

Review

Ethics interrogating the physical sciences in an insecure society

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There is no doubt that the world we live in is a world of contradictions. To a layperson, both sides appear parallel without a meeting point. However, for the critical thinker and philosopher, opposites are like two sides of a coin. Each side is necessary for the coin to have value and be used as a valuable material. Efforts are made to identify the perennial conflicts of interest between ethicists and physical scientists who serve humanity around the world. This article aims to explore the interactive effects of ethics on physical scientists as they respond to recent events in the world of science. The paper adopts a qualitative research design and uses an evaluative method to analyze the data collected from the available literature. It is discovered that the products of physical scientists are cherished because they are value-based. The findings of physical scientists are valued by ethicists, a fact evident in available codes of ethics in different professions. Any attempt to prioritize one over the other would lead to a state of disequilibrium. The consequences of such preferences can be severe, as demonstrated by the unethical release of the Coronavirus from China. This leads to the conclusion that ethics plays an all-encompassing role. No progress can be considered genuine without subjecting the results of actions to ethical evaluation. It is critical to make ethics a formidable guide in the production of outcomes in scientific processes.

Key words: Ethics, physical sciences, insecurity, applied ethics, plagiarism.

INTRODUCTION

Charles Dickens' novel, *A Tale of Two Cities*, was published more than 162 years ago. Yet, its storyline feels fresh to anyone witnessing the havoc that the Coronavirus has caused and continues to cause in today's world. This is a time marked not only by improved scientific and technological advancements but also by the dominance of Internet-based science. In *A Tale of Two Cities*, Dickens speaks of a life filled with contradictions, stating, 'it was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the season of Light, it was the season of Darkness, it was the spring of hope, and it was the season of despair.'

This passage poignantly addresses the philosophical challenges confronting human existence.

In today's world, every individual lives in fear. The fear of rapid attitudinal change is well captured by the observation that 'patterns of behavior that were universally deemed morally unacceptable in the past, whether in society, the workplace, or the community, are now being vigorously promoted as viable alternatives' (Dickens, 1859). Studies have shown that such alternatives must be categorically rejected on the grounds that 'no matter what the consensus of the local community is, and no matter what those in positions of

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power claim, certain social values and the facts of nature that underlie these values are fundamentally flawed and must be rejected as false' (Asemota, 2003). However, these works have not explicitly explained the reasons for the rise of insecurity in today's world.

It is against this backdrop that the concern of ethics examining the physical sciences attempts to evaluate the relevance of integrating knowledge of ethics and values into the commendable work that physical scientists are doing to enhance the quality of life for people worldwide.

There is no retreat concerning the development of science and technology and the accompanying expectations humans have of it. The world we live in is desirous of economic prosperity which cannot be attained without scientific and technological advancement. Whenever there is a talk about emerging development in science and technology, it naturally follows that it comes with the improvement that fosters better living standards for every human being in the immediate society and for others on the face of the earth. The truth is that new products and services which are beneficial to humans are introduced into the system, but not without moral issues and challenges. For instance, countries like Malaysia, India, China, and the US have benefitted immensely from good investments in science and technology. Lives in these countries have been transformed due to the upgrade of facilities. For citizens to have better access to health care, education, and communication among other goods and services, it is critical to insist that "current research in the basic and implied sciences and technologies requires sound ethical practice based on a defensible moral stance. Moral norms, in our view, are deeply grounded and evolved convictions about justice and injustice right and wrong, good and bad. It is not about rules". With this gamut of works, it is important to add value to the already existing literature on the role of ethics in the development and application of the physical sciences.

In recent times, there are pieces of evidence to show that advancement in science and technology is not enough to bring about the desired growth and transformation. Rather than improve the living condition of members of society, the wave of scientific and technological development is responsible for the insecurity of human lives and property. Can it be said that in our world, everything about human life is possible? Who would have thought that America with its heavy investment in research and development can be successfully bombarded on September 11, 2001? Who must have had the privilege of prophesying the outbreak of Coronavirus or COVID-19 or its different variants? These events have not only shown that as long as there is life, everything is possible, albeit a challenging relationship between ethics, values, and the physical sciences.

This article reassures the reader of a world that is made up of both innocent and dubious people. It is not for

human beings to begin to separate the good from the bad people so that our world would be a humane place to live in. This is possible if the knowledge of ethics is used to interrogate the physical sciences in its works. When these efforts are put in place necessary ethical attitudes would be inculcated in the scientists and technologists whose conception of the physical sciences would be seen as positive forces for securing a habitable society for everyone. The moment scientists and technologists are not guided by the ethics of their profession, which is an emerging good becomes a source of insecurity to humans, the environment, and whatever form of inequality in the world. The presence of ethics in the physical sciences ensures the resolution of ethical dilemmas in the applicability of the products of research, the promotion of integrity in research findings, and countering corruption among members of the research team.

This gain will go a long way to dissipate the energy associated with the conflict of interest of both classes that are parallel to one another. This is the result of unhealthy rivalry in contemporary society that must be condemned outrightly. The hope of this paper is for readers to attempt to draw ethical values from the existing tenets of society and their profession for the good of human life. This is the hallmark of interdisciplinary studies in an era of globalization and the utmost utilization of human resources.

Conceptual clarifications

For a clearer appreciation of the study, there is need to be involved in a conceptual clarification of the terms. This task attempts to get an operational definition of the concept with gleans from the understanding of different scholars. It is done so that the ambiguity that accompanies the use of certain words would be discarded.

Ethics

The term ethics is derived from the ancient Greek word "ethikos" which comes from "ethos" meaning custom or habit. It was originally coined by Cicero, a Roman politician and lawyer. It is usually used interchangeably with morality as if both of them are the same thing. This mistake is often made when the term morality comes from the Greek word "moralis" and ordinarily is equivalent to the Latin word "ethikos" which means custom is used to speak of moral value. However, technically, they are not the same, and professionally, both cannot be applied interchangeably. This professional has been explained and technical difference is that ethics is theoretical. It deals with set principles and standards for acting, while morality is a code of judging behaviour. When the theory

matches with the practice the individual is said to be a person of integrity. This is a personal understanding of the distinction between both concepts.

Physical science

The term physical sciences are precise to the study of the physical or natural world. It is divided into four broad areas, namely: astronomy, physics, chemistry, and the earth sciences. The earth sciences are sometimes considered to be either made up of four or five branches such as: geology, meteorology, oceanography, and astronomy or geology, meteorology, climatology, oceanography, and environmental science. With this list, it is not out of place to say that physical sciences deal with inanimate matter. A common thread that passes through all the physical sciences is an abstraction.

SCIENTIFIC METHOD

It has been a great debate whether philosophy or any of its branches fits in as a science. What is science? Science is a systematic way of getting to know how things are in the world. It begins with observation, thinking, and demonstration and such a demonstration can be repeated again and again to produce the same result. The logicity of collecting determined results through the experiment is known as the scientific method. It is used in testing a hypothesis that is contained in a statement as a means of getting to a scientific theory. The procedure of assembling the various constituents with integrity showcases the cordiality of ethics with any science at all. Bearing this point in mind, the existing debate as to whether ethics is a science or not, does not hold in recent times and should not be contemplated to avoid wasting precious time. On this point, Copland (2003) wrote that: "Science and ethics must not be separated...The progress of research must be kept free from religious and political intervention" (Nanda, 1997). He emphasized that ethics is an integral part of science as it requires the scientist to be consistent and empirically justified in his interpretations of the actions of scientists.

This position is most objective as the products of any scientific finding can be measured and experimented with universally if the ethics guides are followed by any scientist who is interested in verifying the tested hypothesis or confirming the theory. The roadmap to the right and most appropriate theory is through a verifiable scientific method necessary to measure the suitability of the result. Rene Descartes was aware of how his senses often made him mistake a tree for a man. He knew that "it was not possible for one thing to have two natures at the same time" (Copland, 2003). The making of mistakes as a human being brings in the ethical perspective as a means of ascertaining the accuracy of observations,

predictions, and the analysis of collected data. He needed to take several steps to reduce the error to its barest minimum.

This involved reproducing the experiments to avoid wide discrepancies between observations and the obtained results. The most interesting thing about Rene Descartes is how he came to achieve the simplest truth in the world. The idea of suspending and denying all the knowledge he had already known before his conversion. He referred to the process as the Methodic Doubt. With the new method, he came to the ultimate truth. He realized that he could not deny the fact that he is a thinking being. This made him conclude that he is a thinking being. I think therefore I exist "cogito ergo sum" (Descartes, 2006). With the discovery of an indubitable scientific method as the Methodic Doubt, the ground was set rolling for a universal litmus test for science activities in the world. The absence of this litmus test was disastrous.

Recall that in 1638, an Italian astronomer, physicist, and engineer, Galileo Galilei, came up with a thought experiment aimed at disapproving the existing physical theories. It was a challenging moment for the science of his era in the sense that testability and falsification of hypotheses were not thought of. Research findings were unidirectional as they were based on deductive reasoning. For example, Settle (1983) explains how "Galileo's tower experiment was used to give explanations for the observations of the scientist" (Ibid). There was a lack of cross-matching between dependent variables and independent variables. So, Galileo's experiment of dropping two balls, the heavy and lighter discovered that the heavy ball hit the ground first, but only by a little bit. Except for a small difference caused by air resistance, both balls reached nearly the same speed.

The result of the experiment forced him to depart from Aristotelian ideas about motion when he claimed that heavy objects seek their natural place faster than light ones. This implies that heavy objects fall faster. With the Pisa experiment Galileo came to explain that without air resistance, a body should fall at a speed proportional to its density. The success of the experiment changed Galileo's thinking and changed the history of science. It provided a control experiment unlike in the days of Aristotle. It also questions the ground upon which Aristotle postulated his law of motion which holds that the laws governing the motion of the heavens were different from the laws that governed motion on earth.

Galileo's disagreement with Aristotle on the law of inertia was fully grounded on both deductive and inductive reasoning. It was cross-checked through dependent and independent variables with the aid of an experimental group and a control group. It was after all these procedures were carried out and the principle of repeatability applied that Galileo declared: "An object if once set in motion, moves with uniform velocity if no force acts on it." His law of inertia explains that when an

object is at rest, it remains at rest and if in motion will continue unless an unbalanced force acts on it. This has become a scientific theory because it has been tested repeatedly and it is referred to as the first law of thermodynamics which describes a phenomenon in these words: energy can neither be created nor destroyed.

The establishment of an experimental group became necessary in the world of science to consolidate the impact of individuals in the ecology of knowledge. This gave birth to the Royal Society on 28th November 1660. The mandate of the Royal Society was to provide proficiency in the sciences by producing experimental evidence that supports the truth in form of theories and laws gotten through the process of repeatability of research findings. The truth got is conceived as a framework upon which observations and facts can be based and such truth is an objective reality. This is difficult for people who are cognitively trapped in their myopic learning. To such people no explanation is satisfactory.

A twist on the suitability of an undiluted scientific method with universal applicability came in with an emphasis on human nature. Whatever kind of knowledge is acquired depends on the mental worth of the intelligentsia and its benefits to humanity. The 17th Century philosopher and empiricist, David Hume in his *Treatise on Human Nature* argued against the existence of innate ideas as emphasized by Immanuel Kant who refers to “innate ideas as knowledge *a priori*” (Settle, 1983) which is obtained by analyzing concepts independent of experience. For instance, the knowledge human beings have of God’s existence does not come through any form of sense experience. Is this strong enough to deny the sense of contributing to humans having knowledge of God? It is important to know that it is not enough to deny that *a priori* knowledge is independent of all experiences, what is significant is to show such a thought pattern is in itself empirically defeasible. If it comes to a *a priori* justification, it is a matter of a different ball game.

Philip Kitcher is optimistic that “a person is entitled to ignore empirical information about the type of world she inhabits” (Kant, 1965). This is interpreted by Hilary Putnam to mean that “there are certain truths that are rational to believe with the use of *a priori* justification” (Kitcher, 1983). One such truth is the existence of God. But Hume insists that “all human knowledge is gotten from experience” (Putnam, 1983). The debate between knowing through experience and thinking has taken an unyielding path of eternity. It cannot be resolved in this article. The direction that is appropriate for this paper is how scientific development impacted ethics. The interest of this article is to establish the existence of a formidable relationship between ethics and the physical sciences.

This relationship can be seen to exist if the question of morality (responsibility) in ordinary ways of reasoning is

associated with the being of a God, or in human affairs, there is a common use of the proposition ‘is’, and ‘is not’. What are the basic principles that guide the scientist at work? Does the scientist take responsibility for the product of the work performed? To what extent do concepts like the integrity of knowledge acquisition, production, storage, management, and sharing of data mean to the scientist? Does the scientist need a written code of ethics to operate? Hume’s teaching on the distinction between “what is” and “what ought to be” is helpful. It was clear that God was no longer the source of values. Human beings are integrated into social-interpersonal relations. Qun Gong argues that “the source of value is composed of social institutions, cultural constructions and the characteristic of the subject action in the background” (Hume, 2006). The firm lesson to be learned is that the human being has both psychological and social existence. It is the social actions that define who a human person is, not the state of abstraction. This implies that the physical scientist must be one who is scientifically honest, open, and ever prepared to take responsibility for the product of his work. This quest is nothing new to those in the humanities especially those in the area of philosophy. It is important for those in other disciplines to follow this path of honour. When the principles and procedures are followed appropriately and correctly, it is an indication that ethics is at work even if no mention of ethical concepts is made in the work.

ETHICS AND THE PHYSICAL SCIENCES: A RELATIONSHIP

Now, the relationship is established between ethics and the physical sciences. It is most critical to say that it is erroneous for anyone to separate ethics or morality from the sciences, physical sciences, and humanities. There has been no era in which ethics has been separated from any way of thinking more than in this century. Today, human activities have made us distinguish between the old world and the new world. The old world had ethics permeating every facet of human endeavour. An unwritten code of ethics was taught to the younger one through observation which is learning by watching and doing. For example, there was no written moral code for a child to learn how to cultivate, dig heaps, and plant yam seedlings among the Tiv people of Benue State. A child would learn by going to the farm every day with his father. The celebration of the Eucharist by a Catholic priest is learned by the seminarian through watching over some time. This makes the ethical issues involved in these practices be taken for granted by all and sundry.

When the elders begin to talk about those days, they are referring to the degree of respect that was accorded to values like: truth-telling, honesty, integrity, humility, transparency, accountability, sincerity, and faithfulness which are needed to turn things around in our age. In

those days, the family name was deified above all other things apart from the name of God. The Tiv of Benue State, North Central of Nigeria were people who understood the importance of value in the ecology of values in the cultural system. A good family name was recognized, cherished, and respected more than material wealth from an unknown source. Whatsoever an individual did, it was to the honour or disgrace of the family name. Everyone was careful not to tarnish the family name. The meaning attached to the family name was taken to wherever the person goes; in the shrine, marketplace, during communal meetings, in the school, and on the farm. What else would have informed the maxim of "iti i dedoo hembra nyaregh" which means a good name is more worthy than money among the Tiv people, if not the priority given to value? The seriousness attached to ethics can be transposed to the field of the physical sciences, sciences and humanities.

At this juncture, it is clear that ethics and the physical sciences are inseparable. The inseparability best be understood with relevant, discipline-specific examples. In the field of chemistry, Ryoji and Richmond, have declared that "Chemistry is closely involved in society, providing the foundations for areas of applied science such as nutrition, medicine, environment, energy, and materials" (Gong, 2013). What the Chemist does goes beyond the mixing of chemical reagents. It has a lot to do with the human system. The product can build or destroy the human body depending on the quality of the work done. Chemical products that are harmful to the human body and bad and should be destroyed and the chemist should take responsibility for the action performed and the appropriate sanction must be applied after the proper investigation is carried out. Whenever the chemist does otherwise, it becomes unethical behaviour. This pathetic behaviour of the chemists is reported in the Vanguard newspaper:

There is no data to know the magnitude of treatment failures and you know that there is a high level of kidney failure. Most of these diseases you should see in the elderly people are now in the younger people are caused by drugs. Kidney failure is found in elderly people but nowadays is more with the young because of drugs. The same applies to all other ailments but the common denomination is that people go to the chemist and buy drugs (Noyori and Richmond, 2013).

There are so many factors responsible for the presence of fake drugs in most markets in the world. Most important is the desire to get rich quickly through corrupt practices. The Nigerian dealer goes to countries like China, India, and Pakistan to collaborate with pharmaceutical companies to package drugs for the Nigerian market at a reduced price. These companies would agree to produce such drugs which turn out to be substandard and falsified drugs. What makes this practice immoral is that the packaging is sophisticated so

much that medical experts in the field find it very difficult to differentiate the fake from the original except through laboratory analysis. The faked drugs are found among the fast-selling brands and disgustingly they are sold at the same price as the original drugs.

The whole world is devastated by the Coronavirus which occurred in Wuhan, China in December 2019. In the article "The origin, transmission, and clinical therapies on coronavirus disease 2019 (COVID-19) outbreak, an update on the status", Guo et al. (2020) agreed that it all started in Wuhan, China (Vanguard News (Online) (2019). The World Health Organization declared Coronavirus a world pandemic because it has become a disease that people are not immune to as it spreads across large regions of the world. The problem with coronavirus is not its origin that is traced to either bats or pangolins, how after several years after the appearance of the virus around the globe, improved science and technology cannot exactly explain how the virus came in contact with human beings. Johns Hopkins' report:

The first case of COVID-19 was reported on December 1, 2019, and the cause was a then-new coronavirus later named SARS-CoV-2. SARS-CoV-2 may have originated in an animal and changed (mutated) so it could cause illness in humans. In the past, several infectious disease outbreaks have been traced to viruses originating in birds, pigs, bats, and other animals that mutated to become dangerous to humans. Research continues, and more studies may reveal how and why the coronavirus evolved to cause pandemic disease (Yan-Rong, 2019).

This is one strand of the story of the origin of the coronavirus. There are so many other strands. The lab leak conspiracy has gathered momentum over the world as presented by Timothy (2022) on Fox News Channel. Scientists of repute in the Johns Hopkins University think the coronavirus is not a product of evolution, but some lab process. The science that is interested in finding the truth will not relent until it gets to the truth of the matter. The ethical issues arising from the outbreak of the coronavirus are contained in the universal spread to all regions of the world, the uniform application of the lockdown principle to reduce its spread, and the difficulty of different laboratory tests giving different results to patients among others.

The field of physics is not exempted from cases of unethical behaviour among scientists. This strange unbecoming attitude was acknowledged when it became necessary for more emphasis to be placed on carrying out the most appropriate research conscious of attempts to destroy the reputation of scientists. Kirby and Houle (2004) described two cases of unethical publications that rock the Physics community. According to them, "The fabricated data and resultant false claims appeared in multiple-author papers that had been subjected to peer review and published in respected journals. The discovery of the fabrications prompted considerable soul

searching in the physics community and raised concerns that APS should perhaps be doing more to promote ethics in physics”.

Warning stakeholders in research institutes, it became paramount for scientific and technological research in any part of the world to be done in a manner that does not bring disrepute to the integrity of the participants. Being aware of this all-important factor, the American Physical Society (APS) wrote: “The physics community has traditionally enjoyed a well-deserved reputation for maintenance of high ethical standards and integrity in its scientific activities. Indeed, the American Physical Society is one of the few professional societies which have not felt the need for a formal code of ethics” (Broad and Wade, 1981; Kirby and Houle, 2004). This is indeed a statement of integrity in the field of physics. Society was aware that a good reputation is critical to the life of an individual, the group and the nation at large. This requires that workers be unbiased in their search for truth. The physicist should have a clear understanding of the method adopted for the research. The truth of the matter is that if workers are researching for a better knowledge, it is an indication of being loyal to the state. It behooves the government to fund such vital research that is error-free. This will go a long way in giving confidence to the beneficiaries of the products of the research findings. It is on the exhibited sincerity of any organization that the welfare packages depend on in the world.

The medical physician needs the application of ethics more than other disciplines because of their association with human life directly. Anything contrary to maintaining the ethics of their medical profession, the name of the individual is at risk just like the reputation of the organization. No matter the kind of legislation in place, when it comes to issues of life, no legislation is greater than the reason for the protection of life at whatever level it is. Is it safe for a young mother to seek to abort her pregnancy for any reason? The pro-abortionist would say yes and the pro-lifers would say no! There are so many reasons for a mother to decide to abort her pregnancy in consultation with a medical doctor. However, when abortion is contemplated, the life of the child which is at the point of contemplation is defenceless but real and valuable. This life should be respected and given all the rights due to it. It is uncharitable to kill a potential human being in the name of freedom of choice.

PLAGIARISM: UNETHICAL CONDUCT IN DATA MANAGEMENT

The idea of plagiarism is an attempt at sweet-coating evil by not calling it the right word. When data is used in a work without acknowledging its source, it is theft and should be seen as stealing. Yes, the result of the new study is reliable, but it is short of affirming through the process of verification of a previous discovery or finding.

Apart from refusal to acknowledge the source of information, it gives way to unguided falsification of data which is not a true representation of the findings of the current study. The reason for falsification of information is evil intended as it is a way of not applying the funds collected from the sponsors to their full usage. This leads to misrepresentation of scientific experiments as well as the products and outcomes. These unethical behaviours are some of the challenges that called for the introduction of professionalism in the conduct of research. All concern expects that for every specific observation and experiment a statement of claim is to be made; the procedure should be open to verification. This does not preclude the possibility of change if the tested hypothesis produces something new and better due to the availability of new data.

The failure to follow such a laid down procedure amounts to plagiarism. The evil of plagiarism encourages evaluators in most of our educational systems to touch the surface superficially of the articles presented for the promotion of candidates in the name of the “Politics of publication” to the detriment of the content of the article and the depth of its analysis. In most Nigerian universities what is required for the promotion of academic staff among other criteria is the number of articles one publishes in an “impact factor” journal like Springer, Elsevier, etc., that followed the rating of Thomson Reuters. These organizations do not understand that articles in the Arts and Humanities are not rated on an equal basis as those in the sciences, applied sciences, and social sciences. It becomes a serious crime not to promote staff because they are not able to publish in Thomson Reuters which is more of a science-based journal than it is for arts and humanities.

The problem in making decisions for publishing articles in “Impact Factor” journals is the result of a lack of self-confidence by those in the University Administration. Academia must note that it is not everything that glitters that is gold. A book should not be judged by the cover, but by the content which is appreciated after rigorous reading of the material. These breaches of ethics regarding academic rating take place in universities. This is succinctly captured in these words:

The researcher . . . will be judged [by] the number of articles, and the corresponding journal names, appearing on the CV. He or she will not be judged [by] the work spent on each paper, how many backup checks were performed to confirm the results, and so on. The high number of papers, in highly ranked journals, is what builds a career. . . . The recent sad events [show] that it is for many people more important to publish spectacular results than to publish true results (Broad and Wade, 1981).

It is apt to state based on the statement cited above that ethical issues are not tied to the appropriation of chemical or magnetic particles alone. They involve a professional

code of conduct which is needed for the effective transfer of knowledge. It is unethical for professionals not to acknowledge younger scholars when they source materials for their research articles and presentations at different fora. There is no gainsaying that ethics is significant to human existence. It is critical because ethics readily permeates every aspect of human life. Ethics can be a guide in the field where the physical scientist or technologist is at work.

FACT-VALUE DISTINCTION

Experimental sciences deal with statements of fact but are merely based on the collection of facts. The scientist abhors what is termed opinion or speculations based on speculations of an individual or group of persons. The facts are gotten through experiments and observations. An empiricist tells you what is and a moralist prefer to discuss what ought to be. The former is understood as a fact, while the latter deals with value. It is not everything that is said that is true that can equally be right and vice-versa. I indeed borrowed a gun from Mr. A; it is not right for me to return the gun to Mr. A when I discovered that he is mad. This example presents the source of conflict of interest between science and ethics or facts and values. This paper defines fact as an objective truth about an event or statement obtained through the scientific process and it can be empirically verifiable through the senses to form knowledge.

Value cannot be measured as objective truth because what ought to be can never be objective. I make bold to define value as a subjective approach to issues based on an individual's reasoning concerning personal faith or ethical worldview which cannot be scientifically proven to be either true or false. A practical example of an Aristotelian syllogism is helpful.

- (1) A mother cannot survive without a transfusion of her son's rare blood type – what is
- (2) It is only right for the son to help his dying mother – what ought to be
- (3) Giving blood involves no risk whatsoever – what is
- (4) The son ought to donate blood to his mother – what ought to be

There are two statements of fact 1 and 3 as well as two statements of value 2 and 4. The statements of fact can both be empirically and logically verifiable. They are objective truths. The statements of value are purely subjective because the son could decide not to help his dying mother and refuse to donate blood to his mother. Whether it is right or wrong, it is not possible to explain the value judgment reached at this point purely from the knowledge one gathers of the material world. A Jehovah's Witness before deciding whether or not to donate blood for transfusion has subjectively switched off on blood transfusion, so the decision not to donate blood

to his dying mother was already made before the question was even asked. Such action is comparable to carrying out scientific experiments with controlled experiments.

The import of the earlier discussion is that a fact is not determined by the belief of the presenter. A fact is always independent. A fact is exclusive to the observer and the observed. In every physical science, everybody with the pre-requisite skills can verify the fact of an issue or statement. It is not out of place to categorically state that a fact simply is. Such facts are universally attainable if and only if the procedure is applied, and the same result is gotten. It is right to talk about truth and trust in matters of facts. However, there are facts that at a point may not be known, but this does not preclude that they may not be known at all later. For example, the atom was earlier defined as an indivisible element, but in recent times the atom has been discovered to be divisible.

The crux of the matter with the fact-value statements is that it is difficult to make a value-laden claim like a factual claim. Factual claims can mistakenly create cause and effect in everyday life. While values determine what becomes a culture of a people. This is obtainable in our modern world where one's meat is another's poison or what gives you pleasure gives me pain. This has propelled politicians in most of Africa to defect from one political party to the other without thinking of the consequences of their actions on other followers. For instance, a one-time founding father of the People's Democratic Party (PDP) defects to the All Progressive Congress (APC) without consulting those who followed him/her for personal reasons.

This explains a value judgment in which complete acceptance of all variables is possible. Nevertheless, it is not even possible for anyone to live without thinking of value. There are times each individual believes in subjective value, but there are times there is an agreement among the different persons. This agreement creates the culture of a people. The cultural elements that stand out tall in a community or society may not be resolved, but interested parties who want to live peacefully with one another must learn to tolerate the parties in a dialogue.

VALUES AND MORALS

The attempt to examine the relationship between ethics and the physical sciences is to guide the scientists in physical science to make decisions that are conscious of the dignity of the human being. An appreciation of what morals and values are will go a long way in explaining why individuals are different in their beliefs, choices, and attitudes. When an individual makes moral claims, they are like facts, but these moral claims are not facts. The reality is that morals are culturally and socially formed and inculcated through societal learning. Morals are conventional and grounds for judging the character of an

individual. The presence of morals in a society motivates living a good and happy life. This is the biggest challenge the ethicist who is involved in value judgment faces in life.

There is no certainty about the truth of a value. There is no experiment one has to perform to investigate values like tolerance, the immorality of suicide, or murder. This brings in the issue of the 'is-ought' barrier. It is a barrier in the sense that one is not able to ascertain with certainty the fact that a thing is this way it ought to be this way at all. Hence, it is much homely to state that all values are better considered as matters of opinion and preference; they are at most relative to the agent and the culture of the judge. This position is unacceptable rationally. For if all value judgments are subjective, then it is possible to justify any action, including the worst one can imagine. Available cases can be cited to support this argument. Some of the most notorious and brutal criminals have attempted to justify their actions, suggesting that they did "the right thing." A good example is that of Al Capone, the famous gangster who is quoted to have said that "I have spent the best years of my life-giving people the lighter pleasures, helping them have a good time, and all I get is abuse, the existence of a hunted man" (Kirby and Houle 2004). The second case is that of "Slobodan Milosevic who in February 2002, repeatedly denied all guilt concerning his orchestration of genocide in the Balkans" (Dale, 1964). If values are relative, who's to say they were wrong? This allows any action to be morally justified. Uncomfortable with such moral relativism for this very reason, many ethicists have channeled considerable effort into finding a foundation for morality in the physical sciences (Keith, 2022).

CONDUCTING RESPONSIBLE RESEARCH IN THE PHYSICAL SCIENCES

Ethics makes for responsible actions and ways of thinking. It deals with the right and wrong of thought or action. Can we say that ethics is a science? The feeble-minded person would always say no to the question. The simple response comes as a result of the fact that as a science it cannot act in favour of a statement of fact and a statement of value. Ethical issues cannot be universally and objectively applied to every situation. It is largely conventional and relativist. David Hume sees this perspective as a "naturalistic fallacy" through which he explains the reality of an eternally parallel line between *ought* and *is*. He summarized the argument thus:

In every system of morality, I have always remarked, that the author proceeds for some time in the ordinary way of reasoning...when of a sudden I am surprised to find, that instead of the usual copulation of propositions, is, and is not, I meet with no proposition that is not connected with an ought or an ought not. This change is imperceptible, but it is, however, of the last consequence. For as this ought or ought not, expresses some new relation or affirmation, it must be observed and explained; and at

the same time that a reason should be given, for what seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it (Schultz, 2003).

The beauty of the argument is in the demonstration of how a philosopher can "observe and explain" the transition from *is* to *ought* which to distinguish between the realms of fact about the empirical world and value which deals with moral knowledge. If this is true as Hume presented it, then, it is fair to state that Hume was not out to deny the reality of a change that is "of the last consequence" (T. 469) which should not be considered too fast. The important thing to do is to "deduce" the *ought* relation if morality is to be derived from their way of reasoning. Let us consider Hume's example (a) we ought to have no other gods before Jehovah and (b) this is what Jehovah commands "seems altogether inconceivable" (T. 469). Statement 'a' and 'b' represent matters of fact and matters of value respectively. It is based on this understanding that Hume concluded that there is no sound inference or reasonable transition from *is* to *ought* is possible.

It should be noted that Hume did not claim to demonstrate that it is impossible to make a connection between natural facts and moral imperatives. However, he claims that it is possible to at least transit from *is* to "should" with careful observation and explanation of natural facts about human agreements or conventions to conclusions about our "natural obligations or morals". A good number of examples are handy. These include the obligation not to rob, steal, break promises, etc., this is an emotivist approach to ethics as he prefers to see reason as a slave of passion. This kind of scepticism is tied to the possibility of human beings having causal knowledge of the natural world.

This understanding was strongly rejected by Immanuel Kant who was of the view that causal relations are not relations between things as they are *noumena* "in themselves", they are rather between things as they are presented to us in the phenomena which are through experience. What does it mean to say that things are "in themselves"? Why is it not possible to know things as they are "in themselves" by human beings? How can human beings only know things as they are given to us in the experience? These were the questions of facts that were bordering Kant. These questions were put to rest when Kant came up with the *Critique of Pure Reason* in which he declared that our minds are not just passive receptacles for sensory experience.

Our minds can structure sensory inputs in every human being in a certain way. He speaks of categories like time and space which are prior to all experience. How are they before all experience? Kant began by explaining what being "a priori" means in his scheme of work. By "a priori" he concluded that the laws of nature are ultimately grounded in the structures of human perception, rather than like "things in themselves". Therefore, how things

are “in themselves” cannot be known by us. This is because there are limits to human reason.

It was from this conclusion that Kant decided to attack Hume’s notion that reason is the slave of the passions. Still, with the aid of the *Critique of Practical Reason*, Kant demonstrates that our moral duties can be rationally derived. The import of his position is that reason should never be a slave to the passions but should rule the passions. Kant is aware of human nature as an autonomous rational agent and as such, they are ends in themselves. This is the understanding that is deeply lacking in most people in our contemporary society, especially in Africa. Leaders in various positions treat other human beings as means to an end, not as ends in themselves. They treat themselves as ends in themselves but turn to treat others as means to an end. This is often done by allowing their rational wills to serve as an instrument of their sensual desires.

The politician does not see the youth as a free individual to be empowered so that his/her future is bright. They see them as means to their becoming a chairman, assembly member, member of the national assembly, governor, minister, and president of a country. This is what Kant abhors when he cautioned that we should never use others as a means to our ends. This position which is our basic duty to ourselves and that of others is clearly articulated in the different versions of the “categorical imperative” especially in the *Groundwork of Morals* wherein he declared that “Act only according to that maxim whereby you can, at the same time, will that it should become a universal law”. It is very difficult to apply this principle in cases of suicide, lying, self-development, charity, and promise-making. These cases have not resolved the existing tension between Kant’s epistemology and ethics.

In his epistemology, Kant upholds that the natural world is governed by causal laws; while in his ethics human action is governed by moral laws. This parallel tension is not feasible for the harmony of the human being who is principally an embodied being; spirit and body. It is impossible for a composing being to be controlled by two sets of diverse laws. The spirit is free but imprisoned in the body. How can the free spirit act in a world that is causally determined by sensual desires? Kant appeals to the mysterious noumenal faculty of “the will” which somehow transcends, but supervenes nature. This would be explained subsequently.

INFLUENCE OF ETHICS ON SCIENTIFIC RESEARCH

The focus of this paper is to examine how values that are embedded in ethics influence scientific research which is directly built on facts. To achieve our goal, it is important to make a distinction between fact and value demands. What does this mean to speak of value as a scientific researcher? Every research is scientific. This must be kept in mind from the inception to the end of any research

project. As a scientific researcher, it is important to do everything within your power to affect the research process and its result. If this is not watched, the findings of our research would also be affected. The fact of the matter is a total commitment to scientific truth as an “ultimate value” that is capable of shading or distorting research findings/results. Other good examples of values that affect our choices of research problems and commitments are given thus: (a) a feminist might be more likely to study gender than a non-feminist (b) a libertarian might be more interested in studying individual rights than a non-libertarian. This way of thinking has tremendous implications for universities globally. The compositions of specialized universities like universities of agriculture, health, and technologies have contributed immensely to the production of facts, than the conventional universities. This will go a long way to making the world a secure place.

SPECULATION AND VERIFICATION

There is no need for those who know about the study of knowledge to waste so much of their time debating a close tight relationship between speculation and verification. This is a cordiality that has existed between philosophy as a particular field of study and science. The comment is necessary for those who may argue that philosophy is not a science. Let us agree that it does not need the rigorous interpretations of its variables, it is relevant to show that there can be no scientific progress without philosophical speculations. Why do I say so? Why is this aspect of knowledge not given fair recognition by scientists and her allied forces? Whoever wants to make progress in life, the person must recognize the role of speculation. It is so critical for successful scientific discovery. The acceptance of speculation is the birth of a healthy society. There is no way sciences can make a better society without hypothesizing and bringing out the diverse functions of that which is to be. The matter for worry is that if those in the humanities who are custodians of critical thinking, especially philosophers fail to promote productive speculation, then we are doomed to be eternally destroyed.

CONCLUSION

For the physical sciences to effectively and efficiently meet the expectations of those who depend on their functions, they must not merely speak of being ethical; they must demonstrate their ethics in all aspects of their work. While ethics is speculative, the physical sciences rely on the principle of verification. While ethics engages in theorizing, the physical sciences strive to formulate solutions that are practical for human use. This critical task falls within the purview of the humanities in general and philosophy in particular, often under the guise of

ethics. Many individuals who fail to comprehend the role of ethics dismiss the justifications that scientists provide for their discoveries (Hume, 1978).

It is essential to recognize that the entire field of humanities has become the powerhouse driving global development. Governments worldwide, and especially in Africa, should acknowledge and integrate this understanding into their national policies, particularly concerning the education of the younger generation. An overemphasis on science, mathematics, and technological education at the expense of arts and humanities will not yield the desired outcomes of an educated society. It is imperative that all stakeholders work together to nurture the evolving relationship between ethics and the physical sciences. This relationship should be woven into every discipline that impacts humanity. Ethics inherently permeates the cultural realms of science, morality, art, and religion, and this reality cannot be denied. It must be embraced and built upon to achieve the integral development of both natural and human resources in our world.

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