining defiance against indigenous customs for as long as seven market weeks.

However, when the church had grown to become stronger, that in itself also confirmed another belief. It suggests to indigenes that the gods did not want such deviant missionaries to live among the populace of Mbanta and therefore their seclusion in the evil forest alone was regarded as a sufficient punishment from the gods. In a related event however, when Okoli had died the following day after he had killed a sacred python, his death was taken as a confirmation that the gods have no patience in dealing with deviants (Achebe, 1986). Apparently, because Azande sees evidence abound everywhere, Evans-Pritchard (1976) notes that their beliefs are to themselves axiomatic, and seems to them unthinkable for other persons to doubt those beliefs. In chapter one, I indicated a critique of the metaphysico-religious perspective which plays out here. This way of entertaining beliefs makes the appeal to false cause a wake-up call.

A closely related case concerns an African society where indigenes refused the services of modern power plants in supplying clean water simply because of the belief that the gods would be offended by the attendant noise pollution from the power plant (Inokoba, Adebowale & Perepreghabofa, 2010). This is particularly a serious threat to the livelihood of society if one considers how, as Horton (1967) reports, no number of repeated failures in testing such beliefs suffices as counterevidence. To be charitable, there could be legitimate concerns about noise or sound pollution following the installation of the power plant. So, at first sight, it may appear as though, like the narrator had Affia to say in *Homegoing*, the association of phenomenon to agentive forces are mere allegories told to caution people against the social implications of one's decisions or actions (Gyasi, 2016). From such interpretations of the African worldview, it appears associated rituals of indigenous African society are mere symbols whose function is to serve as a constant reminder that keeps in check some fundamental implied values cherished by the related societies (Osahon, 1998). So, Wiredu (1980) for instance notes that the belief in ancestors living a kind of mundane life where they are ever ready to take a sip of libation is rationally indefensible.

Anthony Appiah seems to be urging that beyond the symbolism therein, some Africans till this day have been entertaining same beliefs and performing same rituals in demand for interventions from the gods. As he further intimates, if such Africans are rational, then one would expect them to tell that it simply does not work (Appiah, 1992). So, the fact that the belief systems still persist should arouse our curiosity not for quick arm-chair judgments, but for self-introspection about whether we have really understood all that is going on relative to the African indigenous belief systems. Thus, an unprejudiced effort to understand the indigenous Africans should invite one to delve deeper by asking questions about not what it is that they believe but how they came to form such beliefs in the first place (*ibid*). In other words, the quest for a better understanding should take us beyond the metaphysics to investigate the epistemic grounds where we interrogate the very methodological protocols that gave rise to such beliefs in the first place.

At last, the situation leaves one with no other choice but to do some diligence that focuses on examining the criticality of the method under which such beliefs are validated. This is especially important when, as in the case of refusing the installation of a power plant, some belief systems involved are potentially life-threatening. Indeed, the African culture coupled with inherent belief systems is significantly important to the well-meaning populace that subscribes to it. After all, as Wiredu (1980) acknowledges, the hallmark of an African orientation to a discipline is first of all the sensitivity to nurturing what is relevant to the African situation. Yet, as Bodunrin (1981) cautions, based on sufficient evidence we must also tamper the culture of building African knowledge systems with a sense of criticality that reflects our genuine quest for truth. And if this should end up eliminating unproductive beliefs, there really is no point in being glued to them. Conversational rethinking of the method of African science is aimed at achieving just this. The ideal business is as Ochieng-Odhiambo (2010, p. 200) would say "sifting through our legacies: retaining that which is alive, casting off that which is lethargic, and critically fusing the heritage of the past with modern scientific conceptions"

So, clearly, stakeholders of African science have to dispassionately reflect and welcome as many criticisms as are constructive. For that matter, it serves a well-meaning intention to use the collaboration of the methodological protocols of mainstream science in addressing or fixing possible gaps in the methodology of African science where applicable. After all, there is no competition. To be sure, then, the exercise is not an opportunity to use a back door to exchange or superimpose the method of mainstream science on indigenous knowledge systems. For the context of rethinking African science here seeks not to alter the African worldview to suit the methodology of science but vice-versa. So, in the end, the aim is not to collapse any one of the methods into another, but to draw their strength together in ways that better serve the interest of African scientific theorizing. For reference sake, the method under construction is to be called African conversational science.

African Conversational Science

When it comes to the logic of scientific discovery, the standard view in philosophy of science draws a clear distinction between two methodological contexts. One methodological context constitutes proposals about the procedure by which a scientist suggests an idea pending the sort of test that justifies its claim to science. In other words, the context concerns how scientist generates a hypothesis; a tentative idea from which is inferred consequences for testing. In Popper's view, this idea continues to retain this tentative status even after passing a test put in place to refute its consequences (Kothari, 2006; Popper, 1996). The second methodological context is about the considerations that validate a proposed idea (hypothesis) as duly scientific knowledge. In the first context, one of the positions is associated with inductivism. Inductivism holds that laws and theories in science ought to proceed from the logic of induction. Accordingly, the requirement is such that science should begin from careful observation of particular instances, and these careful observations should be the basis from which the scientist infers a generalized idea called a hypothesis (H) (henceforth I use hypotheses to include theories laws). Another alternative view that concerns the first context is often associated with hypothetico-deductivism (henceforth referred to simply as H-D) (Curd & Cover, 1998). This alternative limit the logical procedure of scientific discovery to specifically the method of deductive logic (Gillies, 1993; Gimbel, 2011; Morvillo, 2010; Derksen, 1985; Rosenberg & McIntyre, 2020). As the name suggests, the method combines two concepts, "hypothesis" and "deductivism". As the indication holds, this presupposes that the method associated with H-D begins first with generating a hypothesis (Whewell, 2011; Irzik, 2008; Feibleman, 1972).

Following the method of H-D, a hypothesis should be motivated by a bold conjecture that has not yet been observed, in fact, a prediction so bold that it is so improbable given previous knowledge. The requirement seeks to prevent situations where scientists could pile ad-hoc successes for theories by simply hypothesizing a claim whose truth is a likelihood prior to the performance of any test (Popper, 2005; Putnam, 1991; Whewell, 2011; Lakatos, 1989; Appiah, 2003). This is the typical advantage of H-D that makes it a suitable logical basis for foiling a challenge facing the method of African scientific theorizing. Apparently, the culture of scientific theorizing among the Azande is such that claims are often made under conditions that already favour their likelihood (Evans-Pritchard, 1976). In such cases, the abounding empirical proofs seem to be simply ad-hoc. In *Things Fall Apart*, for instance, the people of Umuofia are notably very strong and are therefore feared by neighbouring towns. Yet, a precondition for winning a battle is that before the people embark on any war, they are supposed to clear off their innocence before an oracle (Achebe, 1986). So, it appears that even if the strength of their human resource brings forth any victory, their success story is considered a gift of intervention by the oracle of the Hills and Cave who preordained the win because the oracle supposedly found Umofia's case to be a just one.

Applied to African scientific theorizing, H-D gives an urge for progress as it requires a hypothesis involved to maintain an appreciable risk of failing a related test (Popper, 2005; Graybosch, Scott & Garrison, 1998; Putnam, 1991; Whewell, 2011; Lakatos, 1989; Appiah, 2003). Precedents in mainstream science include Nicolaus Copernicus' revolutionary idea of heliocentrism, Alfred Wegener's idea of continental drift and Galileo Galilee's idea of free fall (Dawkins, 2012; Couvalis, 1997). In relation to African science, however, eliciting such novel ideas (hypothesis) has the right to be inspired by traditions, intuition, taboos, divination, etc. This means that given the context of H-D, the indigenous knowledge systems only play the role as the basis for inferring a hypothesis for testing.

As far as African conversational science is concerned, the import of hypotheses keeps ontological forces to the role as the agents of causality. As I noted in chapter three, this is the requirement that ensures the Africanness of the discipline. However, before testable consequences can be inferred from a hypothesis in question, the properties associated with African ontological forces require the intervention of another proposal. Typical of the African forces, Kelly Smith in his work *Appealing to Ignorance behind the Cloak of Ambiguity* proposes two methodological assumptions for thinking about ontologies considered as conscious parties. For him, it is a matter of important concern whether or not the motives and actions of such entities in question can be rendered transparent and meaningful to human understanding. In the context of this concern, two assumptions lend themselves up for consideration. The first, mysterious divinity assumption, presupposes that the actions and motives of an entity in question are beyond anything transparent or comprehensible to human reasoning (Smith, 2001). So, when these sorts of entities are put at the center of any explanation, the answers one obtains are just as bad as an arbitrary conclusion. The reason is that given their mysterious ways, when two contradictory explanations are linked to the actions of same entity, there is no basis for preferring one over the other. Nevertheless, the more troubling aspect of this assumption is that it makes it impossible for humans to nurture any relationship with such entities. This is because, as I indicated, there are simply no clear modalities to render their aspirations, goals, ideals, and values accessible to human understanding. And without any assumptions to bridge this gap, there is no common ground to initiate any meaningful relationship.

This brings one to Smith's second methodological assumption; the rational divinity assumption. The possibility of initiating any meaningful relationship between two parties begins with some assumptions that are in some ways accessible to both parties (*ibid*). These assumptions are principles that account for the ideals, values, and goals of the parties involved. This supposed assumption about the divinity involved is the rationale scheme that makes it possible to evaluate the decisions and actions of the entity in question. Practitioners ride on a set of assumptions to pursue rituals intended to, for instance, placate, appease convince or even force one party to act in a certain way (either beneficial or destructive to society). Accordingly, the presumption that such forces act in ways accessible to human cognition provides a guide to deducing some consequences that could be subjected to the art of corroboration or refutation.

Across several indigenous societies, Africans entertain the belief that one can enter into a meaningful interpersonal relationship with ontological forces. Indeed, in the wisdom of the Mbuti, the forest is a personal agency that ought to take care of the inhabitants of the land. If a run of game-hunting yields poor results, the belief is that the forest has simply lost interest in the existing relationship, and through cuddling, the people can rekindle the relationship with an art of singing (Appiah, 2003). This belief that one party can access the intention, aims, goals, and motivations of the other party, then, sufficiently triggers the application of rational divinity assumptions. In other words, the belief in the possibility of forming a relationship with ontological forces indicates that actions and inactions of African ontological forces are exercised according to rules and principles readily accessible to the human mind (Teffo & Roux, 2005). So, for example, from a rational divinity assumption, it may be concluded that like humans, ancestral forces likewise expect to get constant attention from their subjects. Indeed, the idea that ancestors have a sense of appreciation for human attention is a key motivating factor for the institution of indigenous festivals as it sets a period of reminder to reignite company with the higher Forces. This further explains why ancestors are said to impose hardship on subjects as a reminder to pay respect to the dead (Ashforth, 2004). So, from such rational divinity assumption, one can adduce a hypothesis that says "All venerations of ancestoohood lend the farms of the subject [involved] to the experience of bounty harvest" (Essien & Falola, 2009, p. 155). The implication is that in terms of categorization of the sciences, African science is in the company of behavioural sciences since it seeks to theorize an explanation of the phenomenon and subsequent predictions with recourse to the dispositions, intentions, actions and inactions of ontological agencies (forces) at work.

As I indicated earlier, from the first context (of obtaining a hypothesis), the next stage in the proceedings of the scientific method (context of scientific justification) is about the methodological procedure for validating an obtained hypothesis as a scientific body of knowledge. From Olu´fe´mi Ta´i´wo’s work *Ifa´: An Account of a Divination System and Some Concluding Epistemological Questions*, a view that comes across (from the Yoruba perspective) in terms of the performance of this function is the confirmation theory. Before evaluating the suitability of African science to the proposal, it is important to begin the conversation by first explaining the anatomy of confirmation theory. As a theory of the method of justifying scientific knowledge, the confirmation theory operates according to the following scheme:

Hypothesis (aspiring to be confirmed as a theory)
Auxiliary statements $\boxed{\mathbf{G}}$

Prediction (I).

Confirmation theory presupposes that a hypothesis and an auxiliary statement (together constituted as G) entail certain consequences given as (x) ($Gx \supset Ix$). This implies that for every x, if x is a property that identifies with G (say water), then x must exhibit a characteristic trait typical of property (I) (say it must boil at 100 degrees Celsius). To prove this, a scientist must obtain something that identifies with the properties of water. Subsequently, the scientist should proceed to gather empirical evidence of water in a boiling state at a temperature equal to 100 degrees Celsius (Carnap, 1966; Couvalis, 1997; Appiah, 2003). So, by way of confirmation theory, the way to justify a theory as science is (for the scientist) to find an observation of something with the properties of water (G), with a further empirical observation that suggests that it boils at 100 degrees Celsius (I). An observation that satisfies "G • I" (where "•" is indicative of conjunction) justifies the scientific status of the claim "All water boils at 100 degrees Celsius" (Hajek & Joyce, 2018).

Relative to African scientific theorizing, a diviner diagnoses a problem at hand and informs a client of what sacrifices need to be executed to avert the occurrence of further torrential consequences. Subsequent to the observance of the sacrifices, if one observes that the problem ceases to manifest or good fortunes accrue, the diviner's insight is considered a confirmed hypothesis. Take for instance the earlier hypothesis; "Ancestral veneration produces bounty farm harvest". The terms of confirmation theory suggest that should a subject fulfill his/her part of obligation by venerating the ancestral forces through the performance of sacrifices (G), he/she should expect blessings in terms of bounty harvest (I). To the indigenous African, then, the express import of experiencing a bounty harvest after the fulfillment of his/her part of the obligation counts as confirmation of the hypothesis (Taiwo, 2004; Horton, 1967; Frisvold, 2016). Other circumstances reducible to instances of confirmation theory at play include situations where people are said to die when supposed enemies have consulted ontological forces for revenge (Appiah, 2003). Similarly, there are also reports of people who got well from chronic diseases when supposed spiritual therapies and medicines were administered (Gyekye, 1978).

However, confirmation theorists further suggest that the sort of empirical evidence that can legitimately confirm a given hypothesis must live up to standards that identify such claims as scientific laws (Goswami, 2009; Carnap, 1966; Appiah, 2003). Indeed, it is often suggested that science is impossible without laws and therefore all genuine sciences are advanced towards the discovery of natural laws (Ruse, 1998; Plantinga, 2011; Mellor, 1998; Hergenhahn & Olson, 2001). As Roberts (2004, p. 151) reiterates "a field of study can only perform the tasks of science if it is capable of discovering laws". Confirmation theorists insist that this intervention is necessary to exclude accidental generalization from true generalization (Sankey, 2008; Anjum & Mumford, 2018). In other words, an important condition underpinning confirmation theory is such that the only admissible observations that can confirm a hypothesis are those that can stand the test as scientific laws. So if a phenomenon is not a result of scientific law, then no matter how many positive results an observation yields in favour of the hypothesis, it cannot confirm its status (as a scientific theory). This is corroborated by Nelson Goodman (1955, p. 74) as he clearly notes "Only a statement that is lawlike-regardless of its truth or falsity or its scientific importance-is capable of receiving confirmation from an instance of it; accidental statements are not".

Before subjecting African scientific theorizing to such a demand (which requires that a proper confirmable statement should be law-like), it is important to assess the reason (s) that compel science to take the search for laws with all due seriousness. By implication, the answer to this question is important in estimating what African science could be losing if it fails to take the call to pursue laws seriously. To put the importance of laws in perspective, then, a classical view championed by Carl Hempel is in wide currency. It suggests that the core mandate of science is to render explanation and prediction and these are essentially functions of scientific laws. In other words, as Rudolf Carnap reiterates, scientific laws are used to (i) explain known facts and (ii) predict or retrodict hitherto unknown facts. So, before one can render an explanation or prediction deemed scientific, reference should be made to a law that subsumes the specification of local facts and conditions (Klemke, Hollinger & Rudge,1998; Carnap, 1966; Hempel, 1966; Ruse, 1998; Mellor, 1998; Swoyer, 1982).

Indeed, some philosophers insist that explanation requires more than mere invocation of laws and initial conditions. James Woodward in his work *Explanation* summed up three of the very popular counter-arguments against the use of laws in rendering explanations (i) the problem of asymmetry, (ii) the problem of irrelevant information and (iii) the possibility of explanation in the absence of laws. To remedy the situation, it is often suggested that laws can only render a sound basis for an explanation on the condition that they are causally connected to the phenomenon they explain (Klemke, Hollinger, & Rudge, 1998; Appiah, 2003; Woodward, 2008; Godfrey-Smith, 2003). That said, Railton (1998) however notes that such criticism against the role of laws in scientific theorizing seems to only demonstrate the insufficiency, inadequacy or incompleteness of the role Hempel assigns to laws, not its irrelevance. Again, some views of which Carnap and Ruse are notable representatives defend laws against particularly Woodward's third counter-argument. Per the defense, explanations that appear to be free from laws are in disguise underpinned by laws. The reason such laws go unnoticed is because the explanations exempt premises and therefore, such omissions are implicit presumptions of laws so familiar that it is unnecessary to expressly state (Carnap, 1966; Ruse, 1998). So, I shall proceed on the assumption that no well-meaning argument has neither downplayed the importance nor eliminated the usefulness of laws in scientific theorizing. If so, then the bid to rethink African scientific theorizing should make the pursuit of laws a necessary condition for coming out with an acceptable explanation.

Having established the importance of laws in scientific theorizing, the next agenda should delve into analyzing the details of what constitutes a proper scientific law. Generally, a scientific law is a universal account of a regularity (Rickles, 2020; Godfrey-Smith, 2003). However, not all regularities are regarded as nomic. Therefore, even though scientific laws ought to be an event that exhibits an established regular pattern of occurrence, not all regularities instantiate a scientific law (Swoyer, 1982). Indeed, a very familiar problem relative to scientific laws relates to how to distinguish Humean accidental generalization from regularities that are typically nomic (Armstrong, 2016; Swoyer, 1982). The rationale for taking the distinction seriously is this. A prediction that turns out true may be a result of sheer luck, spurious correlation or accidental recurrences. The only way to distinguish such incidents from true state of affairs is to accumulate critical evidence to show that the fundamental blocks of the world really work by such principle as exemplified by the regularity in question (Putnam, 1991).

To draw this distinction, laws are expected to go beyond describing an existing state of affairs and by so doing, they are further required to consolidate regularities as fundamental properties of physical states (Ruse, 2001). As such, scientific laws are deemed to be binding on hypothetical cases that bear the description of such physical states. In technical terms, the explanation put the most essential feature of a scientific law down to its ability to support counterfactuals (Tooley, 1977; Lange, 2002; Niiniluoto, 2012; Lange, 2008; Roberts, 2013). Thus, we do not know whether there are an infinite number of planets in the Milky Way galaxy. Nevertheless, if there were, Kepler's laws impose on them the duty to follow a path that corresponds to an elliptical axis around the sun (Weinert, 1995). So, commitment to the revolutionary axis around the sun is a law for any supposed planet in our solar system. Unlike accidental generalizations, the reason scientific laws support counterfactuals is that it rides on an underlying force that commands a particular outcome when the background assumptions are in place. So, it is an accidental generalization that all substances in my pocket are currencies. For there is no law-like connection that commands necessity between substances found in my pocket and currencies. In other words, there is no force intrinsic to my pocket which prohibits a non-currency from intruding, neither is there any causative power that converts the content in my pocket into currencies (Lakatos, 1989). So, when Hume talked about the inability to observe the secret powers that make bread something nourishing, he was indeed alluding to this requirement where scientific laws are clothed with the capacity to command a particular effect (Hume, 2007; Appiah, 2003).

Yet, if laws must govern counterfactual cases (such as the possible existence of a 10th planet), then there is another concern that threatens the suitability of observation as a basis for justifying statements of scientific laws. This difficulty is about how a scientist can be so convinced that the sanctions of a scientific law would be complied with by related objects which, relative to counterfactuals, have not been found to actually exist. In other words, how do scientists infer from an observation that because for instance, nine planets follow Kepler's laws, then, if a tenth planet does really exists, it would also obey same Keplerian laws? The answer comes from another requirement simply described as the principle of replication or repeatability (Hergenhahn & Olson, 2001). As such, if an account of regularity cannot be predictably replicated, then a generalization of that regularity in question cannot suffice as a scientific law. The presumption is that because accidents just happened to occur without any necessity, successive testing may at one time expose any sheer coincidence. By this, scientific theories sufficiently eliminate the sort of biases that stem from personal intuitions and fabrications, as the laws being sought for are said to be an impersonal mechanism on which the workings of the universe are founded. So, scientists ensure that instances of regularity are true laws if such regularities have the effect of the replication principle (Klemke, Hollinger & Rudge, 1998; Lange, 2008; Arabatziz, 2008; Gross, 2020).

Before evaluating the prospects of African science relative to the pursuit of fundamental laws, it is worth exploring the different conception of laws that underpins scientific enquiries. In scientific theorizing, laws are categorized into at least three broad categories; (i) nomic necessity or necessitarian account of laws, (ii) probabilistic account of laws/regularity and (iii) ceteris paribus or hedged account of laws (Roberts, 2004; Carnap, 1966). The first, strict regularity or necessitarian account of law suggests that science discovers laws of the form $x\ (Fx \supset Gx)$, otherwise expressed as (All Fs are Gs). Such a conception of laws implies that the property of F-ness has a necessary connection with the property of G-ness. As indicated by the universal generalization, lawlike expression is not localized or directed to particular matters of fact. It is supposedly meant to be followed by all related items in all possible worlds (or universes whose description does not entail self-contradiction) at all times, past, present and future. In other words, at any given place and time, if there is a certain physical condition of F (as admissible under the law), the observation of G is a necessary implication and any single counter instance is supposed to disprove the law in question (Carnap, 1966; Feynman, 2011; Anjum& Mumford, 2018; Mellor, 1998).

Generally, confirmation theory is conditioned by two different assumptions about the standards of proof, namely confirmation by verification and confirmation by probability. Since the necessity view of laws insist that laws are complied with at all times and at all places (Tooley, 1977), then it suggests that a favourable observation suffices as conclusive proof. In other words, an observational statement that entails "G • I" (where "•" is indicative of conjunction) conclusively confirms a generalization in question. So, if an observation is found consistent with a hypothesis, then the generalization in question constitutes a true scientific law (Carnap, 1966; Ayer, 1960; Cozic, 2018; Hajek & Joyce, 2008; Hempel, 1960; Schlick, 1960). On the contrary, if β is observed such that β is "G • not-I", then the generalization aspiring to be considered as a scientific law is conclusively disproven (Nicod, 1930; Ayer, 1960; Hempel, 1965; Pietroski & Rey, 1995; Hempel, 1960).

Verificationist's interpretation of confirmation theory has lost appeal among theorists, and for the same reason, it cannot be considered as a legitimate basis for sustaining African scientific theorizing. In an investigation, the items of the world to which a supposed scientific study concerns, say trees, fishes, human beings, etc. is called the universe or population. The entire enumeration of all the items that constitute the population under study is called census enquiry. Given the possibility of other universes, it is practically impossible to undertake a census enquiry. So, no number of observations made suffices as conclusive proof of a generalization (Krauss, 2012; Hempel, 1966; Pietroski and Rey, 1995; Colson, Hallinan & John, 2014; Feibleman, 1972).

For the same reason mentioned in the foregoing, there is an infinite number of living forces relative to the African worldview. Across the terrestrial realm alone, the African worldview consists of potentially an infinite host of forces; human beings, minerals, trees, and animals (Tempels, 1959, Hamminga, 2005; Westerlund, 2006). Consider the plethora of minerals that have not been discovered and even those that may never be discovered. Consider the vastness of terrestrial forces (animals, rocks, rivers), particularly the numerous trees that exemplify delegated powers (Middleton, 1960; Essien & Falola, 2009). Clearly, the scope of available forces makes the use of census enquiry quite impracticable.

Following this limitation, the indigenous Africans appear to have had at least a fair appreciation of why verificationist theory has no place in scientific theorizing. This inference seems to explain why, as Evans-Pritchard (1976) indicates, the Azande does not generalize a failed hypothesis. A falsified instance of a hypothesis may simply be one out of the many exclusive instances which remained uncovered by the initial sample size. This also explains why some scholars stick to describing African scientific theorizing with a scope that always constraints the validity of conclusions to specified context, usually in terms of a particular geography, society or people (Chimakonam, 2012b; Emeagwali & Shizha, 2016). So, the fact that the Mbuti finds his/her belief about the causes of certain phenomena in flagrant contradiction to what neighbouring societies believe does not necessarily put whatever knowledge in contention into any crises (Appiah, 2003). Under the circumstance where there are potentially infinite entities of any item under study, the use of sampled size cannot warrant conclusive proof as presupposed by the verificationist assumption (Nola & Sankey, 2007; Appiah, 2003; Blin-Stoyle, 1997; Goodman, 1955; Ayer, 1960). And for this same reason, the theory is not a reasonable option for constituting a theoretical foundation relative to African scientific theorizing.

The strict regularity view of laws has been criticized under advances from theories in physics and Nancy Cartwright's work *Do the laws of Physics state fact*? is widely known for this stance. Indeed, her initiative was quite novel because, before her effort, the problem she sought to demonstrate had only been used to question the scientific status of the non-basic sciences; psychology, economics, history, etc. (Pietroski & Rey, 1995; Hitchcock, 2004; Anjum & Mumford, 2018; Earman, Roberts & Smith, 2002). Yet, if Cartwright's plea is successful, then the basic of all sciences, physics for that matter, is itself not immune from such challenge. This would further imply that in terms of the standards of proof required, there is really no divide between the natural sciences and particularly the social sciences (Kincaid, 2002). In rethinking the method for African scientific theorizing, my contention is a simple plea; conformity to strict laws by a supposed scientific theory is not a necessary condition. For this reason, African science is, to wit, not bound to live up to its condition. However, before I take a look elsewhere for an alternative, it is important to explain why.

In challenging the significance of the necessity view of laws, Nancy Cartwright draws an explanation from the law of universal gravitation. She shows that between charged particles, the law of gravity is inoperable. Its impact is altered by other forces typical of electrical charges acting within the same field. So, as she says, laws only describe certain abstract powers, but for practical purposes, they do not specifically constrain the behaviour of objects they supposedly concern (Cartwright, 1992). The indigenous African's belief that causes cannot stand in isolation seems to have some backing here (Hamminga, 2005). In furtherance of the same point, Michael Morreau (1999) intimates that if laws are conceived as universally binding, then they fail to apply to anything one can think of. For there are no such cases where the behaviour of an object is a result of a single related force in action. As such, laws of nature are not universally true because their application simply breaks down in one frame of reference or the other (Hitchcock, 2004; Dretske, 1998). It may however be contested that exceptions do not really pose any danger to the strict necessity view of laws. The basis of the contest is such that laws obtain the warrant of strict necessity once one can complete the set of all the admissible exceptional conditions (Lipton, 1999). So, for instance, the suggestion may hold that a law would still conform to strict necessity criterion in situations such as "Where condition a, b, or c are inoperative, All As are Bs". The seeming challenge now concerns whether at all material times, one can have a complete knowledge of all the conditions to complete the exceptional gaps admissible under a specified law. In Cartwright's (1998) opinion, doing so will occasion a kind of trade-off by which laws would practically lose their explanatory power.

Again, advances in quantum theory suggest that strict laws have salient limitations when reality is reduced to its fundamental building blocks. As I elaborated in the previous chapter, the strict necessity view of laws presupposes a deterministic universe. At the most fundamental level, the universe seems governed by a regularity that is not, strictly speaking, deterministic (Klemke, Hollinger & Rudge, 1998). This kind of law is referred to by Roberts (2004, p. 153) as probability regularities. As Armstrong (2016) intimates, if we take science as governed by the strict nomic necessity, then the probabilistic distribution of events in quantum theory poses a problem of admissibility into science. Not only is the history of science replete with theories churned out in terms of probability laws, but in modern advances in physics, probability theorem seems to be the best statement of law ever discovered (Galavotti, 2008; Hawking, 1996; Gribbin, 2013).

In support of the role of probability laws, Railton (1998, p.746) indicates that because physical indeterminism is deeply rooted in the very way the world works, the universe should at least be partly understood by what may be called "lawful chances". So, indeed, developments in quantum theory show that the necessitarian view of laws is at best only sufficient but not necessary in scientific theorizing. If science insists on discovering only laws of strict necessity, then quantum theory, the greatest intellectual feat of modern science, risks losing classification as a body of scientific knowledge (Wallace, 2012). This is the all-important reason why even though Popper (2005) had a very legitimate criticism against probability laws, he was nonetheless unwilling to dismiss its claim to be part of the nature of scientific laws. It appears, then, that science cannot at least put all explanations under the auspices of nomic necessity. As such, the commitment to scientific theorizing must accordingly be tampered with a moderate conception of laws. On that note, an alternative conception of scientific laws is probability laws/regularity. Unlike the necessity view of laws, probability laws are confirmed on the basis of relative frequencies (Frank, 1957; Niiniluoto, 2012).

Indeed, following the demise of verificationism, the term "confirmation" is usually understood as the subsequent amendments in ways that seek to address the associated challenges (Rosenberg & McIntyre, 2020). As Carnap (1966, p. 21) for instance notes: "At no time is it possible to arrive at complete verification of a law. In fact, we should not speak of 'verification' at all—if by the word we mean a definitive establishment of truth—but only of confirmation". By the explicit import of this amendment, the proper business of science is to propound theories with enhanced credibility, reliability, strength, or likelihood but never the establishment of absolute truth. So, confirmation theory conceives of scientific truth in terms of a continuous scale of probability that never catches the absolute point (Nicod, 1930; Geoffrey-Smith, 2003; Carnap, 1953; Lipton, 1998; Hájek & Joyce, 2008;

Armstrong, 2016; Carnap, 1953; Rickles, 2020). Thus, henceforth, unless reference is made specifically to verification theory, confirmation is to be understood in reference to the amendment; probabilistic laws for that matter.

Under confirmation by probability, laws, as they were under verification theory, entail a certain consequence. Take for instance the implication of Boyle's law (H): "If you decrease the volume of a gas (G), then its pressure increases (I)". According to confirmation theory, any observation such that "β is both G and I" confirms the law (H) (Hajek & Joyce, 2018, p. 117; Putnam, 1991, p. 123). In other words, any observation that satisfies "G • I" (where "•" is indicative of conjunction) increases the belief in or the reliability of the law (H) (Hempel, 1966; Couvalis, 1997). In the same way, any observation that indicates "G • not-I" diminishes the reliability or belief in H (Carnap, 1966; Hergenhahn & Olson, 2001; Blin-Stoyle, 1997).

This sense of confirmation theory explained is classically referred to as Nicod's criterion of confirmation. To be sure, in confirmation by probability therefore, the measure of support a positive observation gives to H is a function of the inequality relation $0 < H < 1$, where H represents the hypothesis aspiring to be considered as a law, 0 represents the ground threshold and 1 represent the absolute truth mark (Lakatos, 1998). If the probability of H given an observational statement is greater than 0.5, H is confirmed, if less, H is disconfirmed and if equal, the observational evidence is considered neutral to H (Nola & Sankey, 2007). Disconfirming evidence of a theory constitutes an unfavorable observational instance that has the effect of weakening the truth of a related hypothesis (Hempel, 1965). Before applying confirmation theory to African scientific theorizing, it is worth taking a philosophical background check about whether or not the theory is indeed equipped to render scientific claims reliable. In other words, on what basis does confirmation theory suggest that the observation of, for instance, G • I (in the case of Boyle's law) render the generalization "All Gs are Is" reliable in the first place?

Confirmation theory answers the above question by suggesting that extensive and diverse observation of positive instances (E) gradually minimizes the chances in the universe by which (H) could turn out to be a false proposition (Godfrey-Smith, 2003; Hempel, 1998). Take an example from one of the current scientific theories of cosmology; the Big Bang theory. As originally proposed by Georges Lemaitre, the theory suggests that the world evolved from a primeval hot dense particle that was overwhelmed by internal pressure to expand. In a split second, the dense atom forcedly exploded and has since kept expanding in a phenomenon called "red shift". With the help of a sophisticated telescope, the rate of expansion is used to calculate the age of the universe with an estimate around 13.789 billion years (+/- 0.037 billion years) (Salmon, 1998; Krauss, 2012; Colson, Hallinan & John, 2014). As such, the Big Bang theory implies consequences that forbid any distant object from dating beyond fourteen billion years (Blin-Stoyle, 1997). Now, confirmation theory suggests that for every single distant object observed (whose radiation dates the object below 13.798 billion years), we have an observational statement (E) that cuts down the possibilities of encountering evidence that could conflict with the hypothesis (H). So, any additional confirmation report from celestial objects (dating below 14 billion years) ensures that the investigator is gradually cutting down on the chances by which any countervailing instance could conflict with or expose the theory (Nicod, 1930; Geoffrey-Smith, 2003). So, as a series of confirmation instances accumulate, there is a direct cut-down on the number of supposed potential falsifiers, and this cut-down lowers the likelihood of encountering counter-evidence. Now, the less likely it is to encounter adverse evidence implies the hypothesis has a higher likelihood to be true, hence reliable.

This answer, however, attracts more threatening questions for confirmation theory. First of all, it is not inconceivable for the boundaries of the universe to have an extension into infinity (Ladyman, 2002; Krauss, 2012). So, no matter how well observational instances agree with a law, positive observations do not necessarily incur a cut-down on potential falsifiers unless the census enquiry under investigation can be estimated in terms of definite value (Frank, 1957; Hesse, 1976; Couvalis, 1997; Popper, 1996). Again, another very substantial challenge of confirmation theory concerns the very underlying concept of probability. To explore the details, an illustrative example is key. Supposing a theory is supported by a scientific law that says the probability of event A occurring at time t is as low as 1/1000. Popper's third principle of falsification insists that a good scientific theory should forbid certain states of affairs; for "the more a theory forbids, the better it is" (Popper, 1962). According to Popper then, this may suggest that a theory that grades the probability of an event occurring as low as 1/1000 has a good scientific credential because it has a higher propensity to be contradicted by observation. However, technically, the problem seems to be that any prediction based on such a bold hypothesis seems to lack any empirical basis that makes it possible to disconfirm the law (Armstrong, 2016; Lakatos, 1989). The reason is that if the prediction is based on probability, then any outcome be it a positive observation or otherwise is consistent with the hypothesis. So, a law that appears as probability regularity makes confirmable generalization compatible with every kind of observation. From Popper's (2005, p. 195) acknowledgment of the problem, "clearly, that even the greatest improbability always remains a probability, however small, and that consequently, even the most improbable processes—i.e. those which we propose to neglect— will someday happen”. The situation brings forth a salient challenge in applying confirmation theory to African scientific theorizing.

Consider one of the conditions that call for the consultation of Ifa. Supposing there is an inexplicable prevalent rash of death among young children in society (Taiwo, 2004). An oracle of Umofia may theorize an explanation of the phenomenon in terms of birth cycles typical of ogbanje or abiku. Ogbanje/abiku is a child whose fate is continuously tied to death and rebirth at a very tender age (Achebe, 1986). The child is said to have grown so fond of his compatriots in the “other” world in such a way that he/she yearns to always reunite with them quickly after birth (Westerlund, 2006). To test the hypothesis, Popper’s recommendation requires one to deduce consequences that forbid certain things from happening. So, one may infer that children (under the accused circumstance) must not live beyond say age 10. To falsify the oracles’ claim, we may involve a thorough and frequent medical check by ensuring good dietary habits, consistent medications and so forth, all aimed at preventing the child from dying at least before age 10.

Supposing that by intense medical supervision, one is able to secure a 98 percent chance that an abiku in question will survive after age ten. As bold as the theory of abiku may seem, it remains nonetheless unfalsifiable because the theory does not rule out the negation of its consequence, no matter how small that probability remains. So, the fact that the child dies before age 10 does not undermine the theory. Yet, if so, then no particular observation can falsify the theory, for whether the child lives or dies, either possibility is technically permissible by the probability rule. So, Railton (1998) reiterates the point that both the probable and improbable outcomes of any indeterministic process have, after all, the same kind of explanation. In other words, the really unacceptable consequence, as Popper (2005) notes, under the assumption of probability, there are no genuine means of replicating the claims of scientific theories. Yet, if theories are essentially not open to replication, then scientists cannot even tell how their own mistakes have altered any particular finding. For after all, no outcome of the test is really unexpected. Consequently, it appears probability regularity proves challenging in advancing African scientific theorizing.

Suffice it to evaluate the final conception of laws in scientific theorizing, hedged regularities. Indeed, I am very keen on exploring the detailed merit of hedged laws because they appear to sit well with the substance of African scientific theorizing. As a result of unforeseeable or uncontrollable external circumstances, hedged laws (sometimes called ceteris paribus laws) are typically conditioned by exceptions to the law in question. These exceptional conditions presuppose that the validity of scientific laws depends on situations for which a theorist cannot readily account exhaustively at any material time (Roberts, 2004). So, a hedged law typically describes how a system is to behave when external interferences are sufficiently ruled out (Huttemann, 2014). Based on hedged laws, to say that "All Fs are Gs" implies that "All F and ____ are G" (where "____" is an omission that signifies the extension of other unknown antecedent conditions). So, under the principle of hedged laws, the fact that "All F are G" does not imply that if something were to be an F then it is necessarily a G since the investigator cannot secure a warrant that all features of the world will continue to hold same (Lipton, 1999).

The motivation underpinning the admissibility of hedged laws is a logical consequence of the critiques against the nomic necessity view of laws. As I indicated earlier, Nancy Cartwright advanced the view that necessitarian laws risk being empty because at all material times, the behaviour of any object is a consequence of composite forces at play. In demonstrating the law of free fall for instance, Galileo assumed the “fall” of an object as one that occurs within the context of a vacuum which presupposes the absence of air resistance (Niiniluoto, 2012). So, as Huttemann (2014) indicates, Galileo’s law which states that bodies fall according to the formula s = 1/2 g x t x t is false, for in other media like water, the equations fail to capture exactly how objects behave. Boyle’s law only applies in ideal gasses where there are no intermolecular forces at play. For such a circumstance is the only condition under which gasses would have no further interactions other than collisions with one another (Anjum & Mumford, 2018).

Again, the limitation on the necessity view of laws is precisely the essence of what Newton showed relative to Kepler’s laws. Apparently, some conditions have to be obtained in order for Kepler’s law to be valid. Ideally, no planet follows Kepler’s elliptical path because there are numerous perturbations from other planets. Thus, by extension, laws can be stated as true by containing them within certain remits of application. Apparently, the ideal aim of scientific laws is only to elicit explanation under circumstances that limits external interferences close to the barest minimum (Pietroski & Rey, 1995). Yet, even the most successful attempt at this exercise does not completely negate the possibility of interfering factors because some of these interfering factors simply elude the investigator's awareness.

To explain why, Duhem-Quine's thesis presupposes that a hypothesis cannot be isolated for blame in the wake of adverse observational evidence (E). For all background beliefs including analytic propositions are equally suspect auxiliary assumptions should there be any adverse observation (Cozic, 2018; Quine, 2013b;

Gillies, 1993; Duhem, 1991; Nola & Sankey, 2007). So, in the event of adverse observation, Duhem-Quine thesis compels the decision that one or more of the background assumptions is simply not consistent with the hypothesis in question (Arabatzis, 2008). The scientist now has to scout through the puzzle in an attempt to locate the source of inconsistency (Putnam, 1991).

As Feibleman (1972) notes, more often than not, factors that could cause troubles for the success of the expected prediction are very innocent-looking. In the unlikeliest event, granted that (i) the scientist is able to provide all the necessary background assumptions and (ii) a scientist is endowed with a good sense of intuition to easily trace out the supposed mistaken background assumption (say b2). Even so, in order for a scientist to give surety to his intuition, Kuhn (1996) intimates that the scientist would require another experiment that isolates the suspicious factor (b2) from other extraneous interfering factors. The reason for this exercise is to ensure that the scientist is not blaming a wrong background assumption on an innocent hypothesis.

However, in the effort to validate his blame on b2, the scientist is required to sufficiently rule out all potential interferences that could unduly fault the innocent hypothesis. Supposing that the scientist is convinced about the isolation of b2 for further testing. If the result of testing b2 also turns out to be incompatible with predictions, the scientist is expected to undergo the same protocols (of observation and systematic experimentation) to rest assured that an innocent b2 is not being blamed for a mistaken background assumption. Clearly, given an adverse observation, the quest to sufficiently pin an error down to any particular assumption is bound to launch what Rudolf Carnap particularly indicates as an infinite regression of experiments (Carnap, 1966; Nola & Sankey, 2007). In the wake of such difficulty, hedged laws appear to constitute the suitable foundation for saving science.

Consider a related development. Heinrich Hertz employed an experiment to determine whether or not cathode rays carry an electric charge. To do so, he separated cathode ray from the electricity produced in cathode tube and passed the rays through an electrometer after which he detected no electric charge. He further puts plates of different charges into the cathode tube to check if cathode rays would be deflected. Again, he detected no deflection. He concluded that cathode rays carry no electric charge (Achinstein, 2008). Duhem-Quine criticism would suggest that the hypothesis "cathode rays carry electrical charges" has not been necessarily falsified by the adverse observational evidence. The kind of conclusion supported by the adverse observation is such that at least one of the background assumptions about the experiment, perhaps the kind of plates employed, the cathode tube, etc is altogether inconsistent with the hypothesis. Indeed, Duhem-Quine criticism proved right because in this specific case, the problem was not the hypothesis but a background assumption, there were interferences from unknown background assumptions.

The rationale that motivates hedged laws is that there is always room for suspicion about some unknown factors interfering with any confirmation report. For experiments in themselves cannot ensure that the hypothesis in question achieves what is called sufficient isolation of the system (SIS). As a principle, SIS is an ontic assumption which presupposes that the only ontic variables operating within a system are limited to the ones of which the scientist is well aware at any given time (Nola & Sankey, 2007). However, there is always room for ontic gaps since Hertz in particular could not tell that the air occupying the cathode tube had not been evacuated sufficiently to allow the effect of electrical currents to show. Indeed 14 years later, J. J. Thompson showed this error, a feat that won him the 1906 Nobel Prize (Achinstein, 2008). The possibility of such ontic gaps renders hedged laws very instrumental consideration in scientific theorizing.

Critics of hedged laws may suggest cases where scientists seem to have used ingenious means to contain the testing of a hypothesis from possible external interferences. This seems to cast hedged laws as simply lazy orientation to achieving confirmation, particularly in ways that leave scientists the chance to deny their theories the boldness required for them to stand the test of falsification. One important support of the criticism is Henry Cavendish who reasoned how well to distance himself in order not to have his mere bodily presence interfere with the investigation he carried on gravitational force. Indeed, sticking to smaller-sized objects in experimenting with gravity meant dealing with the force at a very weaker magnitude. Thus, the experiment must be carried out under tight-closed circumstances that denied any slight interferences from disrupting the results. To foil all possible interferences in an experiment to accurately measure the gravitational attraction between bodies, Cavendish instituted the proceedings of measurement through a microscope operated from a suitable distance (Arabatzis, 2008; Feynman, 2011). Again, Newton's law failed to give an accurate description of the shift of Mercury's orbit as it revolves around the sun (Krauss, 2012). It appears that, were Newton's laws governed by hedged conditionalities, the disconfirming instance of Mercury's orbit would be considered not to have falsified the laws in question; only some other things weren't equal.

However, in 1915 Einstein published a paper in which his novel idea of gravitation described with better approximations the precessions in Mercury's orbit.

The same theory led to the prediction that lights passing through the gravitational field of the sun should be deflected by the sun's gravitational pull. The sun's brightness posed a serious challenge to how any observational evidence can confirm the hypothesis. A rare occasion like a solar eclipse can expose the light's path through the sun's gravitational field. Einstein's universal gravitation led to a prediction that had to wait until favourable falsifiable conditions were present to put the implication of the hypothesis to test. In 1919, a solar eclipse was expected to occur. In a historic test that has since been repeatedly confirmed, Arthur Eddington took advantage of the eclipse and configured an experiment to test the prediction of general relativity. A displacement in the position of the stars indicated that light rays going through the gravitational field of the sun are bent by the sun's gravitational pull. Indeed, the value of displacement matched exactly Einstein's expectations and it accorded a massive endorsement to the superiority of Einstein's theory over Newton's (Carnap, 1966; DeWitt, 2010; Morvillo, 2010; Popper, 1962). According to a development of this sort, it appears, then, that Einstein had filled the "all other things which supposedly weren't equal" gap in Newton's laws.

Again, in the debate on the wave-particle essence of reality, Schrödinger first sought to advance De Broglie's wave equation to describe the behaviour of hydrogen. In his calculation, Schrödinger left a margin of allowance called the relativistic hydrogen equation, and this was meant to cater for the effects described by Einstein's special theory of relativity. His projections disagreed with observations about atoms. As it turned out later, it is known that Schrödinger needed to include the spin of the electron, a property rather associated with particles, in order to come out with a wave equation. The criticism is such that even though Schrödinger could hardly be blamed because the idea of spin in quantum mechanics was a later development (Gribbin, 2013). Yet, the knowledge gap did not mean interfering factors are bound to forever go unnoticed. When Newton first applied universal gravitation to the pull on the moon, the calculation showed a huge discrepancy. The fallout led Newton to consider his theory as having been contradicted by fact and he kept it from publication. Six years later, the measurement of the Earth was revised and this implied that astronomers have been using the wrong estimate of the distance between the Earth and the moon. When Newton used the revised details to rework the gravitational pull on the moon, the result was astonishing; it did agree with observation (Feynman, 2011). In all the related examples cited, it seems that patience, dedication and hard work can lead scientists to isolate hypotheses for testing. Does this not suggest that the conditioning of hedged laws is just superfluous and an excuse for lack of trying harder? It appears as though if only a scientist is persistent enough, hedged laws would be unnecessary. For all the supposed things that aren't equal can be figured out and trimmed down to constitute laws with universal application.

Such a response, I suppose, is insensitive to a challenge pending. Indeed, without hedged laws, every test in scientific theorizing is in substance a single crucial experiment; a test considered sufficient in deciding the truth or falsity and hence the demise or otherwise of a hypothesis in question (Feibleman, 1972; Zukav, 1979). The reason is that when a hypothesis fails a test, the only reason that makes it worth holding on to is the strong belief that not the hypothesis per se, but some background assumptions and conditionalities were supposedly unequal. This is why the first point of call is for scientists to blame themselves if their theories face adverse observations. What the history of development in science indicates is that scientists are rather very hesitant in dismissing troubled hypotheses simply because of the anticipation that, on their part, some procedures and adjustments could or may have been done better. This explains why Kuhn (1996) intimates that even successful paradigms are not expected to solve all persistent anomalies. This presumed inherent problem of fallibility about theories seems to me a subtle concession of possible unknown interferences. Indeed, the scientist may never be aware until perhaps posterity is favoured with deeper insight to discover the details in an independent study (Carnap, 1966; Mosley, 2004). Thus, the best explanation of why scientists hesitate to let go of falsified hypotheses is an implied concession for the important role hedge conditionalities play in scientific theorizing.

Given the facts of some background assumptions, calculations expected from the orbit of Uranus disagreed with what Newtonian laws predicted. If, ab initio, scientific laws have universal application, then the adverse observation emanating from the orbit of Uranus revokes the validity of Newtonian laws. The only methodological presumption that makes the adoption of an auxiliary statement meaningful is to put the validity of Newtonian laws under hedged conditionalities. Under the circumstances, the role of hedged laws is not to reintroduce dogmatism, but to bring science to par with same judicious persistence to problem-solving mentality. As it turned out, the problem was not with Newtonian laws, it was about how to solve what Kuhn would call a puzzle; it is an exercise to secure further conditionalities about the solar system which together with the laws of Newton, can confirm the validity of classical mechanics. This auxiliary statement was, at last, supplied by way of hypothesizing an additional planet, Neptune. Calculations were based on Newton’s laws to decide where the possible source of the perturbations obstructing Uranus’ orbit could be coming from. Telescopes were later focused on the anticipated region and in September 1846, astronomers duly discovered Neptune

(Putnam, 1991; Bird, 2008). This feat is often claimed as having constituted an important confirmation instance in favour of Newtonian laws (Lakatos, 1989).

The point that needs emphasis is that if Newton's laws were not wrong even after being threatened by the anomaly of Uranus' orbit, then there were, as it turned out, some factors that were not "equal" somewhere. It was the then out-of-reach information about the number of planets that brought a superficial difficulty to Newton's innocent laws (Nola & Sankey, 2007). This corroborates Feyerabend's (1993) opinion that theories contain underlying assumptions that may either be unknown or known and yet impossible to test at a particular time. This is why an adverse observation during a test is not always a fault associated with the hypothesis involved. So, without the presumption of hedged conditionalities, Uranus' orbit would have constituted a crucial test in occasioning the demise of Newtonian laws sooner rather than later. Scientists may not feel at ease to include the hedged conditionality for fear that it creates an ad hoc assumption that shields theories before "confrontational" evidence. Be that as it may, in practice, hedged laws are indeed an unavoidable presumption in scientific theorizing. For without them, every experiment is to be regarded simply as a crucial test.

There is another important reason that makes it nearly unsustainable to run a scientific enquiry without the presumption of hedged laws. Consider a development in Astronomy. Mercury's precession around the sun failed Newton's laws and on the presumption of nomic-necessity, Newtonian laws would have been falsified. The options available to scientists were either to let go of the theory or introduce a testable auxiliary statement to save the laws in question. The initial attempt intended to correct the anomaly was inspired by a similar technique that led to the discovery of Neptune and this consideration led to the postulation of an unknown planet

(Vulcan) whose gravitational force was presumed as possibly exerting the anomalous pull on Mercury's orbit (Zukav, 1979). However, several attempts at using Newtonian laws have failed in discovering Vulcan. Given the use of a similar logic that led to Neptune's discovery, scientists could not have known that answers would not finally surface if they persist in their search. Yet, the failure to discover Vulcan's existence makes it a justifiable practice for theorists to be measured in their insistence on nomic necessity. This is particularly true because an undue persistence to subsume every anomaly under nomic necessity is resource-intensive and time-consuming. The vastness of our universe, the obscurity of reality and the brevity of human life do not make an undue persistence worthy of pursuit (Nola & Sankey, 2007). So, Pietroski and Rey (1995) indicate rightly in my opinion, that there is really no principle cast in iron hands that should dictate to scientists about when to desist from resorting to hedged laws.

For the most part of this exposition on scientific law, I have been describing the undesirable consequences of denying a place for the role of hedged laws in scientific theorizing. Suffice it, then, to introduce African science into the discussion by showing how the concept of hedged laws sits well with the fundamental properties of the African worldview. Conceived as personal agencies, African ontological forces are entitled to actions beyond constraints by physical laws. Other than strict compliance with physical laws, the course of their actions is a decision informed by their aspirations and goals, existing social order and communal interest (Hamminga, 2005; Gyasi, 2016; Essien & Falola, 2009). This means that an African scientist can put all the necessary physical conditions in place expecting a particular prediction to manifest. Yet, in the end, the outcome may be overruled by the Forces' desires. The outcome of a supposed test may also be a product of two or more forces interfering with the work of one another. This phenomenon of forces' interferences is what Horton (1976, p. 170) refers to as the "convergence of causal sequence". Indeed, this phenomenon is a prevalent order of affairs owing to the conviction that the universe, as the indigenous Africans recognize it, is a full "house" of active forces (Gbadegesin, 1991). It is a chain of forces which, as Hamminga (2005, p. 63) says, is constantly "empowering" and "depowering" each other. So, events of the empirical world are simply a product of a complex network of constant interactions.

Examples of interferences from existing forces abound. To be sure, one's (long) life span may have been catered for by the benevolent will of God, yet, an offended ancestor may afflict the person with diseases that counterbalance such flourishing life with terrible life experiences. Furthermore, a witchcraft force or sorcery-invoked forces elsewhere may even interfere in the situation to end the life of the victim in question (Bascom, 1991; Westerlund, 2006). One may be blessed with prosperity by his/her clan ancestor. Yet, when people with higher vital forces like chiefs die, their vital forces have a wider scope of influence than ordinary ancestors. So, the manifestation of one's brighter prospects could be curtailed by an epidemic resulting from an offender's action against a deity or an ancestor of a higher rank (Westerlund, 2006; Achebe, 1986). Marriages are also contracted to unite families and this includes ancestral histories of both families. So, the curse of a distant ancestor is a potential interfering factor that could influence the prospects of someone in another family even after decades (Gyasi, 2016). Again, one is considered as having shown infidelity to a furnace should a smelter engage in sexual relations a night before engaging his metal works. The consequence is that forces that protect his trade will withdraw their service. The smelter would be prone to bewitchment which usually results in the production of brittle materials (Peek & Yankah, 2004).

A well-tried and tested medicine can fail at any time. Yet, this does not mean the successes that came the way of same medicine were a benefit from certain coincidences at play. The idea presupposed here is such that the material composition of medicines does not heal by themselves. The healing power of any medicine is a prerogative of either the Force that directed a scientist's insight to the discovery of that medicine or the vital force the tree continues to receive from the sun's energy. So, several reasons are sufficient to foil the medicine's effectiveness. A practitioner who, out of greed, overcharges the required price for the medicine negates the efficacy of the medicine (Konadu, 2007). The particular time for harvesting plants and leaves for medicinal purposes has a toll on its effectiveness; leaves are to be collected at midday, roots are most effective when collected at midnight and barks are most effective when collected late evening. Plants are believed to also emit some form of energy and radiation crucial for the therapeutic process, but only psychics have access to detecting such signals (Emeagwali, 2016). Yet, even when further efforts are put in place to do a background check of why a particular medicine failed, there may be other witchcraft forces and anti-social beings who would be bent on frustrating the process simply because of their selfish interest. Apparently, life experiences and the world as a whole are constantly under the influences of forces, whether or not they have been invited by a diviner or the victim to influence the state of affairs.

Hedged laws imply that the nature of constant interactions among realities results in a delicate web of causal networks whose consequences cannot be readily accounted for without exceptions (Lipton, 1999; Cartwright, 1998; Morreau, 1999).

For specifying all exceptions to the law would simply give the law a form of nomic necessity (Earman & Roberts, 1999; Lipton, 1999). The complexity of the web of interacting forces is deeply attested to by a concept science describes as a "chaotic state". As a principle, a chaotic state indicates kinds of physical interaction between physical systems in which any slight alteration, so minuscule as the flap of a butterfly's wing triggers consequences of greater magnitudes (Appiah, 2003).

The nuances of possible interferences account for the popular metaphorical statement in an Akan proverb; "Obosom anim, yeko no mprensa", which roughly translates as "it takes three visits (to a god) to be rightly informed about an issue at hand" (Appiah, 2005, p.5). Really, this does not mean that one cannot be rightly informed about a situation until the third visit to the god. Barely every indigenous African knew of a situation where oracles have been wrong beyond the third occasion because forces typical of the witches interfered with the forces' predictions (Appiah, 2003). The "three" times attendance is merely metaphorical, which means every explanation or prediction is subject to interference. The import of the claim is such that every feedback from the forces' outfit is tentative and can therefore be overruled by results from a subsequent enquiry. So, in reality, it takes as many visits as the client can to keep updated. Evans-Pritchard seems not to have come to terms with the substantial implication of this rationale. For he explained the situation as the inability of the African (Azande) to readily acknowledge contradictions in predictions. For him, this occurs simply because the Azande does not bring all related beliefs to bear on a problem but rather keeps the functions of beliefs to different situations (Evans-Pritchard, 1976). From the nature of quasi-physical entities, it seems more charitable to argue that situations rather do not remain the same due to constant causal interferences and therefore explanatory laws that characterize African science can only take the character of hedged laws.

Even though Morreau (1999) concludes that hedged conditionalities constitute the only kind of laws that science can genuinely hope to establish, some scholars have equally raised genuine concerns. I suppose such concerns are worthy of consideration because they are gap pointers that would lead attention to dealing with some foreseeable problems in African scientific theorizing. Indeed, hedged laws suffer the most opposition in scientific theorizing for similar reasons about the possibility of abusing them. As I indicated earlier, it is often criticized that propounding theories on the explicit assumption of hedged laws shield the theories from being falsifiable (Huttemman, 2014; Earman & Roberts, 1999; Lakatos; 1989). When hedged laws encounter adverse observation, critics intimate that the exact place(s) to situate the blame becomes a problem. Is the scientist to focus his suspicion of blame on the supposed unknown factors that weren't equal or on the hypothesis itself? Because of such concerns, placing scientific laws under hedged conditionality is accused of perhaps, intentionally trading off its incorrectness for imprecision (Morreau, 1999).

The difficulty in spelling out all the supposed unknown interferences inspires the criticism called the problem of vacuity (Smith, 2002). The problem of vacuity provokes another difficulty. If confirmation of a law requires all other things to be equal, and yet things are hardly equal as presupposed by the hedged conditionalities, then hedged laws seem not to have any genuine instantiation. This is referred to as the problem of instantiation (Lipton, 1999). The difficulty that comes with the problem of instantiation leads to a major problem that has come to be popularly known as Lange's dilemma. The point is this. If hedged laws cannot specify their disconfirming instances at a go, then the only time they become false is under conditions in which they are actually falsified. It is as if to suggest that the only time the law is false is only when it proves false or as Huttemann (2014) puts it, scientific laws in question hold unless they are false.

If the kind of laws compatible with African science is hedged regularities, then, by necessary implication, African science is faced with all the challenges associated with hedged laws. This means that the integrity of African science hinges on how well a defence could redeem hedged laws. Lange (2002) urges that the challenges (aforementioned) can be resolved by subjecting the law to a simple requirement. A concerned scientific community only needs to understand the sort of non-negligible factors that are considered interfering nuances. Yet, this provision seems to bring forth another challenge. In relation to the problem of an infinite regression of experiment, a problem resulting from Lange's concern is about how those typically disturbing interferences could be confirmed in any supposed independent study. In a related response, Huttemann, (2014) indicates that the supposed disturbing factors have to be susceptible to bringing about relevant difference(s) either through theoretical or experimental manipulation of related variables. Clearly, then, the major problem facing hedged laws comes down to one thing, an explicit condition to falsification. It does appear, therefore, if African science is to be exercised under hedged laws it must proceed to, at least, spell out clear falsifiable conditions.

The need to stipulate conditions of falsification relative to a supposed scientific claim comes down to a principle Lakatos calls "intellectual honesty". No matter how dearly you cherish a belief, the ability to raise it to scientific appreciation is judged by stipulating the sort of circumstances or compelling evidence under which you are willing to give up on the belief (Lakatos, 1993; Lakatos, 1998; Ruse, 1998; Barrow & Woods, 2006). The requirement of African science to incorporate a falsification principle into its methodological orientation, it seems to me, remains a call in good fate. Notable experiences bear out the relevance of this intervention. Often times, failures of predictions in African scientific theorizing are either rationalized, forgotten or brushed away. Sometimes, blames are directed to other causes such as ignorance, dishonesty or incompetence of the diviner (Bascom, 1991; Horton, 1976). One may say that of course, these are equally threatening factors that lead to adverse observations in mainstream science too.

My point however is that these problems feed well into any excuse intended to abuse hedged conditionalities. In related cases where a hypothesis fails, practitioners of African science may simply sit aloof with the consolation that perhaps, the prediction is not faulty but the result of counterbalancing forces rendered all other things unequal. I am not restricting problems that identify with ad-hoc explanations as a preserve of African science in particular. I am only putting across the advocacy that if African science can nurture transparency and a desire to minimize intentional abuses, then the associated challenges of hedged laws ought to be taken as a genuine concern in the sole interest of the discipline. Indeed, there are several reported cases where clients have entertained serious doubts about the predictions or explanations from some indigenous healers. Yet, clients are disadvantaged in demanding back their funds because practitioners hide behind hedged laws to accuse the victims of somehow interfering with the forces' activities (Offiong, 1983). So, it is not out of place to keep the toes of African science on methodological principles that aim at maximizing transparency and accountability and this is where the conditioning of intellectual honesty comes into its own.

To be able to inject the accountability of intellectual honesty into African scientific theorizing, it is important to begin with how the encounters of failures in testing hypotheses are generally treated in mainstream science. For it appears that the technique employed to save the failures in mainstream science has interesting parallels with how the indigenous priest deals with adverse observation. The strategy in mainstream science resonates with Kuhn's (1996) view of science as an enterprise devoted to puzzle-solving. The essential character of science as presenting a puzzle to be solved means it is the intelligence of the player that is ordinarily subjected to test and not the design of the "game". So, in the event of any failure, the first point of call is to discredit the scientist's competency, not the theory in question. For only the poor carpenter, says Kuhn (1998), blames his tools (the paradigm at work). Accordingly, Appiah (2005) insists that science would have gotten nowhere if theorists simply reject a theory in the name of having been falsified.

In African science too, the treatment of anomalies follows similar protocols. As Taiwo (2004, p. 310) notes, the following concerns come to mind when an anomaly looms:

> *Did the babala´wo read the signature correctly – i.e. did he correctly identify the Odu` that appeared? Did he chant the appropriate ese so that any mistake might be attributed to the client's inability, due to a character flaw or inattention, to identify the appropriate story as hers? Did the client lie to Ifa´ in disclosing the contents of her hand when the `ıbo` was administered? Did the client misconstrue a metaphor in the narrative? Did she misunderstand a phrase?*

So, it is very permissible, and African science contravenes no methodological protocol should the discipline resist the temptation to give up on a hypothesis simply because it encountered a failed prediction. Appiah is therefore right when he notes that "In [mainstream] science, as everywhere else [indigenous knowledge systems], there are babies [genuine hypothesis] and there is bathwater [instances where well-tested hypothesis fails]", so it may not be appropriate, as the implication suggests, "to throw away the bath water [instances of adverse observation] with the baby [the hypothesis in contention]" (Appiah, 1992, p. 119).

In spite of this salient similarity, I must drive home a crucial difference to guide any intended effort to build a synthesis between the method for African scientific theorizing and the methodological protocols of mainstream science. On one hand, in the framework of mainstream scientific theorizing, one can at any given day separate the theorist from his art (methodological procedures). On the other hand, generally, the African scientist stands at the center of the order of creation and his method is a craft that calls on supposedly higher-order ontological forces to attend to a certain duty (Teffo & Roux). Even though the procedure requires the invocation of formal rules, there is a connection between the practitioner and his art because every living force exemplifies a link in the chain of the hierarchy of vital forces (Tempels, 1959). For the diviner to call on the potency of other force, the vital force of the former must have what it takes to stand an encounter with a higher vital force. The same mechanism finds explicit expression in medical treatment believed to be spiritually caused. The supposed spiritual cure aims to prepare the body in a state required for any subsequent physical treatment to exact the maximum impact (Sogolo, 2005). This makes the vital force of the diviner a significant variable in distinguishing between procedures typical African science and the methodological protocols of mainstream science. So, a witch doctor's craft may weaken the potency of same procedures if there is a prior contamination of his/her vital force through for instance the breaking of a dietary taboo (Mavhungu, 2012; Appiah, 2003).

It appears, therefore, that the African scientist must follow methodological rules. In following clearly defined scientific rules of engagement, however, he/she is more of an artist trying to use his/her personal relationship with other forces, experience, and personal ingenuity to make an impression about what the worth of his/her own vital force can achieve for his client. For “all knowledge discovery”, Hamminga (2005a, p. 63) notes, “is the discovery of the power of forces”. The indication is that an outsider may know a particular herb and even understand how it works. However, without the complement of the artistic impression; chants, prayers, ritual songs, libation his/ her strict adherence to the mechanical protocols alone cannot invoke same effect (Battiste & Henderson, 2000). The point can be likened to other professionals who may use extra methodological avenues like music to regulate mood and influence results. So, a neurosurgeon could resort to music to enhance concentration and cooperation between himself and the client or the army may use music to coordinate drill movements and increase cooperation (Aluede & Aiwuyo, 2016). In other words, healthcare to the African scientist is not reducible to knowledge of herbs and plants, it is a whole package that includes a very complex and rather distinct methodology for effective administration of the identified medicine in question (Emeagwali, 2016). To achieve success then, it is therefore compelling that through the advantage offered him/her by the “weight” of his/her vital force, the African scientist bargains to discover the privileges afforded a particular force and to exploit this in the service of his/her client. As such, differences in the diagnosis of same problem by different diviners may stem from the weight of the diviner’s vital force that stands at the center of the operations. For it signifies the depth of one's bargaining power, which is in turn required to cuddle, convince or even in some cases delude a Force for the African scientist to exploit the Force's insight to serve his client. Unfortunately, Horton (1967) seems to have erred in appreciating the difference made by the vital forces of clients and diviners in the operational modalities of African science. He reduced the differences in diagnostic reports of different diviners to an attempt to brush away previous failures. By emphasis, the point really is that the message is not entirely separable from the receiver, because the "weight" of the latter's vital force plays a vital part in the "shape" the message takes. This means that, like Olaoye (1993) righty intimate, the convention of movement from one diviner to another comes down to same issue of consideration in competency that drives a client from one surgeon to another in search of solutions to problems the former could not provide. In other words, because of differences in vital force and the significant role it plays, the subject of an investigation cannot obtain the message without altering it.

Indeed, the advent of quantum theory shows how deeply involved one's own subjective consciousness makes a difference in the turnout of events relative to the way findings are made in (mainstream) scientific enquiry. I used the observer-dependent interpretation of quantum theory as reiterated by Osei (2006) to highlight precisely the same point in chapter four. So, the central role of the vital force as espoused by African scientific theorizing is not alien to African science per se. Nonetheless, ideally, mainstream science is motivated by a presumption to lead an enquirer to capture the essence of the world out there independent of the investigator's influence. So, typical of the orientation of mainstream science, questions about "how did it happen?" look sufficient to lead such enquiry. In an attempt to issue a holistic account of reality African science, then, leads the process to do the final bit of the clean-up exercise. And by so doing, it attempts to capture the ineliminable role of the agent behind the "camera", who, for better or for worse, interferes with the knowledge construction process.

So, on one hand, mainstream science chooses a path where it tries to keep the distinction between the objective and subjective under check. On the other hand, African science carries our curiosity further to the limit where the line between the subjective and the objective coincide. It is as if, to use Zukav's (1979, p. 134) words, "The Cogs in the Machine" are all by themselves "becoming the creators of the Universe". In other words, after an experiment, the fate of a hypothesis is determined by the aftermath observation. However, from an implication of the complementarity principle, the contention is such that the supposed objectivity to be observed turns out to be a product of subjectivity. For it appears to be a creation of the subjective consciousness that performs the observation (Dougherty, 2016; Corey, 2003). To ignore this implication is to misstate the depth of complexities that guide the focus of African science. So, when it is said that African science generates a picture of the world quite different from the narrow answer given by mainstream answer, the emphasis is not on contradiction (Moore & Sanders, 2004). It is simply the use of a diverse approach to capture the very excesses beyond the comfort zone of mainstream science. Because of the salient difference occasioned by going the extra mile, the call for African science to comply with intellectual honesty (relative to challenges hedged conditionality) must be tampered with caution.

The problem goes deeper. Supposing I hold a belief that pulling a gunshot directly at a human's brain is fatal. In testing the belief, an agent would be required to pull the trigger of a gun at a delicate body part of a victim. In this action, the gun as a material force has no specific interest in any decision it is subjected to. For every trigger, then, the gun is expected to undergo the mechanical processes to execute the command to kill (Carnap, 1966). If a gunshot at the delicate body part of the victim does not result in death, my belief proves wanting. African worldview, as I explained in the previous chapter, does not make the issue that simple. As Sithole (2016) makes the case, connections, relationships and harmony rather than mechanical influences are due considerations for physical occurrences. The reason is traceable from the notion that reality is consciousness; God stands as the superpower house, a universal force that charges everything. One of the essential features of consciousness is intentionality; the aboutness of our beliefs. So, forces derive meanings and form intentions based on their beliefs about things (called *ntina* by Lingala of Congo) (Hamminga, 2005). Surely, these beliefs should have a place as part of the decision-making process by which the forces interact with the universe, lest they become a redundant property. So, observe, the Kom (of Cameroun) and the Shona (of Zimbabwe) entertain the belief that agentive forces could kill people through thunder or lightning strikes (Mawere & Mubaya, 2017). Here, putting such a belief to a falsificationist test is not as simple as dealing with pure material force. Indeed, whilst the gun would injure whosoever's head it is triggered against, lighting in the African context could refuse to strike someone to whom it is sent and would return to the sender simply because the supposed victim is adjudged by the force of lighting to be innocent (Mavhungu, 2012).

Typical of witchcraft force, it can learn of ways intended to dissipate its effectiveness and it may "fire" back equally by devising new ways such as hiding in floated calabashes to elude the impacts of such witchcraft antidotes. No witchcraft force would serve her secrets on a silver platter, and if indigenous healers put in intense pressure to expose his/her nature and operation, it makes a salient effort to save its interest first. Sometimes children would die too early to be questioned about the witchcraft force. In adults, it tries departing from the inhabited body when found wanting and in the process, it may go extreme by killing the human carrier to render it incapable of betraying his/her true “colours” (Mavhungu, 2012; Achebe, 1986; Offiong, 1983; Evans-Pritchard, 1976). Sometimes, the mere exposure of the identity of witchcraft dissipates the force from the supposed human container (Ashforth, 2005). Under such presumption where forces reserve rights to veto every petition made to them, observational evidence from even multiple tests can hardly yield a result that reflects a consensus among different enquirers. This clarification presents an opportunity to clarify what I consider to be an ill-conceived criticism against the legitimacy of African scientific theorizing. So Akpan (2010) unfortunately suggests that because African science is underpinned by personal forces, it is devoid of objectivity and would remain miles apart from mainstream science. To be sure, the subjectivity in African science is not about practitioners exercising the discipline under inscrutable principles. Rather the case is such that the findings of every practitioner are partly subject to the conscious will of the forces that could change with time and circumstances. This, then, brings our minds to a major concern from Sithole (2016) and Hamminga (2005b, p. 76) points it very clearly, that relative to the African worldview it seems “experiment in the Western sense is void of meaning”. Consequently, no amount of rigorous testing suffices as a crucial experiment. If that is the case, then the call for African science to come clear on an objective condition of intellectual honesty seems an uncomfortable demand.

The nature of the task before African science further clarifies why relative to mainstream science, progress in African science is not steadily measurable. Indeed, mainstream science has clearly championed some marks of progress be it in terms of unification of theorems or the maximization of empirical adequacy of theories (Feyerabend, 1993). In this regard, hard-core evidence has confronted long-standing convictions, giving rise to a situation where for instance geologists had to abandon the then-entrenched conviction of static continent in favour of continental drift (Ruse, 1998). Mainstream science has brought finality to contentions over questions about belief in phlogiston and ether (Hawking, 1989; Zukav, 1979). A popular tradition held that the heavenly bodies were made of ether and which imposed on them an unconscious desire to mimic the perfection of the gods through circular and uniform motion. Following Newton's first law of motion, mainstream science got us over this way of explaining why heavenly objects move the way they do. In the last quarter of the 19th century, a crucial experiment was brilliantly executed by Albert Michelson and Edward Morley to bring an end to the belief in the reality of ether (Dewitt, 2010). On the other hand, putting a belief down to refutation in a related crucial experiment involving African science is not as decisive as dealing with typical material force. So, it is important to tread cautiously in one's demand for a similar measure of progress.

However, this supposed difficulty is not an alarming call to unsettle particularly African science from mainstream scientific research programmes. With the inception of quantum theory, a well-informed position suggests that indeterminism is an integral feature of reality (Frank, 1957; Carnap, 1966; Railton, 1998). So, the situation is akin to two scientists who fire different electrons successively under same double-slit experiment and yet, landed different results about the atom's final location due to the interference property of waves (Fink, 2007; Feynmann, 2011). This development informs Plantinga's position that even though there are laws, it could be that for all we know, not everything is at least entirely governed by them. Even so, this supposed difficulty presents no frustration to study such phenomenon scientifically given notable related examples like radioactive decay and some aspects of weather conditions (Plantinga, 2001). In spite of these germane concerns, it is however not impossible to put in place some methodological precautions that render intellectual honesty an important consideration in the method of African science.

Suffice it to first present the summary of my proposed method of African science in the following pictograph before which I shall explain.

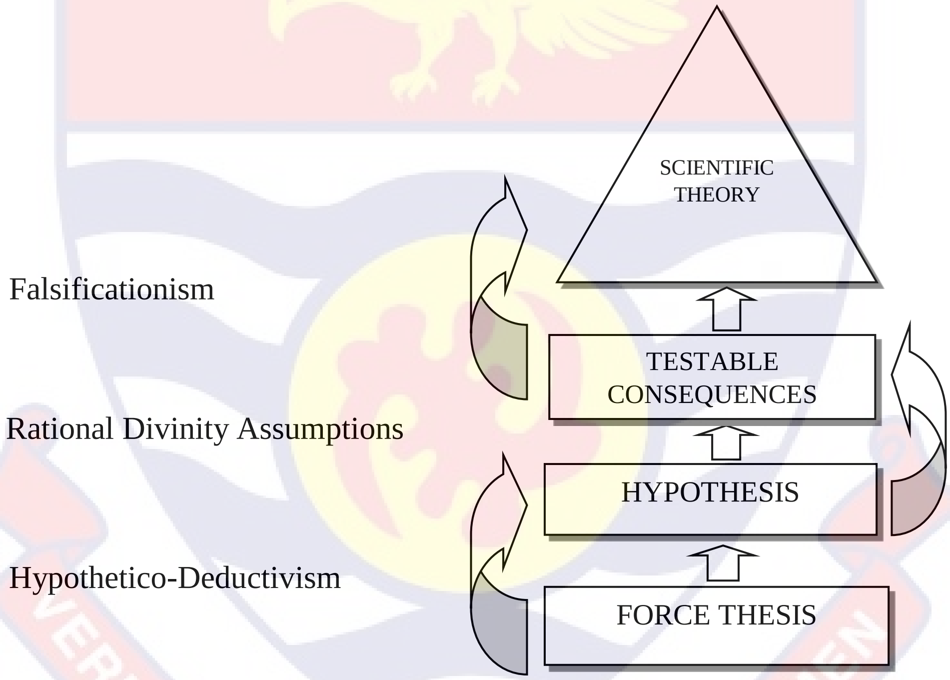

Figure 1: Methodological structure of African conversational science

As Figure 1 indicates, the method according to African conversational science involves a number of methodological procedures. As Lakatos indicates, scientific knowledge rests on foundations known as a body of hard-core claim(s). The hard core of African science is given by the essence of the force thesis. So, all phenomena have an ultimate connection to the will, intention, actions and inactions of related quasi-physical entities. From the force thesis, the method of hypothetico-deductivism is employed to generate a hypothesis. By means of rational divinity assumptions (RDA), testable consequences are inferred from the hypothesis. This means that a test ordinarily directs the modus tollens rule to the RDA, not the force thesis per se. So, faced with any adverse observation, core claims (force thesis) have a protective belt in terms of the RDA. As Lakatos (1998) observes, when anomalies surface, conventional practices require scientists to be very hesitant in rejecting the core claims of the theory. For some theories that have achieved enormous success had to progress through abounding adverse observational consequences (Lakatos, 1989; Lakatos & Feyerabend, 1999). Accordingly, in keeping to standards of intellectual honesty, African scientific theorizing is to be pursued in a manner that even though a test should aim at falsifying a hypothesis, adverse observations only diminish the reliability of the hypothesis in cases where practical situations require a decision to be taken. In principle, a hypothesis that encounters adverse observational evidence, as Chimakonam (2012b) intimates, is only to be set aside temporarily, not falsified. Given the dictum of ceteris paribus, the expectation is that in similar conditions, forces involved may have their numbers altered, or they may develop different intents and aspirations and when such variations have taken place, same hypothesis has a chance of being confirmed.

The quest to replace a falsified theory with a new one is not a result of adverse observation per se, but the failures of the previous theory must be overwhelmingly persistent to warrant its overthrow. Even so, scientists have no option but to stick to the hypothesis unless there is an alternative theory whose potency in problem-solving supersedes the embattled paradigm (Kuhn, 1996; Lakatos, 1989; Bird, 2008; Irzik, 2008; Bascom, 1991). So, until an alternative paradigm emerges, theorists are to continue issuing an anomaly-digesting auxiliary statement that saves the existing paradigm from refutation (Lakatos, 1998).

So far, as far as African scientific theorizing is concerned, I have been explaining means to trigger the demands of intellectual honesty relative to hedged laws. Now, I proceed to elicit appraisal guidelines for counting observation as confirming evidence of a hypothesis. To curtail the problem of nearly every observation counting as positive evidence, it is important not to render observational evidence a positive instance of a scientific law unless as Popper intimates, it was meant as a severe test aimed at exposing it (Popper, 2005; Derksen, 1985). Even though a hypothesis is tested by way of falsifiability principle, a confirming instance does not corroborate the hypothesis as Popper insists, but rather it inures to increasing the reliability of the hypothesis. Given my earlier criticism of reliability assumption of confirmation theory, the reason for such advocacy requires some explanation.

In his paper *Rational Prediction,* Wesley Salmon showed that if falsificationism is intended as a theory that avoids the problem of induction, then surely it fails to be a useful philosophical methodology of science. The rationale he advanced in support of this attests to how fruitless falsificationism is unless it takes reliability as a serious virtue of scientific theory. Relative to the truth status of scientific theories, confirmation theory admits a continuous scale of probabilities where poor theories have low probabilities and theories with high probabilities are regarded reliable. On the contrary, falsification theory proposes that when the attempt to falsify a theory fails, the hypothesis in question has only proved its mettle; it has been corroborated. Because a corroborated theory only tells us how well a theory has stood against past attempts to bring it down, the theory supposedly says nothing about the future and is therefore not meant as a warrant of reliability (Popper, 1962; Popper, 2005).

As Salmon (1998) notes, one of the key roles of prediction in scientific theorizing is to serve as a practical guide for decision-making relative to future expectations. It is worth picking an umbrella if I am reliably informed about a pending rain. So, if a corroborated theory can be of any use in our daily activities, then the predictions borne out of the theory ought to command an appreciable warrant of reliability. Popper's (1996) only insistence is that "Where we are in the position to make such a choice, it will be rational to choose, of two competing theories, that which has survived prolonged critical discussion, including tests". However, clearly, such a response is empty because the virtue of corroboration is not future-looking and it is therefore not a warrant for future projection (Popper, 2005; Derksen, 1985).

If a corroborated theory does not establish that a claim has any reasonable link to reliability, then the question is how is one ever compelled to accept it over for instance mere art of guesses (Salmon, 1998; Irzik, 2008; Cozic, 2018)? In my view, then, Popper's falsificationism does not bring a conclusive end to the problem of induction. So instead of priding his theory on that false impression, it is important to work with the assumption of reliability at the expense of the problem of induction. So, relative to African scientific theorizing, even though the rationale for appraising a hypothesis continues to be the quest to falsify it, a theory that stands the test remains, for all practical intents, reliable.

In conclusion, the exposition in Chapter Four showed that the nature of reality presupposed by the African worldview is in sync with data from mainstream science. Science, then, provides sufficient evidence to diffuse any claim of incompatibility between the two disciplines. For the only divide is diversity, not opposition. Per their unity, African science comes into its own following a threshold where the complexities of reality elude exhaustive penetration by mainstream science. The mandate to explore the "how" questions, no doubt, has achieved a tremendous feat of measurable progress for mainstream science. However, the acknowledgment of this feat should also imply that the call for African science to pursue an enquiry in the same fashion as mainstream science is not only a needless duplication of services but also seems a deliberate mischief set to encourage unhealthy competition. As such, this obviously redundant call for unhealthy rivalry should rather leave concerned scholars wondering why. Beyond a threshold that limits the penetrative insight of mainstream science, African science is trying to leave no stone unturned. By so doing, it ends up, slow but sure though, mopping up on detailed probes that would have hitherto kept us from advancing the "why" questions (Moore & Sanders, 2004).

Following this concern then, one may wonder if the conscience to measure the progress of both disciplines by the same yardstick as exemplified by Akpan's (2010) position is a fair deal since doing so erroneously assumes that the task before each is at the same level of difficulty. The important note worth reiterating is that across the divide of both disciplines, answers provided by each party pose no fundamental contradiction. Scholars seem to be so busy looking out for ways to separate them through competitive rivalry. By so doing, the myopic lens is bound to lose sight of how both disciplines fall in place as a unified power rather than opposing worldviews. The thesis presents an opportunity to consider the domain of both disciplines as a manifestation of a diversity connected by the same agenda to reach an exhaustive account of same reality without any contradiction. Upon the sort of rethinking I advocate, the only option consistent with the critical evaluation of the African worldview is the appreciation of the diversity therein, which leaves the disciplines to respectively pursue what each does best. Where one worldview encounters a genuine challenge, the ideal goal of conversational philosophy is to seek complementarity, not the takeover of one discipline by the other. For after all, there is no competition but diversity. By way of emphasis, the core of my thesis echoes an interesting quote from *Things Fall Apart* “Let the kite perch and let the eagle perch too. If one says no to the other, let his wing break" (Achebe, 1986, p.14). It stands, then, to reiterate the commitment set out by the study. The comparative assessments that end up misconstruing African science as backward-looking is much ado about nothing. To be sure, then, the presumption that set African and mainstream science up to compete with each other is simply unfounded display of stereotypical sentiments, a misconceived appraisal that goes a long way to rob African science of the worth it deserves. For there is no fundamental opposition but unity, there is no backwardness but diversity.

Recommendations for Further Studies

From the findings of the study, I propose three recommendations for further studies. First, from an informal discussion with a colleague on my research interest in African science, he raised a seemingly sarcastic judgment against African science in ways I suppose, may resonate with a lot more views out there. His point suggests that mainstream science has given us airplanes and jets and is in the process of finalizing possibilities of a brain transplant. Why, he asked, do we need any other supposed science that promises no sophisticated technology to improve our comfort? It seems to me that such recurrent critique of African science is an invitation to set a ground for competition between the two knowledge systems. I suppose that the urge to fall for it must be resisted with all might of enthusiasm. To be sure, African science and mainstream science claim to have the right to render explanations in ways that are not only internally consistent but also very useful to respective subscribers. Indeed, the appreciation of this usefulness is a necessary requirement for their harmonious co-existence. However, like mainstream science, the state of African science is not without salient challenges. So, the more constructive criticism, I suppose, is to bring each discipline to welcome critiques and contributions that aim to better the interests of both parties. For after all, they have no point of conflict, neither are they meant to compete with each other. Therefore, I urge further studies to go in the direction of exploring ways the two disciplines can be of help to one another rather than pitching the strength of one against the other. The nature of the study may explore in detail the sort of complementarity that evolves each discipline from perceived limitations. The battle with competing intent does not only blur the appreciation of the values each discipline stands for, but more distastefully, it also leads to the enslavement of one by the other.

In my study, I took a keen interest in two ontological postulates (witchcraft force and ancestorhood) to consolidate the quasi-physicalist underpinning of the African worldview. This contributed to how I navigated the path in drawing an appraisal scheme for how advances in mainstream science corroborate the African understanding of reality. Indeed, the pioneer of the concept of quasi-physicalism, Kwasi Wiredu, used the "Okra" (soul) to kick-start the project. Quame Safro's reaction urged that further attempts should be made to expand the concept across other ontological postulates. I suppose, then, that there are further ontological postulates in the African worldview that can be examined to further expand our understanding of African ontology in particular and scientific theorizing in general. I urge that subsequent studies may want to take a key interest in specifically the nature of the lesser (gods), God and even dwarfs. The aim would be to examine the consistency with which such ontological postulates also cohere with the quasi-physicalist understanding of African ontology. This contribution would help to shape the depth of discussion relative to how the general aspects of African worldview compare with advances in mainstream science.

In my study, I approach African science from the point of view of behavioural science. I recommend further that scholars may take the challenge of working out a typical physicalist science from the African worldview by exploring the avenues of indigenous medicine. Accordingly, scholars could take an interest in comparing how the dynamics of healing procedures in biological systems can lead to an insight into advancing the frontiers of indigenous medicine. From an interdisciplinary perspective, such an approach to understanding the African worldview helps us to bring every culture on board in our quest to push forward the frontiers of scientific theorizing in general. Most importantly, it also brings us to appreciate how the diversities in cultural practices unite people across the global space as one people.

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