STRINGENT SCIENTIFIC CRITERIA

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From a physicist regarding human knowledge: "...everything that you think you understand is based on less stringent criteria than what we accept today in science." This description can be substantially applied to experimental physics. However, it cannot be demonstrated to apply to theoretical physics. Theoretical physics is a guessing game. The game must be played within the constraints placed upon it by empirical evidence. Even so, these constraints are not a safe harbor for truth. While empirical evidence is carefully gathered, theory is a matter of opinion. The use of theory is scientific, so long as the theorist admits to the artificial knowledge contained in the theory.

What is unscientific is to present unexplained and unproven theoretical properties as if they are facts. If something cannot be explained, then it is not understood. If it is not understood, then its theoretical interpretation is not an established fact. Everything we learn about the universe comes to us in the form of measurements of changes of velocity. These changes of velocity consist of measurements of distance and time. It is clear that both of these empirical qualities exist. We also know that changes of velocity vary. These changes very often occur in patterns that we can use to extrapolate new values of changes of velocity. Everything else offered as knowledge about the operation of the universe is theory.

The complexity of theory develops from our discovery that there are complex patterns in changes of velocity. It is the mathematical equations, formed to fit the patterns that are capable of giving successful predictions about future changes of velocity. These equations, if they are presented without added-on theory, represent our empirical knowledge. It is these empirically founded equations that form the framework around which all theory is fitted. It is not the theory that is the demonstrated scientific truth.

The theory becomes added on right at the beginning of our empirical knowledge. This causes the integrity of the empirical knowledge to become undermined very early. The empirical knowledge becomes covered over by our invention of theoretical knowledge. Theory is substituted for those parts of reality that are undiscovered or not yet understood. At first this is not noticeably detrimental to making predictions. The basic mathematical expressions that fit the empirical data can work for a while even after having been distorted by theoretical adjustments. The math of the theory works well until empirical knowledge, for unknown reasons, begins to contradict it.

In order to overcome the contradictions, theoretical adjustments must be made. As we continue to gain in empirical knowledge the theory very likely would change. All theory is vulnerable to being changed. It can even be the case that theoretical physics could be almost completely wrong. This is the case because it is not the theory that leads to predictions about future events. The theory is added on to the true source of the predictive power. It is the empirical basis of the equations that provides predictive power. The equations are first formed to describe extrapolations of empirical data. This is how predictions are made possible. Empirical equations about empirical data represent real physical knowledge.

The truth of our knowledge of the operation of the universe is contained only in the empirical parts of the equations. The theory could be stripped away and the truth of the equations will remain. It is the pure equations, based only upon empirical measurements of changes in velocity, which have the power to make predictions. In their pure form they probably have an even greater range of predictions than they do in their theoretical form. The addition of theory places constraints upon their natural range of physical truth.

However, physicists immediately begin to theorize about the meaning of these empirical equations. The theorist changes the equations into theoretical tools. They do this by adding qualities that are not empirical. These qualities are interpretations that are applied to the equations. The interpretations can be different depending upon the education and point of view of the theorist. The interpretive process becomes attached to the equations from the start. Even the simplest physics equations contain interpretive, theoretical appendages.

All complex theory consists of interpretations fused with popular paradigms. All of these interpretations are only guesses and cannot be substantiated. It is true they are educated guesses; however, the education upon which they are based consists, to a very large extent, of other tenuous theory. Their cumulative effect is seen in both the introduction of theoretical *givens* and various theoretical formulations lacking continuity or unity. The addition of new givens in order to achieve the appearance of unity is not a safe scientific practice. For example: The fusion of two theoretical givens into one by means of artifacts, such as an empirically unverifiable extra dimension, does not represent true, fundamental unity.

The use of theoretical givens represents gaps in empirical knowledge. Since they are artificial in nature, then their symbolic and mathematical identities are also artificial. These givens become piled on baggage carried in the theoretical parts of the equations. This practice of adding theoretical parts is detrimental to the overall usefulness of the clean, original empirical equations. This is the cause of disunity. It is a failing of theoretical physics. All things equations give back to us are the results of those features initially put into them. All possible implications are contained in the initial assumptions.

The theorist can only learn back from their equations what they themselves first imagined to be the nature of the universe. The equations no longer offer clean empirical knowledge; they are loaded with the meaning imposed upon them by the theorist. It does not matter if the theorist does not fully understand the entirety of the implications of his initial assumptions about reality. They are automatically included in his equations right from the start. When he later learns of these, from the use of his theory, such learning is not the result of predictive power.

The most successful interpretations currently offered could easily be wrong. My basis for this claim is that theoretical physics is not yet founded upon explainable, fundamental properties of the universe. A simple example of this failing is the use of $f=ma$. The only part of this equation that can be explained is acceleration. That is because it consists of the measurement of distance and time. The rest of the equation is unexplained. Force is the unexplained cause for acceleration. Mass is the unexplained cause for the variation of that acceleration. What is force?

What is mass? Why does matter resist force? These are a few of the many unanswered questions undermining the fundamentals of theoretical physics.

Theoretical physics builds up artificial walls that inhibit our understanding of reality. For example, a clear break with empiricism is typified by the theory of electric charge. In the case of Coulomb's Law, it is a worthy contribution to our understanding of the operation of an unexplained phenomenon to write:

$$f = k\,\frac{q_1 q_2}{r^2}$$

It represents the discovery of new patterns in changes of velocity. The equation is empirical so long as k and q are admitted as representing unexplained qualities. Coulomb's Law becomes theoretical as soon as the theorist explains q as having a fundamental physical nature called electric charge. This practice causes a unique, theoretical quality of the universe to become rooted into the equation. Historically this occurred at a very early time when we knew only a small amount about the properties of this unexplained phenomenon and nothing about its physical origin.

The theory of electric charge is a guess as to the physical meaning of mathematical quantities that first appeared in the empirical form of Coulomb's Law. The existence of electric charge will remain a guess until someone can explain: What is electric charge? That is why electromagnetic theory is field theory. The words *field theory* are a substitute for saying *the means cannot be shown*. It is an admission that the cause of electromagnetic phenomena cannot be explained. Quantum field theory does not fix this problem. My use of the term field applies to all mysterious causes. For all interacting objects the question to be answered is: What is the first cause of their effects upon one another?

It is a very risky venture for physicists to theoretically invent unique causes for unexplained events. What the theorist imagines can exist is not empirical knowledge. He can imagine that a force field exists, but he cannot prove it. He can observe that particles exist, but he can only imagine why they cause each other to change their velocities. Presently, he imagines there are at least four fundamental causes or forces. This theoretical separation of causes becomes solidified, at a fundamental level, into mathematical formulations by the introduction of new symbols and new names. All higher-level theoretical mathematical formulations that include electric charge as a fundamental physical reality are actually only theorists' interpretations based upon previous theorists' interpretations.

The theory of electric charge becomes solidified into mathematical equations by the introduction of coulombs as units. This act is a monumental, radical, concrete change that makes the mathematics subservient to the theory. The resulting equations are no longer empirically based. They become a part of a theory. An important loss occurs at this point. Unity may have been possible at the fundamental or most empirical level; however, the possibility for this occurrence has been mischievously blocked by the theoretical introduction of a unique, fundamental cause. If the initial guess about the existence of electric charge was wrong, then all higher-level theory derived from it is also wrong. There are no degrees of certainty here. It is either right or it is wrong. A great deal of useful theory depends upon the existence of electric charge.

This theorization of mathematics is pervasive throughout all theoretical derivations. Consider equations such as Newton's:

$f = ma$

And his force as a function of the rate of change of momentum P:

$$f = \frac{dP}{dt}$$

They are usually not identified as being theoretical. It is certainly true that they are representative of real patterns in changes of velocity. However, they are also representative of theoretical distortion. Specifically with:

$$f = \frac{dP}{dt}$$

There is a serious loss of empirical value when the physicist offers either force or momentum as having explainable physical natures or essences. They are not explainable. The only term in this equation that is explainable using empirically demonstrated properties of the universe is dt. Time is known to be real. It is empirical. Things happen during time.

The existence of a physical presence for momentum is theoretical. It has not been separated out as a physical substance. Its derived origin is still solely a name of convenience for the product of force and time. However, now it is theoretically treated as if force times time is like a liquid being poured from one container to another. When a physicist speaks of momentum, energy, electric charge, gravity or anything else, other than distance and time, as if they each have a unique, fundamental, demonstrable, physical presence, then they should explain and demonstrate how this is known.

The possible magnitude of scientific penalty is typified by the theory of mass. In the case of mass, its physical cause has never been understood. Learning what mass is could suddenly change everything. This weakness is pervasive from the fundamentals through all of theory. There are many guesses incorporated into fundamental and, by connection, advanced theoretical physics. Perhaps the nature of cause must always remain a mystery. However, we should restrict our lack of knowledge to one fundamental, unknown, original cause. Then we can begin to apply stringent scientific criteria to the development of a unified theory of physics.