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Ordinary Language Problem and Quantum Reality

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Abstract

Language has severally been viewed as a collection of words, phrases, and sentences. For some, it is a habit system, acquired accidentally and extrinsically. It is further regarded as a structure of forms and concepts based on a system of rules that determine their interrelations, arrangement, and organization. Language also has a relationship with the world and how we talk about the world. It is often likened to a tool, perhaps man's most important one; more useful it seems than fire, the wheel, or atomic energy. However, language like any tool has its limitations. This limitation is very obvious in the discussions of the behavior of sub-atomic quantum particles of reality since the ordinary everyday language of this macro-world does not fit into the picture of the behavior of elementary particles of physics. This paper attempts to highlight the language difficulties inherent in the discussions of quantum reality from a philosophical perspective using such tools as criticism, analysis and speculation to justify the position that ordinary language is not enough to interpret and explain quantum reality.

Keywords: ordinary, language, problem, quantum, reality

1. Introduction

We cannot talk about the properties of the external world using ordinary language unless we can device proper means of communication. These account for the reason why mathematics is held as the language of science and why some philosophers like Bertrand Russell and Alfred North Whitehead sought to reduce the whole of science to the language of logic in their *Principia Mathematica*.

In the world which we live, there are a lot of complexities, paradoxes and contradictions that has to be reduced to the level of our understanding via language. Nature is as complex as man; hence it is imperative for the introduction of language through which one man's idea can be understood by all. Thus, private language raises controversy about the possibility of having objective knowledge in a social context since ordinary language is simply defined as "the device we use for communicating with one another" (Lacey, 1982, p. 39). Even though language has an abstract nature, it is imperative that we probe into this nature. Kyrian Ojong (2011) opines that:

> In the art of communication, we do use language either as spoken or written words, gestures and symbols of one kind or another all of which are intended to signify to others something which we experience internally within ourselves or externally (p. 3).

Quantum theory, a theoretical science poses a lot of difficulties especially for ordinary language. Analyzing its principles, presuppositions and assumptions seems to lead to private language interpretations especially as it discountenances the very idea of a detached observer due to the particles randomness and duality. This is how Christian (2009) captures this point:

> The concept of a detached observer vanishes in Quantum physics; In theory the physicist is in dialogue with reality, together working out the way that quantum reality will reveal itself; the observer changes reality in the act of observing it (p. 517).

This position destroys the objective, impersonal foundation of science as a knowledge yielding enterprise because of the weird and random behavior of particles whose elusive nature leads to different perception and interpretations. And for the autonomy of language to be maintained, one could also conceive that there must be some standards by which linguistic competence is judged and restrictions placed on the assignment of private meanings to the words and symbols of language. Linguistic elements are governed by rules which render our use of the elements of that language regular and systematic, thus the concept of language must be ruled governed.

The mathematics of quantum physics in its sophistication is seen as the best language of understanding the theory because of its workability and the elimination of ambiguity. But the problem seems to be that when we try to interpret these abstract mathematics in ordinary language, we find ourselves in a quagmire. Suffice it to say that mathematics as a language is restricted only to those that have a grasp of it for its meaningfulness. However, this work is an attempt to show that ordinary language with its public acceptability and rules breakdown in the course of its being applied to the explanation and interpretation of the behavior of particles of physics at the sub-atomic level of reality because of the particles random behavior and motion which is different from reality at the macro level. Let us turn to the concept of ordinary language for more insight.

1.1 Understanding Ordinary Language

There are some basic concepts that constitute the use of language. Chiefly amongst them is the concept of meaning. When linguistic expressions are vague or used metaphorically, it does not make for clarity of meaning and purpose. This said the problem concerning language cuts across the same concerns that the grammarians, the psychologists and the anthropologist tries to tackle. In the Oxford dictionary of philosophy, (Blackburn, 2005) defines ordinary language as:

> The language of everyday use; ordinary language philosophy was the variety of linguistic philosophy that paid particular attention to the nuances of everyday usage, believing that philosophical error often arose from neglecting distinctions embedded in that usage (p. 262).

By way of analyzing the afore-quoted, we can infer that the macro world we live in has certain correlations with the language we use in describing its phenomena. When we say: this is a tree, stone, flower, sun, moon, and mountain and so on; we at least understand the reference we are making of words and things. Thus it appears it does not pose much of a problem describing the phenomena of the world which we live in through the medium of ordinary language. We find adequate characterization given to the cognates of physical reality. Perhaps It is this characterization of language via its meaning that made Alston (1964) to give three types of theories of meaning which he calls “referential”, “ideational” and “behavioral”. He explains them thus:

> The referential theory identifies the meaning of an expression with that to which it refers or with the referential connection; the ideational theory with the ideas with which it is associated and the behavioral theory with the stimuli that evoke its utterance and/or the responses that it in turn evokes (p. 12).

In the rationalist and romantic tradition of linguistic theory, the ordinary use of language is regarded as characteristically innovative. Here sentences are constructed that are entirely new. There is no substantive notion of “analogy” or “generalization” that accounts for the creative aspect of language use. For (Chomsky, 1975, p. 129) “It will be equally erroneous to describe language as a ‘habit structure’ or as a network of associated responses”.

1.1.1 The Thesis of Ordinary Language

This incorporates the principle of symbolism and the relations which are necessary between words and things in language. Wittgenstein for example is concerned with the conditions for accurate symbolism, i.e. for symbolism in which a sentence “means” something quite definite. He was concerned about a logically perfect language. But whether he succeeded or not in this quest is outside the scope of this work. But worthy of mention is the fact that Wittgenstein (1974, p. 5) mentioned that the essential business of language is to “assert or deny facts”.

Opining further, Wittgenstein says given the syntax of a language, the meaning of a sentence is determinate as soon as the meaning of the component word is known. It is like saying that theory is related with facts or evidence. The scientific tradition has done well in this area. And the fact that in relating theory with evidence, we have had to think that observation sentences constitute an enormous part of our epistemic input. But as (Quine, 1953) points out:

> Beyond the observation sentences, theories have no empirical consequences they can call their own. The observation sentence, situated at the sensory periphery of the body scientific, is the minimal verifiable aggregate; it has an empirical content on its own and wears it on its sleeve (p. 89).

Wittgenstein (1974, p. 8) makes the claim that "we make to ourselves pictures of facts". A picture, he says, is a model of reality, and the objects in the reality correspond to the element of the picture. The picture itself is a fact. This position is shared by the empiricists who see the use of words as sensible marks of ideas, and the ideas they stand for are their proper and immediate signification.

1.1.2 Linguistic Concerns

Linguistic is getting increasingly formal and mathematical in the sense that languages are sets of signs (a semiotic system). Signs combine an exponent (Sequence of letters or sounds) with a meaning. Grammars are ways to generate signs from more basic signs. Signs combine a form and a meaning and they are identical with neither their exponent nor with their meaning. Language signs have much more internal structure than ordinary signs. Language allows us to express virtually every thought that we have, and the number of signs we can produce is endless.

In linguistics, language signs are constituted of four different levels. They are phonology, morphology, syntax, and semantics. Semantics deals with the meanings (what is signified) while the other three are concerned with the exponent. Sounds by themselves in general have no meaning. The part of linguistics that deals with how words are put together into sentences is called syntax. The minimal part of speech that bears meanings is called morphemes.

Morpheme is assumed to be part of a word; bigger chunks are called idioms so that a word such as "dogs" has four manifestations: its meaning, its sound structure, its morphological structure and its syntactic structure. The levels of manifestation are also called 'strata' or level of representation. The power of language to generate so many signs comes from the fact that it has rule by which complex signs are made from simpler ones thus the concerns of linguistics preference must be about reducing vagueness and ambiguity while entrenching meaning even if it has to employ sophisticated models. Let us now move over to highlighting the basic principles of quantum physics.

2. An Overview of the Principles of Quantum Physics

The story of the discovery of the quantum theory began with Max Planck's determination of the black-body radiation law, the giant first step in 1900. In his work on black-body radiation, Max Planck introduced a new constant into physics, called "h" which was a measure of the amount of discreteness in atomic processes.

A black body is an object that absorbs all radiation falling on it, at all wavelengths. When a black body is at a uniform temperature, its emission has a characteristic frequency distribution that depends on the temperature. Its emission is called blackbody radiation. When Planck did his work, in 1900, physicists thought that atoms could have any value for their total energy, thus energy was thought of as a continuous variable. But Plank's quantum hypothesis according to (Holton & Roller, 1958, p. 577) "implies that energy exchange was quantized". Although the introduction of a quantum of energy had no basis in classical physics, it was not yet clear that the new theory required a radical break with classical concepts. Theoretical physicists first tried to reconcile Plank's quantum hypothesis with classical physics (Pagels, 1983, p. 50).

Einstein took up Planck's idea in his 1905 paper on "Photoelectric Effect". Planck assumed that sources of light exchanged quantized energy. Einstein going a step further assumed that light was itself quantized i.e. consisted of particles called photons. Einstein then proposed the hypothesis that the energy of light is not distributed evenly over the whole wave front, as the classical picture assumes, but rather is concentrated or localized in discrete small regions in "bundles" or "lumps" of energy (Torretti, 1999).

The theoretical ideas of Planck and Einstein which advanced the quantum theory were a response to experiments which opened a whole new realm of natural phenomena thus quantum mechanics has become the subject of endless philosophical debate. This state of affairs is all the more irksome in view of the theory's unblemished record of experimental success (Pagels, 1983, pp. 46-47).

Pondering on the mathematical equations of quantum theory and their meaning for the real world develops an interpretation which departed radically from naïve realism (the world as it appears to us). Newton's laws brought order to the visible world of ordinary objects and events like stones falling, the motion of planets, the flow of rivers and the tides. The primary characteristics of the Newtonian world view were its determinism, the clock-work universe determined from the beginning to the end of time, and its objectivity, the assumption that stones and planets objectively exist even if we do not directly observe them; turn your back on them and they are still there (Pagels, 1983).

2.1 Quantum Weirdness

However, in quantum theory the common sense interpretations of the world (like determinism and objectivity) cannot be maintained. Although the quantum world is rationally comprehensible, it cannot be visualized like the Newtonian world. And that is not just because the atomic and subatomic world of quanta is very small, but because the visual conventions we adopt from the world of ordinary objects do not apply to quantum objects. For example, we can visualize that a stone can be both at rest at a precise place. But it is meaningless to speak of a quantum particle such as an electron resting at a point in space.

In other words, these wave-particles ("wavicles") are so elusive that their location and speed cannot be pinned down at the same time; they can be apprehended only in terms of probabilities (Christian, 2009, p. 515). Strangeness therefore characterizes everything about quantum physics. Regarding the wave-particle duality, the question persists; is nature essentially particulate or wave-like? Should our most fundamental picture of nature be deterministic or probabilistic, particulate or field-like? In a famous double slit experiment, photons and other particles begin their journey as particles and end up as waves; and when the experimenter tries to figure out where, when and how this "sex-change" occurs, he finds that the mere act of inquiring determines what the answer will be. Furthermore, particles can affect one another from a distance even when no force or connection exists between them. "Spooky action at a distance" was Einstein's description of it, and he fairly rejected the notion.

The problem of physically interpreting the behavior of quantum mechanics led to a wide array of theories. Heisenberg came up with his matrix-mechanics, Schrödinger with wave-mechanics. For Schrödinger, the electron is not a particle, he argued, it is a matter wave as an ocean wave is a water wave (Pagels, 1983). According to this interpretation, all quantum objects, not just electrons, are little waves and all of nature is a great wave phenomenon. This matter-wave interpretation was rejected by Gottingen group led by Max Born even though he got himself entangled by his probability interpretation for finding an individual electron particle. Einstein sees quantum mechanics as truly imposing but an inner voice tells him it is not yet the real thing.

2.2 Quantum Interpretation Challenge

Einstein, stating his objection to the new quantum theory remark that "he did not believe God plays" (Pagels, 1983). Max Born later responded "if God has made the world a perfect mechanism, He has at least conceded so much to our imperfect intellect that in order to predict little parts of it, we need not solve innumerable differential equations, but can use dice with fair success" (Pagels, 1983). With Max Born's statistical interpretation of the de-Broglie-Schrödinger wave function, physicists finally renounced the deterministic world view of nature. The world changed from having the determinism of a clock to having the contingency of a pinball machine.

Furthermore, Heisenberg discovered the uncertainty principle and Bohr discovered the principle of complementarity. Together these two principles constituted what became known as the "Copenhagen interpretation" of quantum mechanics an interpretation that convinced most physicists of the correctness of the new quantum theory.

The high point of quantum theory is the fact that it describes energy and matter as waves and as particles. The type of energy in question here is light energy or photon. Classical physics considers light to be only a wave and it treats matter strictly as particles. But in quantum theory, "both light and matter can behave like waves and like particles" (Redmond, 2008, p. 9).

Quantum mechanical equations show that accurate measurement of both the position and the momentum of a particle at the same time are impossible. The uncertainty principle holds that as physicists measure a particle's position with more and more accuracy, the momentum of the particle becomes less and less precise, or more and more uncertain, and vice verse (Redmond, 2008). Thus the emergence of the many-worlds theory of quantum mechanics which supposes that for each possible outcome of any given action, the universe splits to accommodate each one. This theory attempts to take the observer out of the equation. No longer are we able to influence the outcome of an event simply by observing it, as is stated by the Heisenberg uncertainty principle.

3. The Limit of Ordinary Language in Quantum Reality

From the picture of the basic principles of quantum physics just painted, we can sense that the behavior of quantum particles will of a necessity pose great challenge to communication using ordinary language medium. There are certain things we cannot do with ordinary language and the attempt to make it do what it cannot do often lead to trouble. This is how Lee in (Weinberg, 1959) puts it:

> Language is compared to a fish net. The very small fish escape from the web; the very large ones cannot be encircled. In the case of language, the small fry are the infinite details of the material world; no matter how fine we weave the mesh, an infinity escape. We can never exhaust completely even the simplest bit of matter. We can never exhaust what could be said about a simple grain of sand (p. 34).

Words are about things. They are not the things themselves. The world of things is constantly changing. It "is" bright, hard, soft, green, rosy, acrid, black, burnt, black, burnt, rubbery, loud, sharp, velvety, bitter, hot, freezing, silent, flowing, massive, ephemeral, wispy, granitic. These are some of the names we use for the way things seems to us. Words are like maps, and the map is not the territory. The map is static; the territory constantly flows. There is the danger of building maps that fit no unknown territory and the greater danger of not caring whether or not they do. This is the dilemma that most physicists find themselves especially as it has to do with the use of ordinary language to describe quantum behavior of particles.

Classical physics represents the power of a causal language that separates the observer from the observed, the subject from the object. Surely there are facts about the way the world is, independently of what we say; and surely we can talk about the world as it is independently of any observations. Quantum theory, however, does not fit this framework of observer/observed, subject/object dichotomy. The success of quantum theory showed physicists that when they talk about the atomic realm, they can no longer talk of a world whose behavior can be described in the absence of a well defined scheme of measurement.

In talking about the atomic world, the observed and the observer cannot be separated the way they can be when we talk about the world of everyday experience. To go beyond the realm of classical physics, physicist had to give up the paradigm of a detached observer and an independent reality if they must reduced quantum phenomena to the understanding as in the case in classical physics. Russell (1948) puts it this way: "everything here in quantum theory is abstract and mathematical except the sensations of colour and heat produced by the radiant energy in the observing physicist" (p. 41).

All the words or concepts we use to describe ordinary physical objects, such as position, velocity, colour, size, and so on, become indefinite and problematic if we try to use them of elementary particles. Given a particular experimental arrangement, physicists can predict the outcomes of that experiment. Anyone with the requisite ability can replicate them; they are perfectly objective in this sense. What is not given to physicists by nature, but rather is invented by them, is what they say about these outcomes, "the language use in talking about nature" (Gregory, 1990, p. 181).

If physicists try to step outside the scheme of experimental arrangements and observations to envision what sort of independent mechanism in the world really produces those observations, in Feynman's (1964, p. 43) words, "they get down the drain into a blind alley from which nobody has yet escaped". Some say quantum theory shows that experimental arrangements compel electrons to take on certain values such as position and momentum. Physicists discovered that they cannot interpret their measurements in language where position and momentum is simultaneously precise (Gregory, 1990). For (Woozley, 1973, p. 12) "a great many disputes both in philosophy and in other subjects, whether theoretical or practical, owe their existence to the fact that the disputants are using the same words (i.e. the same sound if they are talking or the same marks on paper if they are writing) with undisclosed differences of meaning".

The existence of a world we cannot see makes sense from a physicist's point of view only if this world has observable consequences. Physicist cannot "see" quarks or gluons, but quarks and gluons are elements of physical theory because they lead to predictions that physicists can see, that is, the outcome of such prediction. Talking as though there are quarks and gluons helps physicists to make sense of the world. Fritjof Capra (1977) elucidated this point clearly when he asserts that:

> At the sub-atomic level, matter does not exist with certainty at definite places, but rather shows "tendencies to exist" and atomic events do not occur with certainty at definite times and in definite ways, but rather show tendencies to occur. In the formalism of quantum theory, these tendencies are expressed as probabilities and are associated with mathematical quantities which take the form of waves. This is why particles can be waves at the same time they are not "real" three-dimensional waves like sound or water waves. They are "probability waves", abstract mathematical quantities with all the characteristic properties of waves which are related to the probabilities of finding the particles at particular points in space and at particular times (p. 78).

Niels Bohr concluded that we must take seriously the fact that physics is our way of talking about the world. For him, there is no quantum world there is only an abstract quantum physical description. It is wrong to think that the task of physics is to find out how nature is; "physics concerns only what we can say about nature" (Bohr, 1987, p. 305). When we attempt to speak in some way about the structure of the atoms, we cannot speak about them in ordinary language. The very word or concept, clear as it may be has only a limited range of applicability. Here we have at first no simple guide for correlating the mathematical symbols with concepts of ordinary language and the only thing we know from the start is the fact that our common concepts cannot be applied to the structure of the atoms. Fritjof Capra (1977) rightly puts it this way: "the instant you speak about a thing, you miss the mark" (p. 42).

There is a sense in which no one, including philosophers, doubts the existence of a real objective world. The stubbornly physical nature of the world which we encounter everyday is obvious. The word "real" does not seem to be a descriptive term opines Gregory. It seems to be a harmonic term that we bestow on our most cherished beliefs our most treasured ways of speaking (Gregory, 1990).

Einstein and Infeld (1938) adumbrating on this point says "without the belief that it is possible to grasp reality with our theoretical constructions, without the belief in the inner harmony of the world, there would be no science" (p. 296). Heisenberg (1962) made a similar point when he says "what we observe is not nature itself, but nature exposed to our method of questioning; scientific work in physics consists in asking questions about nature in the language we possess and trying to get an answer from experiment by the means that are at our disposal" (p. 58).

We have always hoped about being able to talk of the world in natures own language. The history of physics makes it hard to sustain the idea that we are getting close to achieving that. Despites the amazing success of physics, there still remains the problem of a theory corresponding to nature via its language. This problem is very much inherent in quantum theory. And it is instructive to reel out (Wittgenstein, 1974) advice who said "what we cannot speak about, we must pass over in silence" (p. 74). This advice appears unprogressive, but we need to be cautious here as science, whose method is wholly empirical, may enter into the realm of metaphysics, whose knowledge has been misconstrue to be useless and meaningless and this happens to be the trap with quantum theory from the perspective of language.

4. Conclusion and Recommendation

One startling discovery in the course of our discussion so far is the fact that the external world by its operations and workings seem to influence our language. It appears that objects that are travelling near the speed of light tends to behave in a manner that can be described as weird forcing us to re-construct our language in other to keep abreast with them. This goes to show that even though language is the invention of man, it can still be influence by factors external to it as is the case with quantum reality.

Often times, we are short of words to describe occurrences in nature even in the macro-world of reality. At such times, language goes on holiday. This is the case with behaviors of the particles of physics that has made the usage of our ordinary language inadequate in interpreting its phenomena. Thus one way of managing this present challenge is not to abandon our attempts but to understand that language though abstract is limited in describing the totality of reality. Or how can we explain a situation in which one stand with mouth agape in awe of the wonders of creation and other occurrences beyond our comprehension without appropriate words to describe this experience?

Salmani Nodoushan (2008) in his paper entitled "The Quantum Human Computer (QHC) Hypothesis" opines that human mind works like a quantum computer. He based his claim on the analogy between human beings and computers because they possess physique, mind, memory, soul and spirit. Krivochen (2011) on the other hand proposes a **quantum linguistics** via radical minimalism (through an inter-disciplinary approach) from where he concludes that language is part of the "natural world", therefore it is fundamentally a *physical system*; as a consequence it shares the basic properties of physical systems and the same principles can be applied, the only difference being the properties of the elements that are manipulated in the relevant system. He claim further that the operations are taken to be very basic, simple and universal as well as the constraints upon them, which are determined by the interaction with other systems, not by stipulative intra-theoretical filters. The effort of Nodoushan and Krivochen is an attempt to bridge the gap between quantum reality which operates on the basis of fuzzy logic where an object can exist in more than two states simultaneously and the inadequacy of ordinary language we use in describing these realities.

Language with its relationship to the mind may not be able to articulate certain realities and to this end, it also goes to show the finitude and limitations of the human brain/mind. It will be safer then to try, however hard we can, to be able to understand, interpret and communicate the external world especially to others through the instrumentality of language. But should we come to a grid-lock, we must realize that such dead-ends are not out of place especially where words and things are involve with an arbiter which is man in his imperfections. Understanding this truth, Krivochen conclude with some doubt as to whether the enterprise of interpreting reality through "**quantum linguistic**" will succeed; for him and for us as well, only time will tell.

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