The Holographic Principle of Mind and the Evolution of Consciousness

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> Man only progresses by slowly elaborating from age to age the essence and the totality of a universe deposited within him.
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> Pierre Teihard de Chardin
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> (1955/1961, p. 180)

The Holographic Principle holds the information in any region of space and time exists on the surface of that region. Layers of the holographic, universal "now" go from the inception of the universe to the present. Universal Consciousness is the timeless source of actuality and mentality. Information is experience, and the expansion of the "now" leads to higher and higher orders of experience in the Universe, with various levels of consciousness emerging from experience. The brain consists of a nested hierarchy of surfaces which range from the most elementary field though the neuron, neural group, and the whole brain. Evidence from the evolution and structure of the brain shows that optimal surface areas in a variety of structures are conserved with respect to underlying surfaces. Microgenesis, the becoming of the mental state through a process of recapitulation of development and evolution, is in full accord with the Holographic Principle. Evidence from a wide variety of contexts indicates the capacity of the mind for total recall of past life events and for access to universal information, indicating

connection with the holographic surfaces of prior “nows” and with the Universal holographic boundary. In summation, the Holographic Principle can help us explain the unity and mechanisms of perception, experience, memory, and consciousness.

KEYWORDS: Holographic Principle, consciousness, evolution, time, mind, brain, memory, microgenesis, quantum physics, conceptual synthesis.

INTRODUCTION

The Holographic Principle is an analogy to the hologram, in which the form of an object is fully enfolded in every point on a two dimensional surface. If we imagine a sphere, we see three dimensions, 3-D. The surface of the sphere has two dimensions, 2-D. The third dimension is the radius of the sphere, which can be drawn inward from any point on the surface of the sphere, to the central point in the sphere. The sphere has an outer boundary, which is 2-D. The third dimension, according to the Holographic Principle, is represented holographically on the surface of the sphere The inside of the sphere, the volume or bulk of the sphere, can be imagined as having a field, which corresponds to the matter and vibrations of energy within the sphere.

The Holographic Principle holds that the information which describes all of the particles of matter and vibrations of energy in the bulk of the sphere fundamentally “lives” at the boundary of the sphere. The maximum amount of information that can be contained in any volume of space is limited, not by the volume of the space, but rather by the surface area that encloses that space. This limit of information is called the Bekenstein bound, named after Jacob Bekenstein, a theoretical physicist who first

formulated the Universal Entropy Bound (UEB), which defines and limits the amount of information on the Holographic Surface of the Universe (Bekenstein, 1981). The Holographic Principle arose through the formulation of the entropy and energy relations of black holes, according to the generalized Second Law of Thermodynamics (Bekenstein, 1974). In the words of Bekenstein (2003): "By studying the mysterious properties of black holes, physicists have deduced absolute limits on how much information a region of space or a quantum of matter can hold."

Raphael Bousso (2000) later elaborated on the Holographic Principle as a universal law that holds for all surfaces, open or closed, regardless of location or shape, and demonstrated the universal Holographic Principle with a wide variety of examples from theoretical physics (Bousso, 2002). Later, Mongan (2007) linked the Holographic Principle to the quantum wave function, demonstrating that local interactions between quanta of mass may have instantaneous and non-local effects effect on the wave function throughout the universe. Non-locality is the quantum phenomenon of instantaneous action at a distance in spacetime. The non-local interaction of quantum fields with the distant universal holographic boundary has been explain in terms of "Wilson loops" and also in terms of a higher dimensional space (Hubeny, Susskind, and Toumbas, 2000).

New findings relating to the Holographic Principle continue to unfold from condensed matter and particle physics. The universe is a system of holographic surfaces within surfaces, or what we may call a nested hierarchy of surfaces, with each surface containing its own "world" of information. The most basic order of information is the fundamental quantum of spatial volume, the Planck space, which has a variable energy, called the vacuum energy. There is a fundamental relationship between the Holographic

Principle and the vacuum energy (Mongan, 2007), which can account for a variety of non-local phenomena (Laszlo, 2004).

Holographic surfaces can be unfolded into sheets, one on top of another, with each sheet or surface being a higher dimension of information. New dimensions of information emerge from the lower-order surfaces as they are unfold on to the higher order surfaces, which carry information of their own respective areas. The higher dimensions manifest information from the lower dimensions that was not there to start with. Higher and higher orders of the quantum wave function exist on the surfaces of world within worlds. Information is extracted from the wave function as we move higher and higher in the hierarchy of "worlds," until we reach the highest dimension of information, the boundary of the Universe, which is in constant and instantaneous interaction with the "worlds" beneath it.

As stated by Antonio Dobado (2005) regarding information in the Universal Entropy Bound:

> The UEB refers to information storage capacity. Usually this issue is contemplated under the point of view of smaller physical systems capable to store one single bit of information like molecules, atoms, photon polarization etc. The point of view of UEB is completely different since it offers a more holistic kind of bound which applies to the *whole memory system.* (italics added)

Our perception creates a duality of subject and object, of the subjective and the objective. We think of information as objective, and experience as subjective. In fact, no such dualities exist. Information and experience are one and the same. Every particle in

the universe is alive with experience. Every organism is alive with experience. The Universe is alive with experience. On the universal level, experience is one. We are one with this universal experience.

Information does not pass into extinction with the passage of time. Time is a series of universal boundaries beginning with the inception of our universe. We know, according to relativity that, at the speed of light, time stands still. So, for light, and for the Universal Holographic boundary expanded outward at the speed of light, time is standing still. Light is essentially timeless. It is eternal.

On the boundary of our universe, there is only now. The universe, is, in fact, continually being recreated, continuously revisiting and repeating its own history. It is always being now. From eternity to eternity, forever and ever, from now-past to now-future, it is always being now. This is the eternal now. Everything and everybody is eternal on the highest dimension of the universal pulse.

And yet time flows. It flows in the lower dimensions, tied to the bulk, tied to matter, tied to the continuous stutter of systems, following the arrow of the concatenation of information. The light moves outward. Time seems to move. And yet, it is always being now.

Our now is the outer surface in time of a series of nows. This series of nows *is* time. As this outer surface moves ever further outward, things appear to be created, things appear to be destroyed. The body dies and decays. This all is an illusion of our perception. When the curtain is lifted, we pass into eternity, which is our home. Eternity is here, right here, all around us, spread like a blanket that covers the Earth. We call this blanket the noosphere (Teilhard, 1955/1961), the blanket of knowing. It is a blanket

upon blankets upon blankets of nows, built up like the strata that lie beneath our feet, each reaching to a higher dimension of knowing. This is the most fundamental basis of evolution.

We stand, as it were, on the outermost blanket of the pulse of our planet. With every pulse is the creative advance. With every pulse there is a higher dimension of knowing. The evolution of life is fossilized, or so it would appear, in the strata beneath our feet. And yet, if we were to remove these strata, we would have no place to stand. We would fall into the void, into the abyss of time, disconnected from are own ground of being.

QUANTUM PHYSICS AND THE HOLOGRAPHIC PRINCIPLE

Quantum physicist Henry Stapp (1997) has argued persuasively that classical physics cannot accommodate the phenomenon of consciousness, because it deals with independent entities that are localized in spacetime. In classical physics, one can only conceive of disjointed physical events in various places in the brain, with no experiential unity. Our conscious experience demands a quantum theory of the mind, which allows for instantaneous interaction between the various elements of the brain. The Holographic Principle is the information theory of such quantum fields. Let us briefly discuss the nature of quantum theory and its connection with the Holographic Principle.

Light, as we know, seems to have a particle and wave nature. The theory of the particle nature of light was first published, posthumously, by Pierre Gassendi in 1660. Around the same time, in the 1660's, Robert Hooke proposed that light had a wave nature, and this was supported by the phenomenon of diffraction of light, which we will discuss shortly. In 1675, Sir Isaac Newton published his first treatise on light, in which

he reasoned that, since light moves in a straight line, and does not seem to bend around objects as waves do, that it is composed of particles, which he called corpuscles. Due to Newton's fame, the theory of the particle nature of light held sway through the 18th century.

What the corpuscular theory of light did not explain was the phenomenon of light diffraction. Two waves originating at different sources interfere with one another. The waves combine to form a complex pattern, whereby the peaks and the troughs of the waves add up, producing a diffraction pattern. In 1801, Thomas Young conducted his famous double slit experiment, which demonstrated the wave nature of light. He found that coherent light, when passed through two separate slits, created a diffraction pattern of light and dark stripes. Where peaks or troughs of the waves coincide, they interfere constructively to form the light stripes, while that dark stripes form where the peaks or troughs of the waves do not coincide and interfere destructively. Later, it was discovered that, if a very weak light source is used, individual photons can be delivered through the slits. When recorded on a photographic plate, these individual photons produce individual spots. When all these individual spots are added up, they form the pattern of light and dark stripes. It was concluded that each photon, in fact, passes through *both* slits, and thus interferes with itself, acting as if it were a wave and a particle at the same time. Thus the wave/particle duality of light was established.

Later, with the advent of quantum theory in the early 20th century, this wave/particle duality was explained by the theory of the quantum wave function. According to this theory, the photon does not travel through any one path, but is a wave function of possible or virtual paths. The sum of the virtual particle paths of the photon

then undergoes diffraction when passed through the double slits. The fact that we see only one spot, rather then a diffraction pattern, indicates that the wave function has "collapsed." That is to say, the wave function of all possible paths collapses into a single particle when observed. Thus, it would seem, we have an observer-created reality. The photon is a wave function until it is observed, then it becomes a particle, leaving a spot on the plate, which will be in the exact same place for *all* human observers. In other words, the collapse is verified *collectively*.

But does the wave function of possible particle paths *really* collapse, or is the collapse really a product of our own, unified, collective observation. Ervin Lazslo (2004) describes a remarkable experiment by the Iranian American physicist Sharhriar Afshar, the results of which were published in 2004 in a British scientific journal. In the place of the photographic plate, the location of the individual photon was measured using a series of wires, connected to photon detectors. It was then observed that the photon produced a diffraction pattern, rather than a spot.

How do we reconcile these conflicting findings, whereby, on the one hand, we observe the collapsed wave function, or spot, and on the other the un-collapsed wave function, the diffraction pattern? Afshar and others (Laszlo, 2004) imply that the wave function is the real nature of the photon, and that the collapsed wave function is a mere appearance. However, another explanation is possible based on the Holographic Principle. The photographic plate can be viewed as a holographic boundary, connected to the universal holographic boundary, creating information regarding the location of the particle. The series of wires can be viewed as a bulk space, capturing the wave function, as the photon energy spreads out as a wave prior to observation. Moreover "mere

appearances" are the *actual* components of our Universe, as we will discuss shortly. Afshar's experiment, to my knowledge, remains to be reproduced, but the results are enticing.

The principle of collapse of the wave function has now been extended to the universal level, where the wave function is the wave function of the Universe, collapsed only in the process of observation. The alternative is the theory of parallel universes, or the multiverse, where all of the wave functions of the multiple possible universe really exist. However, we *observe* only a single universe, and this is verified when we compare our individual observations, or make a *collective* observation.

What if, instead of there being a single universe, there are actually multiple, parallel universes, but only a single *collective* Mind, the Universal Mind, which creates *our* Universe. This is called the One Mind Model of *phenomenal* or *observed* reality (Germine, 2004). According to this model, our seemingly separate minds are fundamentally united.

The One Mind Model was tested by recording the brain waves of the observer of random stimuli through a series of observations in two conditions. Without the knowledge of the observer being recorded, another individual observes the stimuli randomly. What was predicated, according to the One Mind Model, was that the prior observation of the stimuli by one observer would collapse the wave function for the second observer, and that this would produce a different brain wave pattern. When the brain wave patterns were summed over a large number of observations, they were found to be different at a chance level of about 100,000 to one (Germine, 2004). Again, the results of this experiment are enticing, although not absolutely conclusive.

Applying the Holographic Principle, information regarding the location of the particle, or the status of the random stimulus, emerges through a series of higher order holographic boundaries, until the information regarding the stimulus or location of the particle is fully known. So, perhaps, the wave function on a lower level or dimension of observation *is observed as a particle* at a higher level. At the lower level of experience, the experience of the particle itself, there is a plurality of possibilities. At the higher level of experience, there *appears* to be a single actuality. The line that separates these levels of description, it seems, is the emergence of consciousness through the hierarchy of holographic surfaces, in accordance with the Holographic Principle.

The lower domain of experience is what we do not directly observe, the quantum realm, while the higher level is what we ordinarily observe, the classical realm. Based purely on experiment, the formulation of quantum theory initially placed the great divide between the quantum and classical domains between the measuring apparatus and the particle (Herbert, 1985). However, in the early 1930s, John von Neumann, in his rigorous mathematical treatise on quantum mechanics, found no support for such a division, compelling him to conclude that the wave for was collapsed *by consciousness*. Von Neumanns's treatise has been called the "quantum bible" and "the most influential book on quantum theory ever written" (Herbert, 1985). The von Neumann formulation leads us to conclude that the lower realms of quantum reality form a virtually limitless array of potentials that are inherently incapable of realization without the observation of *a knowing entity*, which we identify with consciousness (Kafatos and Nadeau, 1990). We thus have a correspondence between quantum theory, the hierarchical structure implied

by the Holographic Principle, and the higher orders of experience, leading to the full expression of the Conscious Universe.

David Bohm's theory of the implicate and explicate orders involves a holographic principle that is fully consistent with the Holographic Principle discussed here (Bohm 1980; 1986; Bohm and Hiley, 1993). According to Bohm, there is an implicate order that represents the universal, holographic subtext of reality, and which unfolds in every moment to produce the explicate order that we all observe. Thomas Germinario (2004) has equated the implicate order with the unconscious process, and the explicate order with conscious process. He emphasizes the nature of dreams within the implicate order, and the importance of the dream work for maintaining a healthy mind through integration of the implicate order and our daily lives. Allan Combs and Mark Holland (1990) connected the implicate order or holomovement (Bohm, 1980) with Carl Jung's theory of synchronicity (Jung and Pauli, 1955), with the implicate order providing a holographic medium through which apparently disconnected individuals become connected. The principle of synchronicity, the instantaneous connection of people and events beyond the senses, has been equated with the quantum-physical principle of non-locality (Combs and Holland, 1990; Germine, 1991), and has been proposed to be the fundamental mechanism of conscious process (Germine, 1991).

Applying the Holographic Principle theory of mind, subjects may be connected synchronously in the manner of two individuals conversing through cellular phones, where the radio signals are transmitted through a distant satellite. The difference here is that the radio signals travel at the speed of light, and thus the there is some miniscule time lapse between the sending and receiving ends. The Holographic Principle implies a much

more distant and instantaneous communication pathway, with the analogue of the satellite being the holographic boundary of the Universe, as well as a much richer communication, potentially involving a transmission of thoughts and feelings.

Our ego-consciousness seems to mask the universal relatedness implied by the Holographic Principle, and it is perhaps only through transcendence of the ego-consciousness that the higher orders of experience can become conscious. In the phenomenon of synchronicity, there seems to be a meaningful connection between individuals that breaks through the barrier of ego-consciousness. Such a connection is reported by many individuals in the course of dreams, when the ego-consciousness has been suspended, at times informing the dreamer of something that has happened in the life of a meaningfully-connected individual.

MIND, BRAIN, AND THE HOLOGRAPHIC PRINCIPLE

The brain is the center of our conscious experience. This does not imply that consciousness does not exist outside of or beyond the brain. Indeed, it is our hypothesis that consciousness is the inevitable product of the higher orders of experience that have evolved in the progressive universal unfolding of a hierarchy of experience, according to the Holographic Principle. As the boundary of the Universe, and the boundaries of all systems, expand outward, higher and higher orders of information, and therefore experience, unfold in a recursive manner.

The brain is most clearly associated with human consciousness, so much so, that if brain function is permanently lost, we no longer consider humans to be alive. Moreover, it is the brain that lends itself most readily to scientific scrutiny, and, if we are to develop a theory of the nature and evolution of mind and consciousness based on the

Holographic Principle, we must find evidence supporting such a theory in the structure and evolution of the brain. We seek to address, not so much the *what*, which is available in detail elsewhere, but the *why*. As stated by Northcutt (2002): "*Why* neural changes have occurred is the most difficult question and one that has been largely ignored." This is an unsuitable state of affairs.

The Holographic Principle, as conceived in current physics, applies to fields, and perhaps, even to more elementary entities, called strings and branes. These more elementary entities remain hypothetical at the time of this writing. There are many layers between the level of fields and that of neurons. We know that neurons are surrounded by a surface phospholipid membrane, which supports an electrochemical process that is fundamentally necessary to human experience. As the information supported by the membrane surface according to the Holographic Principle is proportional to its area, we should expect to find that the neural correlates of consciousness most clearly associated with those parts of the neuron that have the have a high proportion of neuronal surface area, and, in particular, receptive surface area. Dendrites account for an average of about 90% of the neuron's receptive surface area (Wong, 2002), and so would be expected to be the most important neural structures in information processes. We find this to be true.

The surface area of dendrites is directly correlated with the efficacy of synaptic integration, and we may consider this a function of the mere complexity of connections involved (Shepherd, ed., 1990). However, we must ask ourselves how this complexity is translated to experience and consciousness, to the unity of perception, and to the binding of experience of separate brain structures into an integral and unified whole. The Holographic Principle entails the integration of the various orders of surfaces in the brain,

from the most elementary quantum fields, both intracellular and extracellular, to the whole brain. This entails far more information storage and processing capacity than would ever be allowed by the neuron or connectionist doctrines. This information capacity is so high that we must make an inquiry into the evidence that supports the notion that the brain gives us access to experience that involves such an abundance of information, which we will do shortly, but first let us discuss the evidence of information processing in the dendritic networks.

A wealth of data supports the notion that the dendritic arborizations are the primary structures that support perception (Pribram, 1991). The neural wave form characterizes the dynamics of the dendritic network, and this wave form can be described by an equation that is fundamentally the same as the equation describing the quantum wave form (Pribram, 1991), in accordance with the quantum field integration of information according to the Holographic Principle. Complex mathematical analyses of electrical activity of the brain in space and time indicate that it is holonomic or holographic, forming what is called the holoscape of the brain, which appears to give rise to perception through ensembles of receptive fields (Pribram, 1991). The surface area and holographic nature of electrical potentials of the dendritic networks supports the idea that the dendritic surfaces themselves are intrinsic to experience at the level of neuronal cell ensembles. This is consistent with the Holographic Principle. If we do not invoke the Holographic Principle in this context, with its fundamental non-local basis, then we have to question who it is that is observing these potentials, and how it is that they are translated into information that constitute the unity of experience.

Decreased dendritic surface area is seen in humans with Alzheimer's Disease (AD) and in animal models of AD (Moolman and others, 2004). This is consistent with dendrite area-dependent functioning of memory and cognition, in keeping with the Holographic Principle. However, many other neural changes have also been observed in AD, including dysfunction of the microtubules.

The disturbance of memory and cognition in AD is often accompanied by observations by friend's and family that the person or self has been lost, which can be particularly distressing to loved ones. This apparent loss of self is reminiscent of the "it from bit" principle of the renowned physicist John Archibald Wheeler (1998). It is likely that there is a recursive process involving both "it from bit" and "bit from it." Only the latter principle seems to be endorsed by current mainstream neuroscience, and only in materialistic terms. The abstraction of an "it" being constituted of immaterial information is not considered, in keeping with the vacuous materialism prevalent in science today. This neglect or oversight of Wheeler's principle creates a neuroscientific view of information that is unphysical, and therefore not scientific at all. The "it" which is the person never seems to enter the picture.

As a physician, it has been my own intuitive experience that the person remains present even in cases of extreme dementia, and that the person often seems somehow disembodied in cases of brain death or deep coma, looking down from above. The latter experience would seem to be verified by the reported perceptions of technically dead or deeply comatose individuals, once they revive to consciousness (Sabom, 1982; Greyson and Flynn, eds., 1984).

Brain changes in a variety of mammals and other animals have been so predictable that we can infer changes in the evolution of our animal ancestors based on a combination of fossil evidence and evidence from the brains of extant animals (Streider, 2005). Brain volume has grown exponentially, in mammalian evolution and in the evolution of other animal classes, across all major brain regions (Streider, 2005). The phenomenon of exponential brain volume growth bringing about a relative increase in volume of initially larger brain regions can be explained by simple mathematics. If we take a volume of two cubic centimeters to the third power, we get eight cubic centimeters. If we take an area of four cubic centimeters to the third power, we get 64 cubic centimeters. In the first case we have increased the volume four-fold, in the second we have increased the volume 16 fold. A two-fold increase of the initial volume has thus led to four-fold increase in the final volume. The cerebral cortex, having a relatively large volume in lower mammals, has thus increased in a greater proportion than other areas. Conventional evolutionists have held that this greater cortical proportion in volume in humans is a result of natural selection, conferring the advantages of cortical function for perception, cognition, language, and behavior. However, it is far more parsimonious to explain this increase in proportion to simple exponential growth. Clearly, there is some other principle at work, and it is the simple expansion outward of brain surfaces, consistent with the Holographic Principle.

In accordance with the Holographic Principle of Mind, surface areas of lower order structures, such as neuronal organelles and membranes, develop, in the course of evolution, at optimal ratios to the surface area of higher order structure. These optimal

ratios should be conserved. This leads to the conservation of surface in brain areas as the volume of these areas increase in evolution.

Volume for regular or smooth-surfaced regions of space increases with spatial dimensions by a power of three, and area increases by a power of two. This has implications for the storage and processing of information in the Holographic Model. As stated by Bekenstein (2003a): "Has it not been obvious for generations that, other things being equal, information capacity scales with volume of the information registering milieu? But if so, as the scale of the system goes up, the growth in volume must outstrip the growth of area bringing about a conflict with the assertion of the holographic bound."

If we look across mammalian species, the surface area of the brain increases essentially by the same power as volume (Butler and Hodos, 2005; Striedter, 2005), consistent with the Holographic Principle and the Bekenstein bound on information limits. This phenomenon is largely the result of the progressive convolution of the cerebral cortex, increasing the area of the brain, and, according to the Holographic Principle, increasing the brain's integrated information storage and processing capacity. It has been traditionally thought that the folding of the cerebral cortex into convolutions has occurred in order that it might "fit" within the cranium. It would seem more likely that the cranium should "fit" around the brain, which is why the cranial sutures between the bones of the skull remain open to allow the brain to grow until it fully developed at the beginning of adulthood. In cases of hydrocephalus in children, increased brain size due to increased volume and pressure of cerebrospinal fluid can cause a gross enlargement of the cranium. Moreover, the convolution process was already well under

way in the very small, four-legged mammals (Striedter, 2005), which could just as well have elongate brains with a smooth cerebral surface. Also, convolutions exist in the cerebellum of very small brains, such as those of fish (Streider, 2005). The cerebellum, which is associated with coordination, seems also to be involved in conscious processes (Schmann and Caplan, 2006), consistent with its surface area and thus with the Holographic Principle.

There is an increase in the number of neural brain centers, or modules, with increasing brain size in the course of evolution, which is most evident in mammals (Strieder, 2005; Northcutt, 2002). Primates, for example, have five times the number of cortical centers than rodents. In every case, the increase is most striking in the roof of the telencephalon, the uppermost and evolutionary most recently portion of the brain, which includes the cerebral cortex (Northcutt, 2002), and which has grown in volume at a greater proportion than underlying structures. An increase in number of neural centers, as opposed to the size of neural centers, means that the relative area to volume ratio of such centers is conserved in evolution, consistent with the Holographic Principle. Increase in the volume of neural centers is associated with an increase in connectivity (Strieder, 2005), and in this sense, based on purely connectionist models of brain function (Bechtel and Abrahamen,1991; Shepherd, 1990), an increase in volume relative to area would seem to be favorable. Decreased connection density in smaller volumes of brain tissues forces neural centers to become more independent (Strieder, 2005), which, again, would seem to be unfavorable in the context of connectionist models.

The evolution of the cerebral cortex, as well as many other brain regions, has been associated with an increase in lamination or layering, which is proportional to the size of

the brain region (Strieder, 2005). These layers of brain tissue are potential holographic surfaces. Large brain regions have a greater surface area, in the context of different brain regions, so that the increase in the area of laminar surfaces is proportional to volume, which, again, conserves the optimal surface area relative to volume in the brain, in accordance with the Holographic Principle of Mind.

Across all of these examples of the relationship of surface area to volume in the substance of the brain, it would seem that there is an optimal ratio of surface area to volume. Within each neural center or region, there are a vast number of lower order surfaces. Thus the integration of lower order surfaces by higher order surfaces is a mathematic function which allows for the emergence of information in higher order surfaces, in accordance with the Holographic Principle. The predictability of changes in the volume and area of brain regions and neural centers seems to belie the principle of natural selection, which should lead to differential changes according to functional adaptation. The natural and universal evolution of experience and consciousness, as we have implied according to the Holographic Principle, seems to be a more parsimonious explanation of these phenomena.

Our challenge of the neuron doctrine does not relate to the fundamental function of neurons in the brain, but rather holds that, according to the Holographic Principle, neurons are not absolutely autonomous units, but that surface areas within the neuron are integrated at higher levels in an interdependent manner. The integration of information in the brain is not algorithmic, as in conventional computers. The so-called neural networks currently employed in certain specialized computers are inappropriate models of the

neural network, as they fail to account for the information capacity of surface within the neuron and on its surfaces, in particular the dendritic surfaces.

Information processing in computers, because of these limitations, does not reach the level of experience that we could attribute even to the single celled organism, and will not reach the level of experience associated with consciousness in the foreseeable future, even as we develop vast networks of computers such is the global internet. The development of such experience in computers is analogous to saying that a book is aware of the words and meanings contained within it. We say that this information is "in the book," and this sort of concrete interpretation of information as equivalent to the representations of information is also applied, in most widely-accepted models, to the brain. The book is necessary but not sufficient to elicit the information in its pages – a reader is required to do so, and the reader can remember the information long after the book is gone. In a similar way, the representations of information in the brain are necessary but not sufficient to elicit that information, and this information does not go into extinction with the extinction of its representations.

MICROGENESIS AND THE HOLOGRAPHIC PRINCIPLE

The most complete theory of mind that comports with the Holographic Principle of Mind, as developed here, is the microgenetic theory of neurologist Jason Brown. Brown (2005) presents an evolutionary theory of values, morals, and ethics, building on the microgenetic theory and process theory of his earlier works (1988, 1991, 1996, 1998, 2000). Brown's work has been a progression that began with the study of brain processes in neurological subjects with brain injuries or lesions. In his earlier work (Brown, 1988; 1991) he described the process of microgenesis as a process of elaboration of mental

contents in an evolutionary and developmental hierarchy of brain structures within the process of the genesis of the mental state, and related the hierarchy of the genesis of the mental state to disturbances of language comprehension or expression (aphasia), of knowledge (agnosia), and or purposeful movement (apraxia). The fundamental neurology of these disturbances had been described in Brown's previous work (1972, 1988), and in the seminal work of the Russian neurologist and neuropsychologist, Alexander Luria (1966).

Brown (1988, 1991, 1996, 1998) created a process theory of mind on the basis of his neurological observations, and went on from his neurological work to incorporate process theory in philosophy, as developed principally by Henri Bergson (1911/1998). and Alfred North Whitehead (1925/1953, 1929/1978). Bergson had pioneered the concept of an irreducible duration of experience. This concept was elaborated by Whitehead, in keeping with discontinuities of particles, as "actual entities" of a rudimentary sort, as they make "quantum leaps" along their trajectories, halting or persisting at a given location for a short period of time or duration before leaping to the next.

Whitehead employed these "quantum leaps" to the process by which experience arises in "actual entities" at the most fundamental level of actuality, through the epochal or halting duration of a discontinuous process (Whitehead, 1925/1953, 1929/1978). This halting allows actual entities to participate in a process of internal relations, relations on the "inside" of things. According the Holographic Principle, this "inside" is in the holographic surface of the relevant region of spacetime of the actual entity, and within other surfaces that are non-locally connected with that surface. The holographic surface

is thus the locus of non-local information and experience, in our interpretations of Whitehead's metaphysics.

Internal relations occur through feeling, or "prehension," which is nothing more than the subjective quality of non-local experience. The internal relations of the becoming entity occur in a seriality of prior becomings of the actual entity, with the entity inheriting all of its causal past as well as its relevant feelings or prehensions from prior "occasions" or quanta of experience. This process is, in the Holographic Model, the process by which former surfaces, now-pasts, are elaborated on to the now-present. Prehensions also occur with other actual entities throughout the Universe, with which they are non-locally connected, and with neo-Platonic "eternal objects," existing in an eternal heaven.

The "ingression" of eternal objects is fundamental to each duration of becoming of the entity, and, on this basis, Whitehead formulated the notion of an eternal heaven in constant intercourse all of its creation. There are clear parallels between Whitehead's cosmology and the cosmology introduced here according to the Holographic Principle, in that the "heaven" may be regarded as the holographic boundary, in constant intercourse with the relevant volume of spacetime.

This interconnection of feelings or prehensions, according to their relevance, produces intensities and contrasts which give rise to the creative advance, which, for Whitehead (1929/1978) is the process which impels the movement from the physical to the mental pole of process. With each halting, internally-timeless duration there is a concrescence or integration of these feelings, which, when complete, constitutes a new

actual entity or actual occasion (they are the same thing) at a new locus in spacetime. This movement to a new locus, or transition, is, fundamentally, the quantum leap.

The reason for becoming, according to Whitehead, is always the actual entity itself. He called this the ontological principle. The entity "enjoys" its relations and is "satisfied" by its own becomings. Whitehead's theory of process and relations can be viewed as an experiential alternative view of quantum physics which incorporates a theory of mind. However, Whitehead's master work, *Process and Reality* (1929/1978), is nearly impossible to fully understand, has its own idiosyncratic vocabulary, and is not entirely self-consistent. This relative opacity of Whitehead's work has impeded the generalization of his quantum process theory, or metaphysics, to other areas of discourse.

In his independent formulation of the microgenesis of the mental state, Jason Brown discovered a process theory of mind that had many similarities to Whiteheadean process. He took the concepts of duration and discontinuities of process and applied them to the duration of the mental state as it recapitulates the contents of prior mental states. Through the introduction of novelty, and through the process of microgenesis during the progression of mental states, the Self gives rise to a percept of Self, the ego, in the object world, at the termination of the microgenetic process. This termination is the conscious instant, or instantiation of the microgenetic process. It is all that we consciously see. We see the ego, not the Self, and thus mistake the ego for self, replacing Self with selfhood. The process itself is obscured from our consciousness, but can be inferred from those neurological deficit syndromes, which expose lower "layers" in the becoming. This parallels the "layers" of the nested hierarchy of holographic surfaces in the brain itself.

Brown's theory of microgenesis involves a progression in the genesis of the mental state in a developmental sequence that recapitulates the organism's evolutionary development (phylogeny), embryologic development (ontogeny), and history of personal and social experience and development, in a movement in an upward direction through structures of increasing phylogenetic and ontogenic recency (Brown, 1988, 1991, 1996, 1998, 2005). He developed a view that considered the evolution of mental states to be a continuum from depth to surface, with leaps or saltation between mental states at intervals that are temporally irreducible units of the duration of microgenetic process (Brown, 1996, 1998). The process of neoteny, through which earlier features of development and evolution are brought to the present, was described (Brown, 1996) as a change in the development of some aspect of the mental state, which is attenuated at some stage of elaboration. In neurological and psychiatric deficit syndromes, this attenuation corresponds with the locus of a lesion or functional deficiency. The signature of the attenuated stage is carried through the remaining process of microgenesis, leading to expression of the attenuated phase at the endpoint of the duration of microgenesis, coupled with full elaboration of other elements of microgenesis.

The intellectual pedigree of the theory of microgenesis dates back to the principle of superposition of Sir Charles Lyell, according to which younger strata lie on top of older strata. Lyell, a geologist, was to have great influence on evolutionary theorists, including Darwin and Wallace. The principle of superposition was taken up by Herbert Spencer, a scholar of many fields, who was a contemporary of Charles Darwin, and who had developed an evolutionary theory that perhaps rivaled Darwin's in popularity during the late 1800's and early 1900's. An important element of Spencer's theory was his

observation of the brain, which he fashioned to be layered, with the newer layers added on to older layer during the course of evolution. Looking at the deeper layers was, for Spencer, like peeling away the layers of an onion.

Spencer's idea was taken up by the renowned British neurologist Hughlings Jackson (Kennard and Swash eds., 1989), who developed the notion of hierarchies of brain process and the concept of neurological deficit syndromes as disturbances in the hierarchical structure and function of the brain. The concepts of microgeny and microgenesis, derived from hierarchies of brain function, were later developed by Arieti (1962) and Werner (1956). Later, the concept of a hierarchy of adaptive ego mechanisms, including lower order defenses such as denial and reaction formation, and higher order defenses such as altruism, was developed by Vaillant (1971), with the more mature defense mechanisms bearing on higher order values.

The process theory of the evolution of the brain is extraordinarily important to Brown's process theory of mind. We can place these theories in perspective with the process theory of Whitehead, into which the theory of Brown partially merged (Brown, 1996; 1998; 2005). The materialist perspective of evolution, was, according to Whitehead (1925/1953), inconsistent with the process by which organisms become: "…in truth, a thoroughgoing evolutionary philosophy is inconsistent with materialism. The aboriginal stuff, or material, from which a materialistic philosophy starts is incapable of evolution. This material is in itself the ultimate substance. Evolution, in the materialistic theory, is reduced to the role of being another word for the description of the changes of the external relations between portions of matter. There is nothing to evolve, because one

set of external relations is as good as any other set of external relations. There can merely be change, purposeless and unprogressive."

Whitehead's (1929/1978) realm of eternal objects, prehended in the unconcious, can be viewed as a basic element in the evolution of organisms and of mind. Whitehead (1929/1978), in his view of eternal objects, hearken's back to Plato: "…eternal objects, as in God's primordial nature, constitute the Platonic world of ideas." Whitehead's realm of eternal objects may include Carl Jung's (1934/1967) archetypes of the collective unconscious (Griffin, ed., 1989), connecting Whitehead's cosmology to the corpus of literature on depth psychology. Jung's archetypes were largely based on mythological, religious, and alchemical constructs. Mythology embodies the spiritual and social history of the species, as well as a variety of metaphysical metaphors (Campbell, 1969/1976; Neumann, 1954/1970).

The physical nature of the brain state, including the notion of binding of the mental state into a coherent whole, is also critical to Brown's theory of microgenesis. Recent evidence indicates that the brain is a chaotic or dynamical system (Freeman, 1987; Combs, 2004; Abraham, 2004). The self-organization of dynamical systems, which include all living organisms as well as the brain, has been described in detail by Ilya Prigogine (1980), who won the Nobel Prize in chemistry in 1977 for his work on dynamical systems. Prigogine defines an "internal time" or duration of the states of dynamical systems. Physical time, he states, is secondary, and internal time is primary (Prigogine, 1986). The dynamical interval of internal time, or duration, is governed by the baker transformation (Prigogine, 1980), which can be envisioned as the time it takes

the baker to knead or fold two different colors of dough successively, until it seems to be uniform in color.

The brain, as a dynamical system, thus "deposits" time in the sense of Brown (1996). Here we have a parallel with the "layering" of process time according to the Holographic Principle. We can also detect, remotely, the undertones of Lyell's principle of superposition, albeit in a different form, and in a sense that Lyell could never have imagined.

The work of Jason Brown in process neurology and psychology stands in sharp contrast to the prevailing scientific and philosophical nihilism in these fields regarding the self, free will, and the process of experience. In the sense of Brown's theory of microgenetic process of the brain, and in the sense of the duration of process discontinuities of Whitehead as it relates to the mind, it is important for the purposes of this paper to explore the scientific basis of the brain state. Mental process involves successive durations of such states, each with a "temporal thickness" (Brown, 1996). In recent years the "brain electrical microstate" has been described in detail as patterns of electrical field potential which endure for a period a period of time, typically around 100 milliseconds or a tenth of a second, and are punctuated by rapid transitions to the next state (Fingelhurts and Fingelhurts, 2001; Koenig and others, 2002). Brain electrical microstates are prime candidates for the brain states of microgenetic process and for the dynamical interval of internal time. The application of the theory of discontinuous information states, with the complete repetition of former states, as applied to the Holographic Principle of Mind, requires an information theory that includes time and the duration of mental states (e.g. Germine, 1993).

The process of microgenesis, as it applies to brain evolution, can be seen in purely classical way, related to the recapitulation theory of vertebrate brain evolution (Aboitiz, Montiel, and Lopez, 2002), which implies that "sensory projection sites and sites and processing circuits have been conserved [recapitulated] in reptiles and mammals" in the course of evolution. Again, there is an element of predictability in evolution which seems to belie the purposelessness of random natural selection. In keeping with the Holographic Principle, the development of the organism is a product of its evolutionary history, and is in continuous intercourse with that history.

Microgenesis is readily related to the Holographic Principle of Mind, whereby the past remains actual, and, in the course of each mental state or mental process, there is a literal recapitulation of the organisms entire past. The depth to surface principle entails a direction of mental process which is essential to microgenesis, and which is explained naturally by the nested hierarchy of surfaces in the brain according to the Holographic Principle. In the Holographic Principle of Mind we have a universal principle of microgenesis, whereby the entire relevant history of the organism is repeated during the course of each timeless and eternal moment. In this way, microgenesis can extend back to the very inception of the Universe.

MEMORY AND THE HOLOGRAPHIC PRINCIPLE

In science, there has been the tendency to enshrine empiricism as the only true epistemology or way of knowing. To know directly, beyond or in transcendence of the external senses, has been regarded in modern times as a myth. This has created a scientific theory of mind and brain which is vastly underdetermined. This has been recognized particularly in the area of language by the renowned linguist and scholar

Noam Chomsky (Stich ed., 1975). The brains of Stone Age humans and of the "primitive" peoples of the world were and are essentially the same as our own (Ramchandran and Blakely, 1998), and it seems unrealistic to propose that the human should, solely by his or her own agency, be able to derive and understand the complexities of such universals such as the structure of languages and the systems of mathematics. Alfred Wallace, who pioneered the theory of evolution (Beddall, 1972), argued that the capacities of the human mind were developed in advance of the needs of modern humans. It does not seem possible that mind and mental process are entirely the product of individual brain function, but must involve the higher order levels of experience, which are intrinsic to the Holographic Principle on Mind.

Plato's view, as expressed in the Socratic dialogue of the *Meno* (Plato, 1977), held that all knowledge is recollection or reminiscence. Whitehead (1929/1978) adopts and expands upon the Platonic doctrine of reminiscence: "Whenever there is consciousness there is some element of recollection. It recalls earlier phases from the dim recesses of the unconscious. Long ago this truth was asserted in Plato's doctrine of reminiscence. No doubt Plato was directly thinking of glimpses of eternal truths lingering in a soul derivate from a timeless heaven of pure form." Jason Brown (2005), in the context of his theory of microgenesis, expressed a similar view, "that objects are reminiscences sculpted to actuality by sensation as the end-stage development of an objective world out of subjective memory. In basic entities, the transition over the extensibility of the temporal 'point' conveys the initial phases of a cycle into the later ones."

In his treatment of the innate image, mythologist and scholar Joseph Campbell (1969/1976) remarks: "The recognizing and responding subject is…some sort of trans- or

super-individual, inhabiting and moving the living creature." Psychiatrist Trigant Burrow (1927) held that there is a species consciousness, and that separation from this consciousness is the source of neurosis. The doctrine of innate experiences has experienced a resurgence of research into "innate ideas" (Stich ed., 1975; Carruthers, Laurence, and Stich eds., 2005). Workers in the field have regarded the phenomenon of innate ideas as a product of genetic inheritance, replacing the dogma of empiricism with a kind of vacuous materialism.

It is undeniable that there are mechanisms of memory involving the structure of the brain. Yet, as William James (1898) states by analogy, light passing through a prism is not produced by the prism, but is rather transmitted by the prism. He goes on to write: "…when we think of the law that thought is a function of the brain, we are not required to think of a productive function only; *we are entitled also to consider permissive or transmissive function*. And this the ordinary psychophysiologist leaves out of his account."

Wilder Penfield and his colleagues documented the capacity of the mind to exhibit total recall of a variety of experiences in the course of electrical stimulation of the cortical surface of the brain (Penfield and Jasper, 1954; Penfield and Perot, 1963). Examples of the memories evoked are cited by Oliver Sachs (Penfield and Perot, 1963; Sachs, 1970):

> "At operation it is usually quite clear that the evoked experiential response is a random reproduction of the stream of consciousness during some interval of the patient's life…It may have been a time of listening to music, a time of looking in at the door of a dance hall, a time of imaging the action of robbers from a

> comic strip, a time of waking from a vivid dream, a time of laughing conversation with friends, a time of listening to a little son to make sure he was safe, a time of watching illuminated signs, a time of lying in the delivery room at birth…"

The memories evoked by electrical stimulation only occurred after stimulation of the right or left temporal lobes, and only in a minority of subjects (Penfield and Jasper, 1954; Penfield and Perot, 1963). The veridical (actual and true) quality of these memories is reminiscent of "flashbacks," which are the re-experiences of traumatic events, and which are accompanied by a relative dissolution of the ego (dissociation). These flashbacks or common in Posttraumatic Stress Disorder (PTSD), and are their occurrence is a diagnostic criteria of PTSD. The occurrence of veridical memories on electrical stimulation has been explained away as generic memories or fabrications, particularly in more recent studies (Squire, 1987). However, in some cases, as with the veridical memory of forgotten songs, the subject was able to access the memory in more clarity after the veridical memory was elicited (Penfield and Jasper, 1954; Penfield and Perot, 1963). The need to find classical explanations for these phenomena attests to the inability of neuroscience to explain such exhaustive memory capacity using the conventional neuroscience of memory. The Holographic Principle or Mind gives us a virtually limitless store of memory, far greater than any imaginable computer, limited only by our own abilities to gain access to these memories.

It is generally known that in the near-death experience, as well as in situations where there is a sudden danger of dying, people often sees their "whole life flash before their eyes." Near-death experience life reviews often involve and enormous amount of

information, and it has been argued that the phenomenon must therefore be holographic and non-local (Beck and Colli, 2003). This life review in near-death experiences has been summarized by Atwater (1994) as follows:

> "Seeing a panoramic review of the life just lived, from birth to death or in reverse order…sometimes becoming a 'reliving' rather than a dispassionate viewing. The person's life can be reviewed in its entirety or in segments…It is possible for such 'memories' to be open ended *and to include all existent knowledge*…" (italics added).

These examples of total recall which, in the case of the near-death experience, seems at times to be exhaustive, and perhaps include an "all existent knowledge," are inexplicable in terms of the classical, material brain. The detailed and life-like memories evoked by electrical stimulation of the outer surface of the brain are remarkable in that veridical memories can be evoked by electrical stimulation of the cerebral cortex (Penfield and Jasper, 1954), as if the memory were "stored" on a specific, small area on the brain, although different memories have also been evoked by stimulation of the same spot. Forgotten songs may be remembered, as if they were being replayed on a phonograph (Penfield and Jasper, 1954). The information capacity of the Bekenstein bound, on the holographic surface, is, as we have stated, enormous, such that a single microchip, carrying a gigabyte of data, at room temperature, has a thermodynaimic entropy equivalent of 10^{22} bytes of information (Bekenstein, 2003). Even if only the mind could only access a very small portion of this information, it must be remembered that, as stated in the introduction, what we experience as now-present is simply the uppermost

sheet on an exhaustive series of sheets of now-past. Somehow, perhaps, in brain stimulation and in the near-death experience, we are able to access former sheets in the serial order through which we derive the current moment, now-present, or in the reverse serial order from now-present though nows-past.

The idea of an instant realization to the universe of knowledge is, however, only explicable in terms of our connection with the universe of knowledge, with the all-knowing One Mind. Oliver Sachs (1970) describes the case of "the twins," who, although apparently-retarded "idiot savants" (now generally known as autistic savants). The twins could recall past memories to the smallest detail, could name the day of the week for calendar dates well into the past and future, and could easily repeat numbers of at least one hundred digits. (The "normal" person can perhaps repeat seven.) In one instant a box of matches fell on the floor, and the twins, simultaneously cried "111." When Sachs counted the matches, there were exactly 111. When asked how they counted the matches so rapidly, they said that they didn't count, but rather "saw" the 111.

Most remarkable, the twins would exchange six digit prime numbers, each smiling and retorting with another six digit prime number. Sachs wrote them down, and, curiously, searched in a book he had of tables and numbers, and found that they were all prime (integers that can only be divided by themselves and one). He returned to the twins with has book, and gave them an eight digit prime, after a time of about 30 seconds, they both smiled. Later, one of the twins, after a period of "at least 5 minutes" came up with a nine digit number, and after a similar time interval another twin came up with another nine digit prime. Sachs verified both primes in his book. After a longer time, the twins swapped 20 digit numbers. Although Sachs' book went only 10 digits, he assumed

that they were primes (Sachs, 1970). There is not a "normal" mathematician on earth that could come close to the mental calculation of primes of such high order. It would, in fact, take a quantum computer, calculating by division of prime numbers simultaneously, to come up with this order of primes with this rapidity, unless, of course, the were stored in memory.

Is it possible that the brain is, in fact, like a quantum computer? If it were like a quantum computer, it is clear that even a highly-educated mathematician does not know how to use it in the manner of these seemingly-retarded twins. Yet it seems inescapable that the level of computation or knowledge involved cannot be explained in terms of a theory of mind that is limited to the individual brain, nor can it be explained by efficient causality. A much deeper sense of the Knowing Universe, and of the final causality of Universal Mind is required. The same sort of final causality applies to the evolution of consciousness, reaching ever upward to the Universal. Universal Mind is eternal; it transcends our concepts of time.

It may be that, in the Conscious Universe, the savant has some preferred access to the Universal Mind. There are many other remarkable reports of the abilities of autistic savants (e.g. Ramachandran and Blakeslee, 1998). The autistic individual seems to live in his or her own world, and it is perhaps within that world, with the remarkable capacity that can only be realized through the Holographic Principle of Mind, the Universal level of holographic information is accessible.

It is, perhaps, the absence of ego consciousness, i.e. the consciousness of self versus other, which is characteristic of the autistic individual, which brings down the barrier, as it were, between the Universal Consciousness and our private consciousness.

It is, perhaps, the breakdown of the ego in near-death experiences that allows us to experience the entirety of our lives. It is, perhaps, the dissociation of the ego during traumatic events that allows them to be vividly re-experienced as flashbacks. It is, perhaps, by circumventing the ego that vivid and detailed memories of the past, long forgotten, can be elicited on electrical stimulation of the brain.

DISCUSSION AND CONCLUSION

Here we have just scratched the surface of the Holographic Principle of Mind. If the Holographic Principle is true, than it must be the fundamental principle of mind. *The brain has no way around the Holographic Principle.* For the reductionist, the Holographic Principle is the ultimate reduction. It applies to the most minuscule level of what we can observe, and beyond. For the universalist, the Holographic Principle gives us the ultimate universal. It extends to the limit of our Universe, the Universal holographic boundary, and beyond. For the phenomenalist, the Holographic Principle gives us the ultimate ground of our phenomenal perception, our grounding in the Universal "now," in the now-present of the Universal holographic boundary, moving outward from now-pasts to now-futures.

Wheeler (1988) has said that all of reality is information, and that other physical quantities are "mere incidentals." Information monism is gaining popularity in physics. By breaking the dichotomy of between information and experience, we find a deep connection between Wheeler's monism and the experiential monism of Whitehead, sometimes called panexperientialism, which relates to the later theological concept of his student, Charles Hartshorne, panentheism, God inside of everything (Hartshorne, 1964).

There thus seems to be a convergence of the concepts of information, experience, and spirituality.

There is not one universe, but many parallel universes, or, more accurately, a vast superposition of universes called the multiverse (Penrose, 2004). However, as explained in our treatment of the double-slit experiment, in the observation of events on the quantum level, the individual observer sees only one of these vast superpositions, not a summation of a vast number of potentials. This has been explained in terms of the many worlds or many minds theories, in which there are multiple copies of the same observing individual, but this particular issue remains unresolved, leaving physics ungrounded in reality (Penrose, 2004).

The concept of One Mind is not only more parsimonious than that of many minds, but also lets us out of the bizarre and counterintuitive idea that there are multiple copies of our own selves, which exist as mere *potential,* and are thus not *actual*. There are many possible universes, but there is only One Mind, which determines events on the quantum level, and thus creates our Universe. As we had discussed previously, the quantum level provides the essential ground of the Holographic Principle, such that quantum-level holographic surfaces are elaborated at higher levels, manifesting higher orders of information from the quantum "world." In this process, there is a reduction of the wave function or potentialities of quantum fields. At the level of consciousness, this entails freedom to choose which observations we make (Stapp, 1997), which gives us the capacity to think and to make decisions. These capacities are the basis of individuality, self-determination, judgment, and values.

The progressive evolution of the manifestation of Mind through higher orders of experience, leading to higher orders of consciousness, is entailed by the Holographic Principle. Again, we are dealing here with levels of description, with the multiverse of all potentials fundamentally supporting the single Universe we *collectively* observe. The multiverse is the wave function of the Universe (Penrose, 2004). The recursive integration of nested hierarchies of holographic surfaces brings out a single actuality in consciousness from a wave function that is unconscious. Consciousness thus gives us information at a level of experience that is causal. In this sense, we partake in the creation of the Universe. We participate in creation, and this participation, when fully realized, leads us to higher levels of consciousness and of realization. As a system, the biosphere that we live in has a holographic surface, creating a deep sense of ecology as we collectively move toward a planetary consciousness.

It is only when the Universal Holographic Boundary reaches the information storage and processing capacity needed for the requisite biological and biochemical complexity that consciousness evolves in living things. This evolution is natural and spontaneous, since consciousness gives rise to what is actual, as opposed to what is merely potential. In this sense, consciousness is still in the process of creating our Universe, and levels of higher consciousness will continue to evolve.

We are all in the same "now," and that now is defined by the present Universal Boundary. This assures us that our experience is Universal, and does not pass with time. This is the fundamental basis of memory and of cognition. The identity of mind and brain is a myth. We have a continual, internal or non-local relation with the Universe, as

it has with us. Once this mystery is resolved, the myth is no longer needed, and there is a confluence of science and spirituality.

Experience is primary, information is secondary. We can only gather information from experience, whether it is in the laboratory or in life. We cannot measure the information on the surfaces of systems. The physicists that have formulated the Holographic Principle for all systems are quite aware of this, or else the principle would have been established or discredited. We cannot measure what we experience. It is intangible, yet it is all we know to be *actual*. Everything else is inferred. Because it cannot be measured, it has been fundamentally disregarded by mainstream science. Materialism is considered scientific, while idealism is considered unscientific. But aren't ideas, fundamentally, made of information?

Brain science has mistaken the representation of information for information itself, and has tied those representations to matter and energy. Consciousness, the highest order of information, has generally been regarded as superfluous, something that needs to explained away, or altogether ignored. Yet it is the only "thing" that reaches our awareness. Consciousness comes at a price. For everything that becomes conscious, there must be something that becomes conscious. Consciousness is certainty, and its complement, unconsciousness uncertainty. Consciousness is the particle nature of experience. It has a definiteness about it. The unconscious is the wave nature of experience, it is like the metaphysical cloud of unknowing. If we are the most conscious of animals, then we must also be the most unconscious. Perhaps this is the predicament of humankind.

The Holographic Principle of Mind leads us naturally from the most fundamental experiences, existing as quantum potentials from the conformations of proteins down through the fields of electrons, through their manifestation upward through a recursion or successive applications of the same holographic process, through higher levels of experience, to the emergence of consciousness as higher and higher orders of experience. The quantum Holographic Principle Mind does not require anything more quantum than is obviously present at the microscopic and submicroscopic levels, as it represents successive orders of manifestations from these levels.

Recursion also applies here in the sense that it is used in computer science, in which the function of the part depends on the function of the whole. A program, as a part, cannot work without a functioning whole, the operating system. Recursive wholes which are, for us, supra-conscious, are on the group, species, planetary, and universal levels. As individuals, our consciousness cannot function without recursion to the Universal Consciousness, even though we may be unaware that such Universal Consciousness exists. Reaching upward to these supra-conscious levels is a spiritual process, making transcendence the ultimate solution to the unconscious human predicament.

What was once supra-conscious becomes unconscious through a process of conditioning. We are born as creatures of the Earth and of the Universe, as evidenced by the beliefs and practices of "primitive peoples." There is evidence from cave paintings that our hominid ancestors experienced a kind of holographic perception (Combs, 1996), which could constitute our early connection with the holographic subtext of reality, and which we might then propose existed in our animal ancestors, and in extant animal

species. If this is the case, than microgenesis would entail the recapitulation of this holographic experience as it progresses through our ancestral past.

The supra-conscious mind seems to envelope perinatal experiences, and Stanislav Grof (1994) has developed techniques to gain access to these experiences, as well as to the earlier experiences of our human and animal ancestral lineage, and of our universal history. Grof (1994) concludes: "Our consciousness seems to have the amazing capacity to directly access the earliest history of the universe – witnessing dramatic sequences of the Big Bang, the formation of the galaxies, the birth of the solar system, and the early geophysical processes on this planet billions of years ago."

The succession of nows that constitute our current experience, seem, indeed, to go all the way back in cosmological time. According to the Holographic Principle of Mind, this must be the case. Perhaps we also bare witness, in some ways, to the infinite wholeness of the initial singularity that existed prior to the inception of the Universe, and each becoming of the mental state, according to the recapitulation theory, extends back to that infinite wholeness.

Connectionist neuroscience, in an effort to attain relevance to clinical practice, has recently given us a theory of the relationship of the unconscious to consciousness which is dualistic (Viamontes and Beitman, 2007), an *ad hoc* theory of conclusions based on assumptions, the most erroneous of which are that representations of information are information, and that such representations elaborate themselves through a process of representations of representations in neuronal circuits (Bechtel and Abrahamsen,1991).

As theory, the connectionist models are lacking heuristic value and are inimical to the progress of basic and clinical neuroscience. This is not to denigrate or minimize the

importance of neuronal connections, but these connections are rather like the wires in a radio that plays a symphony. The radio, in and of itself, is incapable of playing the symphony. The radio doesn't write the symphony, nor does it broadcast the symphony over the airways. Yet, if we loosen one wire, the symphony is not manifested through the radio. The brain is not subject to the same vulnerability, in that it has parallel and redundant networks of processing, and, it is in this sense that the connectivity of the brain becomes important.

Connectionism, to the extent that it accepts consciousness and the unconscious at all, attributes them to separate groups of "circuits" in the brain, with consciousness-processing circuits having a limited but detailed ability to analyze information, and unconscious-processing processing more information in less detail (Viamontes and Beitman, 2007). There is an element of truth in this view in that information that has importance and meaning resonates within the brain at higher levels of experience and at higher levels of holographic recursion. This resonance involves what we know, what we feel, and what we are capable and willing to consciously realize.

The Universe, as William Blake noted, can be seen in a grain of sand. Indeed, the grain of sand requires the Universe to exist. The human organism requires the Self to exist. The Self is not a simple amalgam of sensory experiences, as suggested in the connectionist model (Blinder, 2007). This amalgam view of the Self can be damaging when applied to psychotherapy, as the connectionists suggest (Blinder, 2007). The Self is ours forever and ever, from eternity to eternity.

As Milton suggested, the mind is its own place. Our deepest purpose is for our minds to resonate with the supra-conscious levels of experience, much as it is purpose of

the radio to play the symphony. If the symphony is not to our liking, we can turn the radio off. So, perhaps, the transpersonal consciousness can turn our own individual and collective radios off, or perhaps turn the volume down, if we are not in harmony with the Universal Mind.

Physics has given us many enigmas. Quantum theory itself is an enigma. But some of the enigmas seem to involve the limitation of our own abilities of discernment. The thought experiment of "Schrödinger's Cat," as it is often interpreted (e.g. Gribbin, 1984), assumes that the cat is not conscious, and is incapable of observation in the context of collapse of the wave function. This is due, in large part, to the false dichotomy of information and experience. Our observation of other animals indicates, to those that are attuned to the animal mind, who can "feel" the animal mind, that, at the very least, all mammals are conscious. It would seem that the great neuropsychiatrist, Stanley Cobb (1948), may have been correct in his attribution of levels of consciousness to a wide variety of organisms: "…lower animals with no cerebrum appear to be conscious…even plants such as the sunflower that turns towards strong light may have a vague awareness or warmth and comfort. There are many degrees of consciousness and it is my contention that it is integrated at many levels like other important functions of the central nervous system."

With respect to the theory of mind, recent mainstream thinking remains classical and mechanistic. Such views of mind are advocated by our most in prominent neuroscientists (e.g. Changeux, 1985; Gazzaniga, 1985) as neuroscience research attempts to explain all mental function on the basis of pure mechanism and the localized function of specific areas of the brain. Francis Crick, the distinguished Nobel Laureate,

had a very influential second career as a neuroscientist. He concluded that we are basically soulless creatures, that all mental processes could be reduced to identifiable, neural correlates in the brain, and that, in fact, we are nothing but a collection of neurons (Crick, 1995). Crick even went so far as to say that what we call the soul is a group of neurons located in the prefrontal lobes of the brain. Another Nobel Laureate, Gerald Edelman (1987), has written a critically acclaimed book on "neural Darwinism," which purports that the brain's "circuitry" is constructed through a developmental process of "survival of the fittest" neurons and neuronal connections. At the same time the total purposelessness and lack of direction in evolution is expounded, again to critical acclaim, by Richard Dawkins (1986).

The idea that there essentially no self or soul imbued with agency and self determination was expounded by Gilbert Ryle (1949/2002) with his parody of the "ghost in the machine," and this work continues to be influential among many scholars of the mind. Philosophers such as Patricia Churchland (1986), who coined the term "neurophilosophy," take an "eliminative materialist" view of belief, free will, and consciousness. Other philosophers, such as Daniel Dennett (1991) would make experience "epiphenomenal," a by-product of brain processes with no effect whatsoever on the function of mind. However, unlike neuroscience, which is still in its infancy, the philosophy of mind has had a long history, including such notable figures as Plato, Aristotle, Descartes, Kant, Locke, Hume, Kierkegard, and James, to name just a few.

Perhaps, as noted by Ervin Laszlo (1974): "in today's world, most of the traditional functions of cognitive synthesis have atrophied and are ignored and neglected." Hopefully, what we have presented here will be a step in the right direction

for what Laszlo calls a "conceptual synthesis" to help fill the need for meaningful engagement is such a world. The fundamental elements of such a synthesis have been described by Laszlo as follows:

> Conceptual synthesis performs at least five basic functions in the guidance of human affairs. They are the mystical, the cosmological, the sociological, the pedagogical or psychological, and the editorial functions. The mystical function inspires in man a sense of mystery and profound meaning related to the universe and of himself in it. The cosmological function forms images of the universe in accord with local knowledge and experience, enabling men to describe and identify the structure of the universe and the forces of nature. The sociological function validates, supports and enforces social order, representing it in accord with the nature of the universe, or as the natural or right form of social organization. The pedagogical or psychological function guides individuals through stages of life, teaching ways of understanding themselves and others and presenting desirable responses to life's challenges and trials. Finally, the editorial function of conceptual is to define some aspects of reality as important and credible and hence to be attended to, and other aspects unworthy of serious attention.

The interpretation of the Holographic Principle presented here, by connecting information to experience, and by applying the same causal laws to the Universe and to the organism, gives us a new view of evolution and of the theory of mind. It places experience at center stage of brain processes, and, by applying the hierarchical quality of

the holographic boundaries to the brain, gives us a view of consciousness that is not only emergent but also causal, in the deepest sense. By extending these processes, in keeping with the hierarchy of holographic boundaries, to the collective consciousness, to the planetary consciousness, and to the Universal Consciousness, it brings us once again to the perennial wisdom of the major world religions, and aligns us with the stream of thought that has arisen in the history of philosophy. It restores dignity and importance to the individual as a conscious, experiencing, and volitional entity, while opening up the vast vistas that the theory embraces as it penetrates from the most fundamental phenomena of the brain to the entirety of the Universe.

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