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The Universe, Quantum Physics, and Consciousness

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Introduction

There are two essential parts to understanding the universe: its representation in terms of material objects, and the manner in which this representation changes with time. In philosophy, these are the positions of two different schools, one believing that reality is *being*, and the other that it is *becoming*.

The conception of the cosmos, consisting of the material universe and observers, has been shaped by ideas that belong to these two opposite schools. The conception of the world as *being* is associated with materialism, while that of *becoming* is associated with idealism. In the materialist view, mental experience is emergent on the material ground and contents of the mind are secondary to the physical world. Conversely, in the idealist position consciousness has primacy.

The question of consciousness is connected to the relationship between brain and mind. Reductionism considers them to be identical -- with mind representing the sum total of the activity in the brain -- at a suitable higher level of representation. Opposed to this is the viewpoint that although mind requires a physical structure, it ends up transcending that structure. There exist a host of other views of mind, shaped by culture and life-experience, which are characterized by a tension between opposite beliefs systems applied to different aspects of life.

Quantum mechanics is relevant to a discussion of the cosmos, since it is the deepest theory of physics and it is a theory of observables in which information is the fundamental quantity. John Archibald Wheeler used the slogan "*It from bit*" to stress that our constructions of reality are based on responses on our instruments to yes-no questions. He declared "that all things physical are information-theoretic in origin and this is a *participatory universe*" (Wheeler, 1990), where the term "participatory" implies that observations effect the evolution of the universe. Whereas observables are central to quantum mechanics, there is nothing in it on who makes the observations or if observers fit into its framework.

Just as there exists the outer cosmos – the physical universe –, there also exists the corresponding inner cosmos of the mind. The mind processes signals coming into the brain to obtain its understandings in the domains of seeing, hearing, touching, and tasting using its store of memories. The cognitive act is an active process where the selectivity of the sensors and the accompanying processing in the brain is organized based on the expectation of the cognitive task and on effort, will and intention.

The structure of the inner cosmos belongs to the domain of psychology, but it is fair to assume that at some level it mirrors the outer cosmos. In the schematic of Figure 1 it is indicated that if quantum theory describes processes for the outer cosmos, consciousness does so for the inner cosmos. Since quantum theory must ultimately underlie the processes in the inner cosmos, it appears that for the sake of symmetry it should be possible for consciousness to influence the outer cosmos.

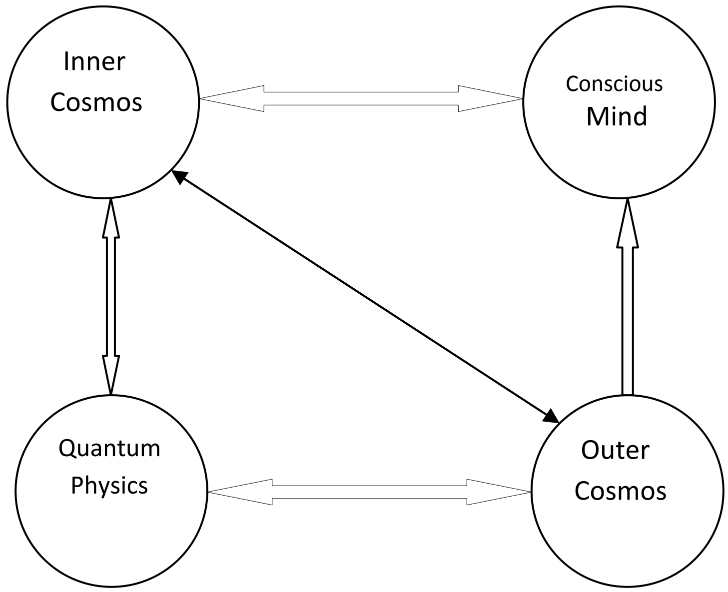

Figure 1. Inner and outer cosmoses, the law, and consciousness

In the view that consciousness is complementary to space, time and matter, it needs material support to be embodied as "awareness". Conversely, it is meaningless to speak of a universe without observers. If we accept that we have discovered the basic laws of nature and also that classical machines cannot be conscious, one may like to assume that quantum processing in the brain, given appropriate brain structures, leads to awareness. Different states of consciousness such as wakefulness, sleep, dream-sleep, coma have distinct neurochemical signatures, and these different states may be taken to be modifications caused by the neural circuitry on a basic state of consciousness. But quantum machines cannot be assumed to have the capacity to be conscious because of the observer paradox outlined in the next section.

Although consciousness cannot be studied directly, it is accessible to further understanding indirectly. In this article, we show why observers are essential in the universe. We do this not by resorting to anthropic arguments, but rather to quantum theory itself. We suggest that improbable coincidences corroborated in literature support the existence of a universal consciousness principle, but, of course, they cannot be taken to be proof for it.

The Observer Paradox

Although the inner cosmos is physically located in the brain, we cannot speak of where in the brain the perceiving self resides because that would amount to a homunculus argument. The perceiving self cannot be in a unique neuron in the brain, because that would require such a neuron to have the capacity to process all the information that the individual possesses, which is clearly impossible for a cellular structure that can only do simple processing. Conversely, if the perceiving self was distributed over an area, then we need to postulate another homunculus within this area to process the information reaching the self.

Thus the conscious self can neither be localized to a single cell, nor assumed to be distributed over the entire brain or a part of it. We cannot speak of where the self is, but only of how the self obtains knowledge. Since the self is associated with the brain it uses it as the lens through which to perceive the world. Our knowledge of the word is, therefore, contingent on the neurophysiologic nature of the brain. If we are able to make sense of the world it is because we are biologically programmed to do so and we have innate capacity for it. Our conception of the cosmos is based on the relationship between our brain and mind. This idea is expressed in the slogan that the outer is mirrored in the inner. In an elaboration of this idea it is assumed that patterns seen in the outer world characterize the inner world as well.

Sacred architecture in many cultures replicated conceptions of the universe. The cathedral is a representation of the heavens of the Christian cosmos. In ancient India, it was concluded, using elementary measurements, that the relative distance to the sun and the moon from the earth is approximately 108 times their respective diameters. The diameter of the sun is likewise approximately 108 times the diameter of the earth, and this fact could have been established from the relative durations of the solar and lunar eclipses.

The number 108, taken as a fundamental measure of the universe, was used in ritual and sacred geometry. Each god and goddess was given 108 names; the number of dance poses in the Nātya Shāstra, an ancient text on theater, dance, and music, was taken to be 108, as was the number of beads in the rosary (Kak, 2008). The Hindu temple had the circumference to the measure of 180 (half of the number of days in the year) and its axis had the measure of 54 (half the number 108) (Kak, 2009a), and we find these dimensions in sacred ground for fire altars of the second millennium B.C.E to the second millennium C.E. Vishnu temple at Angkor Wat. The body, breath, and consciousness were taken to be equivalent to the earth, the space, and the sun, respectively. The telling of the beads was to make a symbolic journey from the earth to the sun, from the body to the inner light of consciousness.

One kind of connection between the outer and the inner is provided by biological clocks in the cells which work according to the rhythms of the sun, the moon, the tides, and other astronomical phenomena (Winfree, 1987). Other biological processes are adjustments to sensory inputs and the observer may also be viewed as an ecological system seeking its balance in a complex environment. From a systems point of view the organism may be viewed as evolving to attractor states. In a dynamical system the observer has no direct role, excepting to alter probabilities associated with the evolution.

Quantum Physics, Observers, and the Cosmos

The astonishing success of modern science rests on the discovery that the representation and its rate of change are proportionate. For example, in quantum physics, the evolution of a system or an object, represented by $|\varphi\rangle$ is given by the Schrödinger equation:

$$i\hbar \frac{d|\varphi\rangle}{dt} = H|\varphi\rangle$$

Likewise, in classical systems the unknown function and its various derivatives are related making it possible to compute future values. In many discrete time systems found in plant and animal life that are characterized by Fibonacci series, the time difference of the generative function equals the function itself.

Quantum physics is different from classical physics in so much that the quantum system is a superposition of many possibilities and while the evolution of the quantum state is deterministic (given by the Schrödinger equation) its observation results in a collapse of the state to one of its components in a probabilistic manner.

Both classical physics and quantum physics present a machine-view of the universe. This machine, which may be deterministic or stochastic, has no place for observers. In social sciences and philosophy freedom and agency for the observer is postulated, but these disciplines do not derive from physics. Either freedom is illusory or the machine paradigm is incomplete in describing the world.

Since material science can only deal with objective associations, it can do no better than see each system as a mechanism of some kind, leading to several difficulties. The brain is viewed as a machine, yet the brain-machine has awareness whereas the computer does not.

Quantum physics is associated with its own paradoxes related to observers such as those implying propagation of effects instantaneously across space (for entangled particles) and time (as in the Wheeler's delayed choice experiment) if one uses ordinary language to describe phenomena (Penrose, 1994; Kak, 2004). This indicates that reality has aspects that are not captured by consistent linguistic narratives.

Physics deals with space, time and matter. As observers we are more than matter at a specific location in space and time; we also have consciousness. Although it is logical to see consciousness as emergent on matter it is also tempting to see it having a more fundamental existence. To claim that consciousness is emergent and therefore inherent in the scientific law and yet deny it ontological reality is not reasonable.

If we view quantum theory as a theory of wholes, then it should apply to large aggregation of objects. More specifically, since biological organisms are entities, their behavior should be governed at some level by *quantum* laws.

The anthropic principle has been invoked to explain the nature of laws. In one formulation of the principle, the physical laws are restricted by the requirement that they should lead to intelligent life at some stage in the evolution of the universe. Since life on earth would cease when the sun exhausts its fuel, and as evolution of consciousness could not have been in vain, the proponents of the principle argue that man will create silicon-based "conscious machines" that will seed the universe and the entire universe will become a conscious machine (Barrow and Tipler, 1986).

In the archaic view, the universe is conscious. In more sophisticated versions of this archaic view, consciousness itself is the ground stuff of reality and on this ground the complex of space, time and matter is seeded.

Evolution in quantum mechanics is deterministic as in classical mechanics except for the difference that as the system interacts with another system, its state function collapses. This dichotomy exists only for separated systems, in which one of them is being observed by the other. Given that the state of the entire universe is defined at the initial point, its evolution must be completely deterministic. Any seeming randomness now should merely be an amplification of the randomness in the initial state and the entropy at the origin should not change as the universe evolves. In other words, the physical universe governed by quantum laws has no place for the emergence of life.

Our currently accepted conceptions of the beginning of the universe postulate much more uniformity than exists now. One way entropy could increase in the universe is by the process of reduction of its state function by some other system. Since the universe, by definition, cannot have any other matter in it, it becomes essential to postulate a mechanism other than that of physical laws, which permits the state function to reduce. This other mechanism may be the working of the "consciousness principle" which can just by the process of "observation" increase entropy (Kak, 2007).

It should be stressed that the "consciousness principle" cannot be a new physical law, because if it were so that then it would only replace the currently accepted dynamics of the universe by a different one. Such a physical law would not alter the conception of the universe as a deterministic or stochastic machine without any possibility of life. Consciousness or awareness implies binding to events and entities, abstract or real, that are separated in time and space, and the perceptible influence of the "consciousness principle" may be seen in improbable correlations as a result of drift of probabilities in the equations of dynamics.

A "consciousness principle", rather than the improbable creation of complex molecules by chance that has been refuted (Hoyle and Wickramasinghe, 1984: Wickramasinghe, 2009), must be the explanation for the rise of life all over the universe. Consciousness interpenetrates the universe, but it needs appropriate physical structures to be embodied. Molecules of life at the general level, and the brains of animals under appropriate biochemical conditions at a higher level, represent such physical structures.

Information in the Cosmos

One cannot speak of information in a universe without observers. Information arises out of a communication game played between a sender of signals and their recipient. For physical systems, the game may be seen as being played between Nature and the scientist. The average information obtained from a quantum system is given by the von Neumann measure, which is a generalization of thermodynamic entropy and perfectly in accord with commonsense when we consider a mixed quantum state. But this entropy for an unknown pure state is zero even though testing many copies of such a state can reveal information about the choice that was made by the sender.

The idea of zero entropy for an unknown pure state is reasonable from the perspective that once the state has been identified; there is no further information to be gained from examining its copies. But it is not reasonable if the game being played between sentient beings. Assume the sender chooses one out of a certain number of polarization states (say, for a photon) and supplies several copies of it to the receiver. Measurements made by the receiver on the copies will reveal information regarding the choice made by the sender. If the set of choices is infinite, then the "information" generated by the source is unbounded. The information in the pure state is limited by the "relationship" between the source and the receiver, and by the precision of the receiver's measurement apparatus. If the sender chose a polarization state that the receiver's measurement apparatus was already synchronized with, the receiver could recognize the state quite readily.

I recently investigated information obtainable from an unknown pure state within the framework of communication between source and receiver (Kak, 2007; Kak, 2009b). I proposed a measure of entropy that covers both pure and mixed states. In general, then, entropy has two components: one informational (related to the pure components of the quantum state, which can vary from receiver to receiver), and the other that is thermodynamic (which is receiver independent). The increase of information with time is a consequence of the interplay between unitary (related to pure states) and non-unitary (related to mixed states) evolution, which makes it possible to transform one type of information into another. This complementarity indicates that a fundamental duality is essential for information.

For a two-component elementary mixed state, the most information in each measurement is one bit, and each further measurement of identically prepared states will also be one bit. For an unknown pure state, the information in it represents the choice the source has made out of the infinity of choices related to the values of the probability amplitudes with respect to the basis components of the receiver's measurement apparatus. Each measurement of a two-component pure state will provide at most one bit of information, and if the source has made available an unlimited number of identically prepared states the receiver can obtain additional information from each measurement until the probability amplitudes have been correctly estimated. Once that has occurred, unlike the case of a mixed state, no further information will be obtained from testing additional copies of this pure state.

The receiver can make his estimate by adjusting the basis vectors so that he gets *closer* to the unknown pure state. The information that can be obtained from such a state in repeated experiments is potentially infinite in the most general case. But if the observer is told what the pure state is, the information associated with the states vanishes, suggesting that a fundamental divide exists between objective and subjective information.

This approach is consistent with the positivist view that one cannot speak of information associated with a system excepting in relation to an experimental arrangement together with the protocol for measurement. The experimental arrangement is thus integral to the amount of information that can be obtained.

The informational measure outlined here resolves the puzzle of entropy increase. We can suppose that the universe had immensely large informational entropy associated with a pure state in the beginning, a portion of which has, during the physical evolution of the universe, transformed into thermodynamic entropy.

The Problem of Consciousness

The reason why consciousness is not accessible to science is that it is not objective. It is the light that the observer uses to throw on objects but this light cannot be turned upon itself. Rational science is related to associations and it must, therefore, be material and reductionist. Consciousness cannot be fitted in the framework of rational science.

There are indirect ways to study consciousness. Neurophysiological experiments have shown that the mind orders events in order to provide consistent picture and that there is a small time lag between initiation of neurological function and its conscious awareness. Mind is an active participant in the creation of models of the world, seen most clearly when subjects who have impairments resulting from strokes or trauma are studied (Gazzaniga, 1995; Kak, 2004).

It is argued by some that once machines become sufficiently complex they would be conscious. But machines only follow instructions, and it is not credible that they should suddenly, just on account of the increase in the number of connections between computing units, become endowed with self-awareness. To speak of consciousness in the machine paradigm is a contradiction in terms. If a machine could make true choices (that is not governed by a random picking between different alternatives), then it has transcended the paradigm because its behavior cannot be described by any mathematical function.

Some ascribe awareness of the brain to the fact that the brain is a self-organizing system which responds to the nature and quality of its interaction with the environment, whereas computers can't do that. But other ecological systems, which are biological communities that have complex interrelationship amongst their parts, are self-organizing, without being self-aware. This suggests that while self-organization is a necessary pre-requisite for consciousness, it is not sufficient.

Cognitive scientists and biologists have considered evolutionary aspects related to cognitive capacity, where consciousness is viewed as emerging out of language. Linguistic research on chimpanzees and bonobos has revealed that although they can be taught basic vocabulary of several hundred words, this linguistic ability does not extend to syntax. By contrast, small children acquire much larger vocabularies -- and use the words far more creatively -- with no overt training, indicating that language is an innate capacity.

It is theorized that human language capacities arose out of biological natural selection because they fulfill two clear criteria: an extremely complex and rich design and the absence of alternative processes capable of explaining such complexity. Other theories look at music and language arising out of sexual selection. But, howsoever imaginative and suggestive these models might be, they do not address the question of how the capacity to visualize models of world that are essential to language and consciousness first arise.

According to the nativist view, language ability is rooted in the biology of the brain, and our ability to use grammar and syntax is an instinct, dependent on specific modules of the brain. Therefore, we learn language as a consequence of a unique biological adaptation, and not because it is an emergent response to the problem of communication confronted by ourselves and our ancestors. This is seen most tellingly amongst deaf children who are not taught to sign a language. Such children spontaneously create their personal signs, slowly adding grammatical rules, complete with inflection, case marking, and other forms of syntax (Goldin-Meadow and Mylander, 1998).

Creativity and Discovery

Some individuals, who have serious developmental disability or major mental illness, perform spectacularly at certain tasks in the areas of mathematical and calendar calculations, music, art, memory, and unusual sensory discrimination and perception (Sacks, 1985). Such cognitive ability cannot be viewed simply as a processing of sensory information by a central intelligence extraction system.

There also exist accounts in the literature speaking of spontaneous discovery in a variety of creative fields. But as unique events that happened in the past, they cannot be verified. In the scientific field, Jacques Hadamard surveyed 100 leading mathematicians of his time, concluding many of them appeared to have obtained entire solutions spontaneously. This list included the claim by the French mathematician Henri Poincaré that he arrived at the solution to a subtle mathematical problem as he was boarding a bus, and the discovery of the structure of benzene by Kekulé in a dream (Hadamard, 1954). More recently, the physicist Roger Penrose claims to have found the solution to a mathematical problem while crossing the street (Penrose, 1989).

Intuitive discovery must be common, and the reason why we don't hear of more such stories is because some people are unprepared to appreciate their intuition or translate it into a meaningful narrative, others feel uncomfortable speaking of their personal experience. The preparation of the scientist comes in the amplification of his intuition. It is also true that the creative intuition is not always correct, and the scientist's judgment is essential in separating the false solution from the true one.

Anomalous abilities and first person accounts of discovery that appear to be spontaneous could either indicate that consciousness is more than a phenomenon based solely on matter or that these accounts are just a listing of coincidences. Conversely, there is no way to prove the veracity of the scientist's account of discovery. It is possible that the account is one that the scientist has come to believe over time and it does not correspond to fact.

Coincidences

The standard scientific view on coincidences is that correlated spatially or temporally separated events must be entirely by chance. Scientific cosmology cannot suppose otherwise, because doing so would imply that it is not complete. Furthermore, many claims of coincidence cannot be accepted at face value. They may be a result of poor observation or recall, self-deception, or deception by others.

In some coincidence events a person may claim to obtain information from another person without the use of the currently known senses or inference, and in precognition one may claim to have knowledge of a future event. In parapsychology experiments, volunteers guess random choices that are made at a remote location to determine if these guesses deviate from chance. The sender attempts to mentally communicate a randomly chosen "target" to the receiver. The sender and receiver are in separate acoustically shielded rooms. A computer is used to choose a target from a large selection of possible targets that may be video clips, and plays that clip repeatedly to the sender. At the same time, the receiver reports out loud any thoughts or images that come to mind, and these verbal reports are recorded. Neither the experimenter nor the receiver has any idea of what target the sender is viewing. At the end of the sending period, the sender remains in his room while the computer plays four video clips to the receiver – the target plus three decoys. The receiver's task is to compare each clip to the mentation, and to select which of the clips most closely matches it.

If no information transfer is taking place, then we would expect the receiver to correctly identify the clip that was viewed by the sender 25 per cent of the time by chance alone. Extrasensory or telepathic perception is inferred to have taken place if the target is correctly identified more often than chance expectation.

The results of such experiments have not quite been supportive of the idea of extrasensory communication. According to researchers in the field, deviation from chance is limited to participants tested by believer experimenters; participants tested by skeptical experimenters obtain chance results!

If it is taken that the experiments are negative, they only rule out the idea of communication of images by some as-yet unknown process. There is also a basic weakness in the conception of the experiment. Unlike images stored in a computer, those presented to human subjects carry varying value and they are remembered in association with prior memories, which are unique for each individual.

Now we speak of two accounts of coincidence and critically examine them. The fictional account of cannibalism in the novel *The Narrative of Arthur Gordon Pym of Nantucket* by the American author Edgar Allan Poe (1809-1849) was published in 1838. In a complicated story of sailing adventure involving shipwreck, the cabin boy Richard Parker is chosen and killed for food.

In 1884, in a real-life event that became a sensation in Britain, a 17 year old named Richard Parker, a runaway who becomes a cabin boy, is shipwrecked together with the crew. After several days of starvation, the crew kills Parker for food. The crew is eventually rescued, brought to London, and tried for murder. Although this coincidence is striking, it may be attributed to the popularity of the name Richard Parker in that period time.

Another coincidence is that of the novel, *Futilty*, about the unsinkable ship Titan that is shipwrecked with much loss of life when it strikes an iceberg on its maiden voyage. In 1912, the Titanic, struck an iceberg at midnight on her maiden voyage and sank on 15 April with great loss of life. There are several correspondences between the two boats but these may be due to the fact that both the novel and the design of the actual ship were based on proposals that were being written about in the 1890s. The coincidence may not be as remarkable as appears on first sight.

A Scientific Coincidence

A much more striking coincidence concerns an early value of the speed of light in the well-known commentary on the Rigveda by the medieval scholar Sāyana (1315-1387), prime minister in the court of the Vijayanagar Empire. It associates the speed of 2,202 yojanas in half a nimesha with the sun (or sunlight) (Kak, 1999). The distance and time measures of yojana and nimesha are well attested in Indian astronomical and encyclopedic texts and this number corresponds closely to the correct value of the speed.

The division of time according to the medieval Vishnu Purāna 1.3.3 (Wilson, 1840) is:

1 day = 30 muhūrtas

1 muhūrta = 30 kalās

1 kalā = 30 kāshthās

1 kāshthā = 15 nimesha

Thus 1 day = 86,400 seconds = 405,000 nimesha

Thus, 1 nimesha = $\frac{16}{75}$ seconds. Half a nimesha would be $\frac{8}{75}$ seconds. It is clear that half a nimesha was used in the text because that is the thirtieth part of a kalā, in the regular sequence where the larger units are greater by a factor of 30.

1 yojana is defined in the Arthashāstra (of Kautilya who was advisor to the Mauryan emperor Chandragupa who reigned 322 – 298 B.C.E.) as being equal to 8,000 dhanus or “bow” (Kangle, 1986). The Arthashāstra further takes a dhanus to equal 108 angulams (finger widths).

Independent confirmation of the dhanus unit is made possible by examining ancient monuments and seeing the largest unit that maps the main dimensions of the monument in meaningful integer multiples of the unit. This has been done both for the 3^{rd} millennium BC city of Dholavira from West India as well as from monuments of medieval India (Danino, 2008; Balsubramaniam, 2009), and it is found that there exists continuity across ages in the use of this unit. The unit of dhanus in use in Dholavira and later India is 1.904 meters. The unit of angulams has been validated from scales obtained in Harappa and it 1.763 cm long.

Therefore, the speed of 2,202 yojana in half a nimesha is:

$$\frac{2202 \times 8000 \times 1.904 \times 75}{8}$$ = 314,445.6 kilometers per second

We find a good fit between the speed of light in this ancient account and the actual value. Since there was no way this speed could have been measured in medieval India, it is a very improbable coincidence. Note further that until just over 200 years ago it was not even known in the Western tradition that light had finite speed. In 1676, Rømer calculated this speed in terms of the speed of earth's rotation around the sun, and this value, we now know, was about 8% less than the modern value. Sāyana could not have obtained this figure from the West or anywhere else.

Perhaps the value of the speed of light should not surprise us since there are other numbers the precision of whose value in the ancient texts cannot be explained. These include the size of the earth which is described to within one percent accuracy in the accounts of Eratosthenes, Āryabhata, and al-Bīrūnī. The apocryphal account of Eratosthenes's measurement of the size indirectly by measuring the shift in the shadow of the sun at noon between Syene and Alexandria is not credible since the distance between the two cities was not known accurately and the shift in the angle of the shadow could not have been measured with the accuracy that the calculation of the earth's diameter demands.

The problem of scientific discovery was discussed from another perspective by the Scottish philosopher David Hume in his "An Enquiry Concerning Human Understanding". Hume argued that our scientific understanding is a consequence of inductive inference, which involves a leap of imagination from the world of the observed to that of the unobserved, which in his words was "beyond the present testimony of the senses, and the records of our memory." He argued that it was instinct, rather than reason, that explained our ability to make inductive inferences.

In the traditional explanation of the workings of mind, habits picked up in childhood and in school are the impediments that prevent one from being connected to one's intuition (Hume's instinct). Real creativity requires challenging dogma as well as one's own certitudes. It is believed that one sees unexpected connections, which is an element of creativity, in extraordinary states of mind. Looking within can reveal unexpected knowledge about the universe for we are a part of the universe (Kak, 2004).

Concluding Remarks

We argued that improbable coincidences corroborated in literature support the view that non-material entities have independent existence. The most compelling of these is the speed of light in medieval literature that could not have been obtained from measurement because the science and technology to do so did not exist at that time. It is also fascinating that this coincidence appears to have been justified by fitting it into the conception of the universe current in ancient India. Nevertheless, such evidence, just like first person accounts of spontaneous scientific discovery, cannot, in itself, be conclusive in establishing that the world of ideas has independent existence.

Evolution in quantum physics is deterministic, but when the system interacts with another system its state function collapses. Neither the framework of quantum physics nor that of classical physics has any place for observers. A quantum mechanical universe will evolve by a global unitary operator in a purely deterministic manner.

Quantum mechanics is not a local theory in the sense that parts far apart cease to be causally connected to each other; entanglement between particles persists no matter how apart they are. It cannot be assumed that as the universe evolved, interaction between different isolated parts of it came about in a non-unitary manner, leading to creation of information. The entropy at the origin should not change as the universe evolves.

Since information in the universe is increasing, it can only be come about by a principle that lies outside of quantum theory. Entropy increase in the universe requires reduction of its state function by some other physical system but the universe, by definition, does not have any other matter in it. We are compelled, therefore, to postulate a state function reducing mechanism other than that of physical laws. We have argued that this mechanism evolves out of the consciousness principle and it has, by means of probability enhancement of events (which is non-unitary), generated conditions all over the universe that favor life.

The working of the "consciousness principle" in the laboratory may be seen in the quantum Zeno effect in which the process of observation increases entropy. This principle, rather than the creation of complex molecules by chance, leads to the rise of life in the universe. Consciousness interpenetrates the universe, but it needs appropriate physical structures to be embodied.

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