JPJRS 10/2 ISSN 0972-3331, July 2007 101-121
DOI: 10.5281/zenodo.4284768
Stable URL: https://doi.org/10.5281/zenodo.4284768

Reality as Relationality: Some Scientific and Anthropological Reflections

Kuruvilla Pandikattu SJ
Dept of Systematic Philosophy, Jnana-Deepa Vidaypeeth, Pune 411014 , kurusj@gmail.com

Abstract: This is an article on identity, change and relationality as constitutive of reality. Starting from the day-to-day experience of counting, the author shows that much more than individual monads or numerals (0-9), it is the positioning or patterns that matter in real life. Then he takes up one contemporary scientific theory to show the significance of relationality. Thereafter he proceeds to reflect on some anthropological issues like the renewal of the cells in the body and the notion of personality, as the focus of our attention. Finally, stressing the relationship between the scientific notion of "centre of gravity" and that of the self, and showing that the self (and reality itself) is in fact a network of interrelating entities, the author speaks of the essential relationality inherent in nature.

Keywords: identity, change, relation, reality, self.

There is an example derived from a story in Plutarch (46-126 ACE), which is often used to clarify the problem of identity and change. Theseus was a legendary king of Athens famous for many exploits, and appearing in works by many authors and on countless vases. The ship wherein Theseus and the youth of Athens returned from Crete had thirty oars and was preserved by the Athenians down to the time of Demetrius Phalereus.[1] They took away the old planks as they decayed, putting in new and stronger timber in their place. This ship became a standing example among the philosophers for the question of things that change. Some thinkers hold the view that the ship remained the same, while others contend that it was not the same.

In the renewal process of the ship, there comes a point at which none of the original components remain. Is it then the same ship? Thomas Hobbes[2] asks: If someone went around picking up the discarded parts and constructed a (new) ship with them, which would be the better candidate for being the original ship?[3] This raises the question of whether an object which has had all its component parts replaced, remains fundamentally the same.

In this article I try to indicate that reality is basically relational. Starting from the day-to-day experience of counting, I show that much more than individual monads or numerals (0-9), it is the positioning or patterns that matter in real life. Then I take up one contemporary scientific theory to show the significance of relationality. Thereafter I proceed to reflect on some anthropological issues like the renewal of the cells in the body and the notion of personality, as the focus of our attention. Finally I indicate the relationship between the scientific notion of "centre of gravity" and that of the self and show that the self (and reality itself) is in fact a network of interrelating entities.

1. Counting the Uncountable

Pythagorean philosophy was the prime source of inspiration for Plato and Aristotle; the most influential philosophers in history![4] The school of Pythagoras was every bit a religion as it was a school of mathematics.[5] The basis of the Pythagorean philosophy is stated as follows:

There are three kinds of men and three sorts of people that attend the Olympic Games. The lowest class is made up of those who come to buy and sell, the next above them are those who compete. Best of all, however, are those who come simply to look on. The greatest purification of all is, therefore, disinterested science, and it is the man who devotes himself to that, [sic!] the true philosopher, who has most effectually released himself from the 'wheel of birth.'[6]

The Pythagoreans believed that all relations could be reduced to number relations. The assertion that "all things are numbers" aptly sums up their philosophy. This generalization stemmed from certain observations in music, mathematics, and astronomy. The Pythagoreans noticed that vibrating strings produce harmonious tones when the ratios of the lengths of the strings are whole numbers and that these ratios could be extended to other instruments. They knew, as did the Egyptians before them, that any triangle whose sides were in the ratio 3:4:5 was a right-angled triangle. The so-called Pythagorean theorem, that the square of the hypotenuse of a right triangle is equal to the sum of the squares of the other two sides, may have been known in Babylonia, where Pythagoras travelled in his youth. The Pythagoreans, however, are usually credited with the first proof of this theorem. In astronomy, the Pythagoreans were well aware of the periodic numerical relations of the heavenly bodies. The *celestial spheres* of the planets were thought to produce a harmony called the music of the spheres. Pythagoreans believed that the earth itself was in motion. Greek mathematicians, as well as the The Pythagoreans, believed that whole numbers and their ratios could account for geometrical properties. The most important discovery of this school which upset their own belief was the incommensurability of the diagonal of a square with its side. This result showed the existence of *irrational numbers*.[7]

The most eminent mathematician of the last century, Bertrand Russell, commented: "It is to this gentleman that we owe pure mathematics. The contemplative ideal – since it led to pure mathematics or contemplation – was the source of a useful activity. This increased its prestige and gave it a success in theology, in ethics, and in philosophy."[8] Mathematics, so honoured, became the model for other sciences. *Thought* became superior to the senses; *intuition* became superior to observation.[9]

Though modern science will not approve of all that Pythagoras stood for, it is evident that number played a very important role in the existence of reality as we know them.[10]

In this article, what I want to stress is the role of relationship and placement in the ordinary counting with numbers. The zero, which is credited to the Indians,[11] is crucial at least in the counting system. What is significant is that the value of a number is based not only on its numerical value but on its positioning. Here zero constitutes an additional aspect of the number system and contributes to its meaning.[12]

Thus the number system that we use in our routine life enables us to appreciate the fact that it is the relationship and the sequencing between the entities that makes the system meaningful. Incidentally we may note that by using finite numerals by humans have devised a way of reaching the infinite. From the above observation it is evident that, though number does matter, "pattern prevails and configuration counts" both in the numerical system and in the larger life system.[13]

2. Quantum Mechanics and the Paradoxical Principle of Nonlocality

After having indicated the significance of pattern and placement in the number system, I investigate just one of the most important and apparently the weirdest scientific theory of today, quantum mechanics.[14] Being such a well-estabhlised theory, I am forced to limit myself to the discussion of a few features of quantum mechanics that point to a deeper relationality of reality.

a. Beyond Local Realism

In physics, the principle of locality affirms that distant objects cannot have direct influence on one another: an object is influenced directly only by its immediate surroundings. The principle of locality asserts that an event which happens at one place can't instantaneously affect an event in other place. For example: if a distant star were to suddenly blow up tomorrow, the principle of locality says that there is no way we could know about this event or be affected by it until something, *e.g.* a light beam, had time to travel from that star to Earth. Apart from being intuitive, locality seems to be necessary for the theory of relativity, which predicts that no signal can propagate faster than the speed of light. This was stated as follows by Albert Einstein in his article "Quantum Mechanics and Reality":

The following idea characterises the relative independence of objects far apart in space (A and B): external influence on A has no direct influence on B; this is known as the Principle of Local Action, which is used consistently only in field theory. If this axiom were to be completely abolished, the idea of the existence of quasi-enclosed systems, and thereby the postulation of laws which can be checked empirically in the accepted sense, would become impossible.[15]

Local realism[16] is the combination of the principle of locality with the assumption that all objects must objectively have their properties already before these properties are observed. Einstein liked to say that the moon is "out there" even when no one is observing it.

Local realism is a significant feature of the classical general theory of relativity and the classical Maxwell's theory, but quantum mechanics apparently rejects this principle. Every theory (like quantum mechanics) that is compatible with violations of Bell's inequalities must abandon local realism.[17] Different interpretations of quantum mechanics reject different parts of local realism.

In most of the conventional interpretations, such as the version of the Copenhagen interpretation in which the wave-function is not real, the many-worlds interpretation, and the interpretation based on consistent histories, it is realism that is rejected. This implies that the actual definite properties of a physical system "do not exist" prior to the measurement of the wave-function. The wave-function that is integral to quantum mechanics is only interpreted as a mathematical tool used to calculate the probabilities of the outcome of the experiments.

In the version of the Copenhagen interpretation where the wave-function is real, it is the principle of locality that is violated. The wave-function is a real object that exists prior to the measurement, but the measurement causes the wave-function to collapse which is a non-local process.

The Bohm interpretation of quantum mechanics always wants to preserve realism, and for that it needs to violate the principle of locality to achieve the required correlations. In fact, it needs to violate not only locality but also causality, which seems to imply a real conflict with the special theory of relativity because real, superluminal signals would have to be propagated.

b. Nonlocality and Action at a Distance

Coulomb's law in classical physics of electrostatics appears to be a theory with action-at-a-distance - Coulomb's law deals with charges which have always been static. Efforts to develop a theory of interaction between moving charges, electrodynamics, led to the necessity to introduce the concept of a field with physical properties. In the theory of electrodynamics as formulated in Maxwell's equations, interactions between moving charges are mediated by propagating deformations of an electromagnetic field. These deformations propagate with the speed of light and therefore do not violate special relativity. The deformations of the field can carry momentum independently, thus facilitating the conservation of angular momentum.

Newton's theory of gravity offered no prospect of identifying any mediator of gravitational interaction. His theory assumed that gravitation acts instantaneously, regardless of distance. Newton had shown mathematically that if the gravitational interaction is not instantaneous, angular momentum is not conserved . Kepler's observations gave strong evidence that in planetary motion angular momentum is conserved.

This problem has been resolved by Einstein's theory of general relativity, in which gravitational interaction is mediated by the deformation of space-time geometry. Matter warps the geometry of space-time and these effects are, as with electric and magnetic fields, propagated at the speed of light. Thus, in the presence of matter, space-time becomes non-Euclidean, resolving the apparent conflict between Newton's proof of the conservation of angular momentum and Einstein's theory of special relativity. In Newton's theory of motion, space acts on objects, but is not acted upon by objects. In Einstein's theory of motion, matter acts upon space-time geometry, deforming it, and space-time geometry acts upon matter.

According to Albert Einstein's theory of special relativity, instantaneous action-at-a-distance was seen to violate the relativistic upper limit on the speed of the propagation of information. If one of the interacting objects were suddenly displaced from its position, the other object would feel its influence instantaneously, meaning that information had been transmitted faster than the speed of light.[18]

Thus paradoxically, quantum mechanics, unlike classical mechanics, seems to introduce the two principles of non-locality and action at a distance! Qualities which are really "spooky," but experimentally verified!

c. Spooky Action at a Distance

A physical theory is said to exhibit *nonlocality* if, in that theory, it is not possible to treat widely separated systems as independent.[19] The simplest example of a non-local system is a wave (which is not localized in space nor in time), or a wave function.[20] Because every object in our universe obeys the principle of wave-particle duality, then all objects in our universe are non-local.

Or, more technically: A physical theory is said to exhibit *nonlocality* if, in that theory, it is possible to violate a Bell inequality. This definition implies the possibility of measuring the nonlocality of a certain theory in a simple way - as the extent of the maximal possible violation of a Bell inequality. The term is most often reserved for hypothetical interactions that occur outside the backward light cone. Nonlocality does not imply a lack of causality only in the case when "ethereal," not "causal," information is transmitted between systems. The theory of special relativity shows that in the case where causal information is transmitted at superluminal rates, causality is violated. For example, if information could be exchanged at superluminal rates, it would be possible to arrange for you to be killed before your grandfather is born, which leads to causal paradoxes. Some effects that appear nonlocal in quantum mechanics may actually obey locality, e.g. quantum entanglement. Entanglement produces non-classical correlations between spatially separated particles in specific states, and that is the counter-intuitive but relational dimension of quantum mechanics.

Quantum mechanics frequently uses the notion of two paired or entangled particles. Quantum entanglement is a strange property that links particles, however far apart they are. Measuring a quantum property on one particle immediately affects the other. Nonlocality in quantum mechanics refers to the property of entangled quantum states in which both the entangled states "collapse" simultaneously upon measurement of one of their entangled components, regardless of the spatial separation of the two states. This "spooky action at a distance"[21] is the content of Bell's theorem and the EPR paradox.[22]

In physics, action at a distance is the interaction of two objects which are separated in space with no known mediator of the interaction. This term was used most often with early theories of gravity and electromagnetism to describe how an object could "know" the mass (in the case of gravity) or charge (in electromagnetism) of another distant object.

Einstein was one of the first to notice very strange features of entanglement. He used it to criticise the Copenhagen interpretation of quantum mechanics, on the ground that entanglement implied what he called "spooky action at a distance".[23] His claim was addressed by Bell in 1964 as indicated in the following section.[24]

d. Bell's Theorem: Relatedness of Reality

Bell's theorem is the most famous legacy of the late Northern Irish physicist John Bell.[25] It is notable for showing that the predictions of quantum mechanics are not intuitive. It is simple and elegant, and touches upon fundamental philosophical issues that relate to modern physics. Bell's theorem states: "*No physical theory of local hidden variables can ever reproduce all of the predictions of quantum mechanics.*"[26] In simpler words, Bell proved that the results predicted by quantum mechanics could not be explained by any theory which preserved locality. In other words, if you set up an experiment like that described by Einstein, Podolsky, and Rosen, and you get the results predicted by quantum mechanics, then there is no way that locality could be true. Years later experiments were done, and the predictions of quantum mechanics proved to be accurate. In short, locality is dead.

So Bell's Theorem asserts that reality must be non-local and it is remarkable for several reasons:

1. It is a mathematical proof, not a conjecture or speculation;
2. It is a proof about Reality not Appearances. How often does one find such a window into the nature of reality?
3. It is counter-intuitive: why should everywhere local facts need to be supported by a non-local reality?

Irish physicist John Stewart Bell considered the EPR system and showed with a devilishly clever proof that all conceivable models of Reality must incorporate this instant connection. What Bell showed is that despite the fact that Relativity prohibits instantaneous connections, despite the fact that no such connections have ever been observed either in EPR experiments or any other, despite the fact that quantum theory itself predicts no observable instant connections, despite all these considerations from Fact and Theory, the Reality of the EPR particles is such that their initial contact must create an instantaneous voodoo-style link between them below the level of appearances

Current physical theories incorporate the upper limit on propagation of interaction as one of their basic building blocks, hence ruling out instantaneous action-at-a-distance. At the same time, however, such instantaneous action at a distance appears to be an essential feature of some very fundamental quantum mechanical effects like entanglement and quantum nonlocality.

The question of whether this 'spooky action' at a distance constitutes a violation of the relativistic upper limit on the propagation of interaction is not straightforward. According to the laws of quantum mechanics, entanglement cannot be employed for relaying information from one place to another. Such an interpretation of quantum mechanics also creates the problem of indistinguishability between particles.

Thus quantum mechanics, one of the "most successful theories"[27] in the whole history of science, poses serious questions on the nature of reality and specifically on the localized, monad nature of matter. One can imagine that the dual nature of light can easily be extended to matter. This implies that light (and matter and therefore reality as such) can be simultaneously considered a wave and a particle.[28] Thus the wave nature helps us to appreciate the "waving nature" or interacting aspect of reality. Thus quantum mechanics tells us that our intuitive understanding of reality does not always correspond to it and that the principle of locality is not always obeyed! This implies one of the other strange results of modern physics, which is that the act of measuring a property always changes the system you are measuring. In other words, "spooky action at a distance is part of nature." Thus the universe is 'nonlocal at the level of individual events'.[29]

3. Antropological Insights

After having studied some of the scientific insights that indicate the relationality of nature, I take up some specific human issues: that of the body and the self. Here too I attempt to indicate the focusing aspect of human being, that open ourselves to a interlacing and relational dimension of the human being.

a. Our Skin Sheds Itself...

Recently, *The New York Times* published an article which posited that whatever be one's age, the body is many years younger. In fact, even the middle-aged may be just 10 years old or less, as far as the body cells are concerned. This arises from the fact that most of the body's tissues are under constant renewal and has been underlined by a novel method of estimating the age of human cells. Its inventor, a Swedish scientist, Jonas Frisen, believes that the average age of all the cells in an adult's body may turn out to be as young as 7 to 10 years. But Dr. Frisen, a stem cell biologist at the Karolinska Institute in Stockholm, has also discovered a fact that explains why people behave their birth age, not the physical age of their cells: a few of the body's cell types endure from birth to death without renewal, and this special minority includes some or all of the cells of the cerebral cortex.

In the scientific circles, it was a dispute over whether the cortex ever makes any new cells that got Dr. Frisen looking for a new way of figuring out how old human cells really are. Existing techniques depend on tagging DNA with chemicals but are far from perfect. Wondering if some natural tag might already be in place, Dr. Frisen recalled that the nuclear weapons tested above ground until 1963 had injected a pulse of radioactive carbon 14 into the atmosphere. Breathed in by plants worldwide and eaten by animals and people, the carbon 14 gets incorporated into the DNA of cells each time the cell divides and the DNA is duplicated.

Most molecules in a cell are constantly being replaced but the DNA is not. All carbon 14 in a cell's DNA is acquired on the cell's birth date, the day its parent cell divided. Hence the extent of carbon 14 enrichment could be used to figure out the cell's age, Dr. Frisen surmised. In practice, the method has to be used on tissues, not individual cells, because not enough carbon 14 gets into any single cell to signal its age. Dr. Frisen then worked out a scale for converting carbon 14 enrichment into calendar dates by measuring the carbon 14 incorporated into individual tree rings in Swedish pine trees.

Having validated the method with various tests, he and his colleagues have the results of their first tests with a few body tissues. Cells from the muscles of the ribs, taken from people in their late 30's, have an average age of 15.1 years, they say. The epithelial cells that line the surface of the gut have a rough life and are known by other methods to last only five days. Ignoring these surface cells, the average age of those in the main body of the gut is 15.9 years, Dr. Frisen found. Similarly, the human body constantly creates, from materials consumed, new component parts and cells, as old cells die. The average age of cells in an adult body may be less than 10 years.[30]

This team then turned to the brain, the renewal of whose cells has been a matter of much contention. The prevailing belief, by and large, is that the brain does not generate new neurons, once its structure is complete, except in two specific regions the olfactory bulb that mediates the sense of smell, and the hippocampus, where initial memories of faces and places are laid down. This consensus view was challenged a few years ago by Elizabeth Gould of Princeton, who reported finding new neurons in the cerebral cortex, along with the elegant idea that each day's memories might be recorded in the neurons generated that day.

Dr. Frisen's method enables all regions of the brain to be dated to see if any new neurons are generated. So far he has tested only cells from the visual cortex. He finds these are exactly of the same age as the individual, showing that new neurons are not generated after birth in this region of the cerebral cortex, or at least not in significant numbers. Cells of the cerebellum are slightly younger than those of the cortex, which fits with the idea that the cerebellum continues developing after birth.

Another contentious issue is whether the heart generates new muscle cells after birth. The conventional view that it does not has recently been challenged by Dr. Piero Anversa of the New York Medical College in Valhalla. Dr. Frisen has found the heart as a whole is generating new cells, but he has not yet measured the turnover rate of the heart's muscle cells.[31]

Thus the anthropological findings regarding our own bodies are interesting. On the average our body cells last about ten years. At the same time there are specific cells that last from the beginning of our life. This throws light on how dependent our bodies are on the changing cells. The interesting question that comes out of this investigation is: if our cells keep on changing, what gives us a permanent self or identity? Are our bodies like the ship of Theseus, which is given the same identity only by external observers?

b. The Centre, that Is the Self

What is a self? I will try to answer this question by developing an analogy with something much simpler, something which is nowhere near as puzzling as a self, but has some properties in common with selves. This leads us to investigate the phenomenon of self or personhood, using another scientific notion of "centre of gravity." In physics, the centre of gravity is an imaginary point in a body of matter where, for convenience in certain calculations, the total weight of the body may be thought to be concentrated. The concept is sometimes useful in designing static structures (e.g., buildings and bridges) or in predicting the behaviour of a moving body when it is acted on by gravity.[32]

The centre of gravity, a well-behaved Newtonian concept, is not an atom or a subatomic particle or any other physical item in the world. It has no mass; it has no colour; it has no physical properties at all, except for spatio-temporal location. It is a fine example of what Hans Reichenbach would call an *abstractum*. It is a purely abstract object. It is a theorist's fiction. It is not one of the real things in the universe in addition to the atoms. But it is a fiction that has a neatly defined, well delineated and well behaved role within physics.

This theoretical *abstractum* is a robust and familiar idea. Consider a chair. Like all other physical objects, it has a centre of gravity. If you start tipping it, you can tell more or less accurately whether it would start to fall over or fall back in place if you let go of it. We're all quite good at making predictions involving centres of gravity and finding explanations about when and why things fall over. Place a book on the chair. It, too, has a centre of gravity. If you start to push it over the edge, we know that at some point it will fall. It will fall when its centre of gravity is no longer directly over a point of its supporting base (the chair seat). The key terms in it are all interdefinable. And yet it can also figure in explanations that appear to be causal explanations of some sort. We ask "Why doesn't that lamp tip over?" We reply "Because its centre of gravity is so low." Is this a causal explanation? It can compete with explanations that are clearly causal, such as: "Because it's nailed to the table," or "Because it's supported by wires."

We can manipulate centres of gravity. For instance, I change the centre of gravity of a water pitcher easily, by pouring some of the water out. So, although a centre of gravity is a purely abstract object, it has a spatio-temporal character, which I can affect by my actions. It has a history, but its history can include some rather strange episodes. Although it moves around in space and time, its motion can be discontinuous. For instance, if I were to take a piece of bubble gum and suddenly stick it on the pitcher's handle, that would shift the pitcher's centre of gravity from point A to point B. But the centre of gravity would not have to move through all the intervening positions. As an *abstractum*, it is not bound by all the constraints of physical travel.

Consider the centre of gravity of a slightly more complicated object. Suppose we wanted to keep track of the career of the centre of gravity of some complex machine with lots of turning gears and camshafts and reciprocating rods – the engine of a steam-powered unicycle, perhaps. And suppose our theory of the machine's operation permitted us to plot the complicated trajectory of the centre of gravity precisely. And suppose that we discovered that in this particular machine the trajectory of the centre of gravity was precisely the same as the trajectory of a particular iron atom in the crankshaft. Even if this were discovered, we would be wrong even to *entertain* the hypothesis that the machine's centre of gravity was (identical with) that of the iron atom. That would be a "category mistake". A centre of gravity is *just* an *abstractum*. It's just a fictional object. But when I say it's a fictional object, I do not mean to disparage it; it's a wonderful fictional object, and it has a perfectly legitimate place within serious, sober physical science.

A self is also an abstract object, a theorist's fiction. The theory of the self may be regarded as part of psychology, phenomenology or hermeneutics, or soul-science (*Geisteswissenschaft*). The physicist does an *interpretation* of the chair and its behaviour, and comes up with the theoretical abstraction of a centre of gravity, which is then very useful in characterizing the behaviour of the chair in the future, under a wide variety of conditions. The hermeneuticist or phenomenologist or anthropologist sees some rather more complicated things moving about in the world – human beings and animals –and is faced with a similar problem of interpretation. It turns out to be theoretically perspicuous to organize the interpretation around a central abstraction: each person has a *self* (in addition to a centre of gravity). In fact we have to posit selves for *ourselves* as well. The theoretical problem of self-interpretation is at least as difficult and important as the problem of other-interpretation.[33]

I propose that we take this analogy seriously. "Where is the self?" a materialist philosopher or neuroscientist might ask. It is a "category mistake" to start looking around for the self in the brain. Unlike centres of gravity, whose sole property is their spatio-temporal position, selves have a spatio-temporal position that is only grossly defined. Roughly speaking, in the normal case if there are three human beings sitting on a park bench, there are three selves there, all in a row and roughly equidistant from the fountain they face. Brain research may permit us to make some more fine-grained localizations, but the capacity to achieve *some* fine-grained localization does not give anyone grounds for supposing that the process of localization can continue indefinitely and that the day will finally come when we can say, "That cell there, right in the middle of the hippocampus (or wherever) – that's the self!"

The chief fictional character at the centre of that autobiography is one's *self.* And if we still want to know what the self *really* is, we are making a "category mistake". After all, when a human being's behavioural control system becomes seriously impaired, it can turn out that the best hermeneutical story we can tell about that individual says that there is more than one character "inhabiting" that body. This is quite possible. All that is required is that the story doesn't cohere around *one* self, *one* imaginary point, but coheres around *two* different (even conflicting) imaginary points

We sometimes encounter psychological disorders, or surgically created disunities, where the only way to interpret or make sense of them is to posit in effect two centres of gravity, two selves. One isn't creating or discovering a little bit of "ghost in the machine" stuff in doing that. One is merely creating another abstraction. It is an abstraction one uses as part of a theatrical apparatus to understand, predict, and make sense of the behaviour of some very complicated things. The fact that these abstract selves seem so robust and real is not surprising. They are much more complicated theoretical entities than a centre of gravity. And remember that even a centre of gravity has a fairly robust presence, once we start playing around with it. But no one has ever seen or ever will see a centre of gravity. As David Hume noted, no one has ever seen a self, either.

For my part, when I enter most intimately into what I call *myself,* I always stumble on some particular perception or other, of heat or cold, light or shade, love or hatred, pain or pleasure. I never can catch *myself* at any time without a perception, and never can observe anything but the perception.... If anyone, upon serious and unprejudiced reflection, thinks he has a different notion of *himself,* I must confess I can no longer reason with him. All I can allow him is, that he may be right as well as I, and that we are essentially different in this particular. He may, perhaps, perceive something simple and continued, which he calls *himself*; though I am certain there is no such principle in me.[34]

Though the self is not empirically perceivable, we are aware of it and we are to some extent our own selves. Thus the self is an indicator of the relationship that involves our body and goes beyond it. Further, it is insightful to see the relationship between the self and one's body. Obviously, without the material body, there is no centre of gravity and so without the physical body, there is no self. And the self may be visualized also as the "focusing centre" that deals with the interrelationship between various physical parts of the body. Since it is not itself physical, it can balance the web of relationship originating from various parts of the body. Thus the self may be seen as the best example of the relationality of reality.

4. Conclusion

Starting with Pythagoras, we saw the importance of numbers (monads) and then went on to see how we can have a concept of infinity using finite numbers. Here the placement or pattern is crucial to draw the significance of the number system. Then we proceeded to see the intricate and highly successful theory of quantum mechanics which leads us beyond local realism. This implies that, according to quantum mechanics, in reality action at a distance is possible, which is truly "spooky." Since such spooky interactions are verified experimentally, all that we can say is that however counter-intuitive it may be, reality is much more profound, paradoxical and relational than we can imagine. Further, quantum mechanics implies that nonlocal at the level of individual events, that is, there is an inherent relationship in reality which goes beyond any local boundaries. This is truly a metaphysical relationship, going beyond the appearances. After the scientific understanding I discussed two basic anthropological domains: renewing of our physical body approximately every ten years and the relationship of the centre of gravity to the self. In all these undertakings, I have tried to illustrate that relationality is intrinsic to reality. The whole of the cosmos is interconnected, just like the human body, which through networking and interconnection form the person or self that I am.

Therefore, a monadic understanding of ourselves as entities may be practical at times, but is definitely inadequate to cope with the complexities of contemporary times. We are the ever widening horizon of our consciousness, which definitely includes our physical entity and incorporates the intellectual, emotional and spiritual dimensions of being alive. In this sense we are not mere individuals, but patterns or relationships. We could very well describes ourselves as the nodes of the network or the focus of interactions.

From a religious point of view, it is easy to see that when Christians affirm God as love, they proclaim the essential relational nature of God. In the same sense, the doctrine of creation is essentially affirming an intrinsic relationship of dependence between the Creator and creation. In this sense without belittling the monadic dimension of reality, contemporary science rediscovers the relational aspect of reality, which vibes very well with the deepest religious insights. Humans are thus not individual entities but horizons that merge and fuse with similar horizons. Such an enhancing vision throws some light on our understanding of the self and personal identity. Therefore counting the uncountable is useful at times, but we need to realize that counting prepossess something more than the countables!

Notes

1. Demetrius Phalereus (345283 BCE), an eminent Athenian orator, statesman, and historian, born at Phalerus, a seaport of Athens; was held in high honour in Athens for a time as its political head, but fell into dishonour, after which he lived retired and gave himself up to literary pursuits; died from the bite of an asp. See http://www.fromoldbooks.org/Wood-NuttallEncyclopaedia/d/demetriusphalereus.html.. See also http://en.wikipedia.org/wiki/Theseus.
2. *De Corpore*, 2, 11, 7.
3. http://www.answers.com/topic/ship-of-theseus#wp-_note-2. Since all the websites have been addressed in June-July, 2007 the exact date of accessing is not given for other online references that follows.

4. Pythagoras (580-500 BCE) was born in Samos on the western coast of what is now Turkey. He was reportedly the son of a substantial citizen, Mnesarchos. He met Thales, likely as a young man, who recommended he travel to Egypt. It seems certain that he gained much of his knowledge from the Egyptians, as had Thales before him. Probably because of continual conflicts and strife in Samos, Pythagoras settled in Croton, on the eastern coast of Italy, a place of relative peace and safety. Even so, just as he arrived, Croton lost a war to neighboring city Locri, but soon thereafter defeated utterly the luxurious city of Sybaris. This is where Pythagoras began his community or school.
5. For example, here are some of the rules he enjoined on his followers: To abstain from beans. Not to pick up what has fallen. Not to touch a white cock. Not to stir the fire with iron. Do not look in a mirror beside a light. Vegetarianism was strictly practiced probably because Pythagoras preached the transmigration of souls. The school of Pythagoras represents the mystic tradition in the scientific!
6. http://www.math.tamu.edu/~don.allen/history/pythag/pythag.html.
7. http://www5.geometry.net/detail/scientists/pythagoras_of_samos.html
8. Bertrand Russell, http://www.math.tamu.edu/~don.allen/history/pythag/pythag.html.
9. http://www.math.tamu.edu/~don.allen/history/pythag/pythag.html.
10. Here it is important that the atomic number and the basic constants of nature may be alluded as examples.
11. In around 500 ACE Aryabhata devised a number system which has no zero yet was a positional system. He used the word "kha" for position and it would be used later as the name for zero. There is evidence that a dot had been used in earlier Indian manuscripts to denote an empty place in positional notation. It is interesting that the same documents sometimes also used a dot to denote an unknown where we might use x. Later Indian mathematicians had names for zero in positional numbers yet had no symbol for it. The first record of the Indian use of zero which is dated and agreed by all to be genuine was written in 876. see J J O'Connor and E F Robertson, "The History of Zero" http://www-history.mcs.st-andrews.ac.uk/HistTopics/Zero.html.
12. Another related notion which may be used to draw the significance of position is obviously the use of alphabets in coining words. More on it will be taken up by me in another forthcoming article.
13. The same could be said of the genetic coding in biology and the periodic table of elements in chemistry. What really matters in the genetic code is not merely the number of genes, but how they are located or their sequence.

14. Physicsweb describes quantum mechanics as "weird and wonderful." It goes on; "Quantum mechanics is the most accurate theory we have to describe the world ... Quantum mechanics is a great deal more than a theory; it is a whole new way of looking at the world. When it was developed in the 1920s, quantum mechanics was viewed primarily as a way of making sense of the host of observations." http://physicsweb.org/articles/world/12/12/19. See also D Lindley 1996 Where Does the Weirdness Go? Basic Books, New York.

15. "Quanten-Mechanik und Wirklichkeit", *Dialectica* 2:320-324, 1948, accessed at http://www.pkblogs. com/abraxas 23/2005 /10/principle -of-locality. html.

16. In philosophy this is opposed to constructivism, which is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning, therefore, is simply the process of adjusting our mental models to accommodate new experiences. See Jacqueline Brooks and Martin Brooks, *In Search of Understanding: The Case for Constructivist Classrooms*, 1993.

17. Most physicists believe that experiments have demonstrated such violations, but some local realists dispute the claim, in view of the recognised loopholes in the tests.

18. Any means of communication faster than the speed of light of prohibited by Einstein's theory of relativity. See http://www.pkblogs.com/abraxas23/2005/10/principle-of-locality.html.

19. Gary Felder, "Spooky Action at a Distance: An Explanation of Bell's Theorem" http://www4.ncsu.edu/unity/lockers/users/f/felder/public/kenny/papers/bell.html.

20. The existence of the wave function collapse is required in the Copenhagen interpretation; the so-called transactional interpretation and in a "spiritual interpretation" in which consciousness causes collapse. On the other hand, the collapse is considered as redundant or just an optional approximation in interpretations based on consistent histories, the many-worlds interpretation the Bohm interpretation and the Ensemble Interpretation.

21. "Spukhafte Fernwirkung". In 1982 the French scientist Alain Aspect verified this experimentally. Today this theory has been proved beyond doubt.

22. In 1935 Albert Einstein and two colleagues, Boris Podolsky and Nathan Rosen (EPR) developed a thought experiment to demonstrate what they felt was a lack of completeness in quantum mechanics. This so-called "EPR paradox" has led to much subsequent, and still on-going, research.

23. As indicated in the previous note, the origins of this topic is a famous paper by Einstein, Rosen and Podolsky (EPR) in 1935; its title was *Can Quantum-Mechanical Description of Physical Reality be Considered Complete?* They considered what Einstein called the "spooky action-at-a-distance" that

seems to be part of Quantum Mechanics, and concluded that the theory must be incomplete if not outright wrong. As you probably already know, Einstein never did accept Quantum Mechanics. One of his objections was that "God does not play at dice with the universe." Bohr responded: "Quit telling God what to do!"

24. http://en.wikipedia.org/wiki/Nonlocality.
25. In 1975 eminent scientist Henry P. Stapp called Bell's Theorem "the most profound discovery of science." See http://physicsworld.com/cws/article/print/1332.
26. http://en.wikipedia.org/wiki/Bell%27s_theorem.
27. The prestigious *Stanford Encyclopedia of Philosophy* states: "As the theory of the atom, quantum mechanics is perhaps the most successful theory in the history of science." http://plato.stanford.edu/entries/quantum mechanics-copenhagen/. In the same vein the *Encyclopedia Britannica* says: "n spite of the overwhelming practical success of quantum mechanics, the foundations of the subject contain unresolved problems." See http://www.britannica.com/eb/article-9110312/quantum-mechanics.
28. If light is a wave, but what kind of a wave is it? An ocean wave is not a thing, it is a property of water, something that water does. If there is no water there is no wave. So if light was a wave, what was waving? This was the most urgent question that physicists were asking. By the time an adequate answer was found, light would end up being described as both a particle and a wave. Yet how could it be both? This would be the first of many paradoxes that would begin to question our common sense notion of how the universe operates.
29. Another way of relating matter and energy (E=mc^2) made famous by Einstein is not necessarily related to our interest of relating matter to relationship. It is true that in the physical world, energy causes interaction and relationship, but energy and relationship cannot be equated.
30. Nicholas Wade, "Your Body is Younger than you Think" http://www.nytimes.com/2005/08/02/ science/02cell.html?ex= 1280635200 &en=65bd5e6cef9fec79&ei= 5088 &partner=rssnyt&emc=rss. Jonas Frisen, a stem cell specialist, after having conducted experiments with Carbon 14 dating on DNA, concludes that the average age of all the cells in an adult's body may turn out to be as young as 7 to 10 years.
31. Nicholas Wade, "Your Body Is Younger Than You Think" *The New York Times* August 2, 2005.
32. http://www.britannica.com/eb/article-9037797/centre-of-gravity.
33. http://ase.tufts.edu/cogstud/papers/selfctr.htm.
34. *Treatise on Human Nature*, I, IV, sec. 6.

No of words: 7129

Date received: May 11, 2007; Date approved: June 26, 2007.