EMPIRICAL EVIDENCE AND THEORY

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From a physicist: “Every single principle that we teach in intro college physics is based on only two principles: Conservation of momentum, and conservation of energy/mass. That’s it! All the other ‘laws’ are based on those two principles - be it Newtonian mechanics, thermodynamics, E&M, etc... We can write those Newtonian laws because of conservation of momentum. We can write the energy equations of the Lagrangian/Hamiltonian because of conservation of energy. Each conservation principle is based on some underlying symmetry of our physical world. Conservation of momentum is based on the isotropic symmetry of empty space, conservation of energy on the symmetry of time. So these are the FUNDAMENTAL assumptions that we build all our understanding on (ignoring the CPT conservation rules).”

Physicists measure changes in velocity and use this knowledge to learn how to predict future changes in velocity. These predictions are made possible by mathematical equations that have been designed to describe patterns in changes of velocity. The equations provide a means for extrapolating new values that can usually predict new empirical data. Symbols of convenience are used to help form the equations. Just four of the possible symbols represent empirical qualities. Two of these qualities are distance and time. They are direct empirical qualities.

Two other qualities are force and resistance to force. These two are indirect empirical qualities. Both force and resistance to force have undiscovered physical natures. We know from empirical data that they must exist; however, all of that empirical data consists of measurements of distance and time. Measurements of distance and time are, in general, the extent of direct empirical knowledge. Force and resistance to force are the extent of indirect empirical knowledge. *Everything else is theory*.

Theory can never be proven, because nothing in theory has a demonstrable physical nature that can be isolated and examined. All that can be proven is that theory is usually compatible with empirical data. However, this only establishes that theory is a professionally added feature. It does not indicate its correctness. Theory is useful to us, but not because of its predictions. The predictions follow from the empirical basis of the mathematical equations. Theoretical predictions are always about future changes of velocity. The theory parts of the equations are the interpretation of properties other than distance and time. These interpretations are useful only in our minds. Theory helps us to organize our thoughts. The limitation of theory is that our thoughts do not have a provable physical nature.

In the equation $f = ma$ only a consists of direct empirical qualities. Acceleration consists of measurements of distance and time. Both f and m are indirect empirical qualities. They are made known to us through terms of distance and time. If we are to learn from our empirical knowledge of them then, they should remain expressed in terms of distance and time. However, theorists do not use Newton's equation in its empirical form. They, instead, place theoretical interpretations upon both force and resistance to force. Force and resistance to force are treated as if we know them in a much deeper way than just by their effects. Force is interpreted as a classical field or a quantum field or whatever else seems mentally useful. We do not know why matter resists force; however, theorists name this resistance to force as *mass*.

Mass is then said to consist of a theoretically proposed physical quality called energy. The theoretical introduction of fundamental physical qualities such as energy and momentum cannot be derived from the fundamentals of physics. Within the fundamentals both qualities are described only as measurements of the application of force. For a given event, a force is applied across a distance and during a period of time. The product of the force and the measure of distance is given a name of convenience called *energy*. The product of the force and the period of time is given the name of *momentum*.

The words energy and momentum are just names for the totals of these measurements of the effect of force. They are sum totals and not physical properties. They are quantitative measurements. Without their names they do not sound so physically substantive. One could still be called *force times distance* and the other could still be called *force times time*. If this were still the case, would theorists be so enamored with them?

It was learned that energy and momentum are conserved. The theoretical meaning of this is a matter of opinion. The empirical meaning is that force applied over a distance and for a period of time is conserved. Somehow force, or the cause of force, is being transferred around without being created or destroyed. This is the meaning that can be derived from the fundamentals. This process of derivation is not reversible as is suggested by the physicist's remarks. The reason for this is that neither energy nor momentum experience changes of velocity. Therefore, we cannot establish that they are physically substantive. They cannot be starting points for understanding the mechanical operation of the universe. Starting points should consist only of original empirical data.

The physicist cannot look at patterns in changes of velocity and then claim to know, firsthand, the physical nature of anything else. For example, the physicist does not know anything about space or time other than the fact that we can make relative measurements that contain them. Measurements are not the thing itself. Measurements are quantitative while physical reality is qualitative. Neither space nor time is accessible to us for the purpose of handling them or experimenting on them. However, we know they exist, because we use the changes of velocity properties of particles to make measurements within them.

The measurements of distance and periods of time can point to the existence of other qualities, but can never make known the physical nature of those qualities. All that is ever known with empirical certainty is that there are objects in the universe that change their velocities and cause the velocities of others to also change. No one knows, by scientific means, why this occurs. When the theorist introduces physical qualities that are not distance, time, force or resistance to force, then it is pure theory. Since the true physical qualities cannot be known, then the theorist's imaginings could easily be wrong.

It is the skeletal, empirical, form of mathematical equations and not their theoretical interpretations that make predictions about future changes of velocity. For example, the theorist may imagine that photons are like bundles of energy. However, this idea cannot be derived from the fundamentals and cannot be shown empirically. What the empirical evidence says, and what the fundamentals point to, is that photons are increments of force that can be applied across a measure of distance and duration of time. For stable environmental conditions, the force is fixed and so are the increments of distance and time.

The empirically supplied key to achieving understanding is *force*. Force is what needs to be explained. Theoretical explanations such as 'Force is the rate of change of momentum.' are artificial, theoretical stopping points that prematurely end our quest for understanding. What is the empirical, universal, physical quality that can explain the existence of force? I offer an answer to this question within the body of the main theory.