ON THE NON-EXISTENCE OF TIME

Introduction: Separating Physical Reality from Our Perceptions

Many of the important revolutions in scientific thinking in the past have occurred when someone has realized that the world which we experience is different from the actual physical world—that our limited senses tend to hide certain aspects of reality, while amplifying others. What we have tended to consider "real" is actually as subset of a larger reality in some instances, while in other cases, it is a combination of memory, logic and imagination supplemented by some aspects of physical reality.

This was certainly true in Isaac Newton's day, when the "natural state" of objects was that they would fall to the ground unless supported by something else. Newton's genius, and revolution in thinking, was to realize that the natural state of an object was, instead, to remain still. Gravity was the explanation for why things did not remain in their natural state in the special case of our experience, which had always been in the immediate proximity of a massive object (the earth).

I would like to suggest a similarly revolutionary, though perhaps less significant, concept which is that, although the notion of time is a very useful mental construct, and our brains and consciousness seem to be well-disposed to perceiving the world through its lens, it has, in fact, no basis in material reality.

Not that time is alone in this regard. A careful separation of material reality from the reality that our minds perceive will lead us to realize that very much of what we call "reality" is in fact colored by the abilities of our senses. As we have developed instruments that are sensitive to phenomenon that exist beyond the range of our senses, we have been able to enlarge our picture, and hence our understanding, of reality.

The electromagnetic spectrum is but one example. Common sense experience has told us for millennia that there is darkness and there is light. It has only been since the 1800's that we have realized that additional forms of radiation—from gamma rays to radio waves—exist beyond the wavelengths of light. What makes light significant to us is simply that our eyes are capable of sensing it. If we are looking at independent material reality, light is no different in principal from other forms of radiation. Even our classification of these various forms of radiation is a product of our minds—in reality, there is just one continuous spectrum from the very shortest to the very longest radiation.

Strictly speaking, then, it is incorrect to say that "light exists" since light is defined by a special condition called the human eye. Light, as a particular class of electromagnetic radiation, has no independent existence in the universe. Depending on the type of creatures that are trying to perceive the universe, the universe might be seen as completely dark (by beings with no sensitivity to any form of electromagnetic radiation) to very bright (by beings who are capable of seeing the cosmic microwave background radiation, who would see a nighttime sky that was light instead of dark.) It is more accurate to say that electromagnetic radiation exists, rather than to say that light exists.

The existence of light as a special form of radiation is simply a function of our eyes and minds. Likewise, the perception of color is also a function of the rod- and cone-shaped sensors in our eyes, rather than any independent existence.

A parallel argument for the non-existence of sound can be made. A wide variety of vibrations exist in solids, liquids and gases. Those that we can hear we call "sound". But again, sound, like light, has no independent reality outside of human experience. It is just a particular form of vibrating particles, which vibrate at a frequency that our ears and auditory nerves are capable of transforming into auditory consciousness.

If sound has no independent existence, how can music or speech be said to have an independent existence? These phenomena exist only because of our conscious minds, which are capable of both creating and recognizing the beauty of music, or the meaning behind speech. Things such as beauty and meaning can be regarded as real, but they are not part of a material reality. Material reality can act as the carrier of beauty or meaning, from one conscious mind to another. The material reality does not, in itself, have such qualities independently.

Smells, taste and touch have similar limitations. We sense only a part of what is there. Anyone watching the performance of a hound dog, or the flight of a bat, is well aware that these animals perceive much more of reality that we do. At the same time, the dog probably wonders why we spend so much time staring at papers, since the squiggles on the paper have no meaning in his mind. Much of what we call "real" exists in our consciousness, not in material reality.

To take an example near at hand: You are reading this paper, which is (hopefully!) conveying some meaning to you. But does the meaning exist independently of the reader? Would it mean anything to an alien who is wholly unfamiliar with the concept of written script? No, its independent physical reality is simply that it is an assemblage of paper and ink (or perhaps electrons hitting a computer screen). Even to use the terms "paper" and "ink" implies a limited human perspective. It is more accurately described as a collection of particles of two types—one type capable of reflecting a particular wavelength of electromagnetic radiation and another type that absorbs this same radiation. To make any statement beyond this is to start to depart from an investigation of purely physical reality, and to start to see things through the lens of human limitations.

With this thought in mind, as we look around us we see that all objects have an existence in our minds in addition to their absolute physical existence. Their existence in our minds is often much greater than their absolute physical existence. This is certainly true of anything made by people, because, in addition to its absolute physical existence, it has a purpose for which it was made. It also has a context into which it fits. Purpose and context are, obviously, aspects of consciousness, not aspects of the pure physical reality.

But when stripped of layers of meaning that the mind of man adds to things, all that we can find in the truly physical reality is a large collection of particles, each having certain fundamental properties we call size, mass and charge. These particles existing in space,

which is to say there is normally a region of non-particles between the particles. I sometimes think of this as "the world of dust". The rest of what we typically call reality is actually happening in our minds (which, I would suggest, are ultimately not a part of the physical reality, but that is a topic for another paper).

Time: From Physical Reality or From Our Conscious Minds?

So, I approach the question of time from the perspective of trying to observe the absolute physical reality, as independently as possible from the limitations of human senses and thinking. The question then is: Is time a part of the actual physical reality—the "world of dust"—or does it in fact emanate from our conscious minds, as does so much else?

Certainly, change exists in the absolute physical world. But in order to eliminate the human perspective, we might consider how a rock experiences change. One morning, it might find itself at a temperature of 10 degrees C. Later in the day, it has a temperature of 20 degrees. But the rock does not know that it has changed because it has no memory of the past. In order to recognize change, *one absolutely must have a memory of some form.* Memory, of course, is a function a mind, and of consciousness. Time appears to be a useful illusion that our minds provide, rather than a dimension having an independent reality.

We often speak of the five senses of sight, sound, smell, taste and touch. In reality, we have several more than that (e.g. sense of balance; a hot/cold sense of touch as distinct from the pressure sense of touch, etc.) Some of our senses are more abstract and not directly associated with sense organs. One of these is our sense of reason or logic. Another is our ability to imagine things. Yet another is our sense of memory.

Memory has two aspects. One aspect is the memory itself. The other is a sense of how long ago the remembered event occurred. Because of this second aspect, we are generally able to keep our memories in chronological order, rather than having a memory that resembles a pile of photographs which are in no particular order. Of course, the logical function of our minds helps to keep memories in chronological order, and we employ various external aids such as books and pictures to provide further assistance in retaining memories in a reasonably chronological order.

Our minds seem well suited to storing memories in this manner. Perhaps this capability evolved for survival reasons—the ability to mentally segregate recent dangers from long-ago dangers was useful in avoiding real, recent, threats that may continue to lurk nearby.

It is this ability to remember things in terms of how long ago they occurred that serves as the basis for our conscious sense of time, at least in the past.

In the case of the future, our ability to extrapolate and imagine things serves a similar role. Again, we not only imagine the future, but we organize our imaginings according to how imminent the future event is. It seems to take little imagination to understand that the sun will rise tomorrow and that work will begin shortly thereafter—perhaps just a

little extrapolation. (This may be more of a function of the sense of logic than imagination.) It takes more imaginative effort to visualize what I may be doing after retirement, many years from now. But all of these extrapolations / imaginations of the future are stored, at least approximately, in chronological order, and serve as the basis for our sense of the future.

But in both cases, whether past or future, we see that our sense of time is a function of the human mind—of memory and imagination--and does not seem to have an independent physical reality. Time is a function of consciousness.

This would indicate that all that really exists in the physical world is the present. The past may have supplied some useful information, which has been carried into the present by things that remain unchanged. But the past itself does not actually exist. It exists only as a present memory which is written into physical changes in the world (including the creation of books, photographs and many other types of physical records) and into the neurons in our brains. If people have puzzled over why we cannot go backwards in time, perhaps the reason is simple: The past to which they wish to travel simply does not exist. All that remains is some evidence of the past, which remains with us in the present.

Similarly, real travel into the future is impossible because "the future" is simply the extrapolation and imagination of our minds. It has no independent reality. (It is, of course, true that one can slow down the aging process, whether through cryogenics or through rapid travel through space, and that this might give the appearance, from some perspectives, of "traveling into the future". However, the fact that one cannot return from such a trip into the future belies the notion that this is real time travel at all.

A New Paradigm

If time has no independent reality, how then should we grapple with the concept of change in a 3-dimensional timeless present universe? Can we entirely abandon the dimension of time in physics?

That, probably, would not be useful. The purpose of physics is to develop an ever-more accurate description of physical reality, and time has its place as a useful concept in this description, just as the concept of temperature has a useful place, even though we know it can be reduced to the average speed of particles, and light has a place, even though we know it is only a human-defined portion of the electromagnetic spectrum. But in a more accurate physics, time should not be seen as a fundamental aspect of physical reality. Rather, it should be seen as a derived quantity, which helps remind us that it is a mental abstraction, rather than a fundamental reality.

But derived from what? I would like to suggest that instantaneous motion is a more fundamental reality and should be recognized as a fundamental quantity. But first, one needs to understand the relationship between time, space and motion.

Time, in its traditional sense, cannot exist without motion. Whether we are counting the number of times that the pendulum of the clock has swung, or the number of times that the earth has circled around the sun, when we speak of time, we are inevitably describing motions. We may come up with various names for these motions, such as year, or month or hour, and forget the motion that is associated with it, but ultimately, time is measure of motion. Conversely, a universe that is entirely motionless, would also have no time. There would be no way to measure it or even think about it.

Motion, of course, is related to the space in which the motion takes place. Where there is no space, there is no motion. Motion, of course, is relative, and can only be measured with reference to another object. It is a vector quantity, having both scale and direction relative to a given framework.

Two of these three terms are held as fundamental. The third is defined in terms of the other two. Traditionally, space and time are considered the fundamental quantities, and velocity (motion) is defined as length per unit of time. I would argue that, since time is more of a function of human consciousness (as noted above), space and motion should be regarded as fundamental quantities, and time should be the term which is derived from the other two. Thus, Time = Length per unit of Velocity.

It may be initially difficult to think of motion in terms of an instantaneous velocity that exists only in the present. To aid our thinking, I would suggest a new quantity which I call "urge" (u). It can be thought of as a property of a particle that describes its "desire" to be somewhere else at the present instant. (I'm not intending to be anthropomorphic here—it is just the easiest way to describe this.) It is a property like mass and charge, except that it is a vector property, having direction as well as quantity. It has both an lower limit and an upper limit. The lower limit is zero, since negative urge, like negative velocity, is simply positive velocity in a different direction. Its upper limit is the "urgency of light" (i.e. the speed of light). This is a constant which Einstein found to be fundamental, and itself suggests that motion or urge is fundamental rather than time.

Urge could be measured in a unit I call a "leen"—a name suggesting a tendency to be somewhere else (although intentionally spelled differently from a physical "lean" to distinguish the one from the other). One might be tempted to think of a leen as being one meter per second, but again, that is a reversion to traditional thinking. It would be better to define a second is one meter per leen.

Other physical quantities would be measured in terms of these fundamentals. For instance, momentum would be mu (mass x urge) rather than mv (mass x velocity). The conservation of momentum can be thought to exist as a natural outcome of the conservation of mass and the conservation of urge. Kinetic energy would be $\frac{1}{2}$ mu^2. Acceleration becomes u^2/l and force becomes mu^2/l. Time, if it is needed, would be defined, as noted above, as l/u (length divided by urge i.e. meters per leen). The urge of a particle, expressed over a length, can be expressed in the (human-consciousness-based) concept of time. All of the equations of physics could be similarly recast into this new system.

Results of a Physics Without Time

But does this bring us to any new perspectives or insights? One might be tempted to dismiss this as simply a way of re-writing the equations of physics that we already have. Is it anything more than that?

I will leave it to others more proficient in the higher orders of physics to explore the ramifications which this change in perspective could have on questions and problems related to time. I would make only a couple of observations:

a) We have not simply changed one fundamental quantity for another. This change in perspective has eliminated one *dimension* (time) and replaced it with a *quantity* (urge). This quantity is associated with individual particles (like charge or mass).

b) The problem of the "arrow of time" disappears along with the concept of time, or perhaps more exactly, it is recognized as an abstraction of our consciousness. In physical reality, there is indeed an "arrow of urge" for each particle, which is simply the vector of the particle's urge. But 100 different particles can have 100 different vectors—generally all particles are not moving in the same direction nor at the same speed. Indeed, it is because particles have different vectors of urge that they tend to dissipate—a dissipation that conventional physics recognizes as the basis for entropy and the second law of thermodynamics. Such dissipation is a mathematical near-certainty, and is more correctly a property of mathematics rather than of material physics.

Indeed, even the concept of organized states and disorganized states may be yet another mental abstraction. We define with our thoughts what is organized or disorganized. The particles themselves do not express a preference for one state or the other. We define the physical age of our bodies as a measure of how organized or disorganized our bodies have become. These again are functions of the consciousness, not fundamental physical realities.

On a cosmic scale, instead of an arrow of time, the separation of the galaxies may well be driven by a separate force ("dark energy" as it is currently called) which adds a separating, or repulsing, component to the urge vectors of galaxies.

The arrow of time might also be regarded as the movement of a situation from an unknown state to a known state. But this again is a property of consciousness and not of fundamental physical reality.

c) Starting from a model that more closely replicates the physical reality is more likely to bring us to conclusions that more closely replicate the physical reality as well. What assumptions have quietly crept into our thinking because we have accepted the seemingly simple assumption that time was fundamental? What flaws in our reasoning would be exposed by viewing physics from a different perspective? The observations expressed in this paper are not intended to reach conclusions as much as they are intended to invite further exploration based on a new perspective of fundamental physical reality.

Conclusion

We have, since the dawn of history, regarded time as a fundamental aspect of the material reality that physics attempts to describe. It seems very reasonable to do so, since people universally share a perception and sense of time. Most people have never thought of any alternative. Yet, in carefully separating perceived physical reality from the actual physical reality (as best as we can determine it) we are forced to conclude that time is a matter of our perceptions and our consciousness, and not a part of the underlying physical reality.

Motion has a stronger claim to being a fundamental aspect of reality. But not the conventional concept of motion measured as a difference in location over a difference in time, since time is not fundamental. Rather, this is motion as a fundamental property of a particle, described as its desire or "urge", in the instantaneous present, to be somewhere else. The rest of physics should be viewed from the basis of length, mass, urge and charge, while time should be viewed as a sometimes-useful construct that has arisen from the particular capability of our brains and consciousness to place things in chronological order.