The Unequal Equal Sign of Science

by Robert L. Peck

Consider the mathematical expression 2 + 2 = 4 which is only an equality when the addition operator, +, is fully applied; otherwise two two's do not necessarily make four. As an example, the + operator cannot be used on two sheep and two cows; however, it can be used if the distinction of sheep and cow are mutually replaced with a more limited term of "animal" to state that the sum of 2 animals and 2 animals equal 4 animals. Similarly, two seemingly unrelated things can be equated if they are both limited to a common characteristic such as comparing only dollars in equating a new house to a wage increase.

The rise in science was built upon the discovery that different objects, forces or interactions between objects or forces could all be equated together using only four fundamental elements. These were initiated by the creators of the ancient Indian *Parātrimsikā* and later documented around 450 BCE by the Greek philosopher Empedocles who named them earth, air, fire and water. These elements were so useful that they became quite widely adapted throughout many cultures as a tool to explain the physical world. Each physical object could be equated to how much of each element it contained and then compared with the elements of other objects. For example, lead had far more earth than did wood, but wood had far more fire. Any force or power that caused a change to occur was equated with fire which was originally equated to the creative power of the sun. The four elements can be compared with the axioms of geometry which are fundamental but cannot be proven. The four elements were likewise the metaphysical building blocks of physical reality. Earth was that unknown thing that gave mass and solidity to objects; air was the mysterious element that provided separation, shape or size; fire was the source of any energy, vitality or change; water was time or the mysterious flow that separated past, present and future as well making changes manifest.

Plato in his *Laws* (around 350 BCE) considered that the elements were created by Nature and then became the building blocks for the entire physical world. Indeed, even today, astrophysicists must use the same but updated elements to describe the creation of the universe. Plato placed the elements even ahead of the gods arguing that gods were created by the Art (*techne*, another mystical force) of individuals. Lucretius, two centuries later, applied the four elements to biological processes in his dissertation *On the Nature of Things*. He described the basic life force as another form of fire evidenced by breathing or respiration which was actively exchanging gasses or fluids with the environment. Vitality was due to more forceful breathing which was the near universal description of the *soul* (the word *soul* in several languages means "deep breathing").

The elements were given various interpretations and levels of importance such as the Chinese usage of the element of air or empty space to convey more information than form or earth in paintings; whereas, the West considered air to be secondary to earth or form. Similarly, musicians still argue about the emptiness or silence between notes as of importance in increasing the fire and water or flow in music compositions.

The element of fire has always proven to be a major obstacle to both science and religion, since nothing can change without it, and yet no one can determine what it is or explain the many different forms it can take. The forms range from a nuclear blast, to light, electricity, growth, fire, sound, physical motion or even thought. There is one characteristic of all forms of energy that opened the door to its description and quantification, and that was the actual physical change that resulted from its manifesting. Using the resulting changes to describe the original energy became quite similar to attempting to describe early cultures by their artifacts. Since it was impossible to define what fire or energy is, the first step was to define its various initial forms such as electricity, light, fuel, mechanical motion or heat. The second step was then to describe the end result or product of the flow or exchange of energy. This resulted in the discovery that all of the various results from all of the different forms of energy could be described using only the three elements of earth, air and water although the simplified result did not seem to have any logical relationship with the original energy.

This process of equating energy to its final product was made easier by the refinement of earth, air and water to what are now called dimensional units of mass, length and time. With these three units any final product of energy exchange can be quantified by equating the quantity of energy to the quantity of mass x distance/ time^2 or E=m times velocity^2. This equation also forms the basis for Einstein's $E=mc^2$ where c is the velocity of light.

However, many things are lost in this type of equality such as equating matter to energy in Einstein's equation or the velocity of mass to a reading light. In the modern materialistic world, no one still has the foggiest idea what fire or energy is or how to envision the change of one form of energy into another. The modern world has essentially replaced philosophical and mystical considerations with a very simplified accounting system that files metaphysical powers under their artifacts which is extended to such extremes as equating love to a beating heart or knowledge to a book.
