MXPLANK RESEARCH REPORT

QUANTUM INFORMATION SELF-ORGANIZATION AND CONSCIOUSNESS: A HOLOINFORMATIONAL MODEL OF CONSCIOUSNESS

MXPLANK.COM

QUANTUM INFORMATION SELF-ORGANIZATION AND CONSCIOUSNESS: A HOLOINFORMATIONAL MODEL OF CONSCIOUSNESS

Abstract. The author proposes a holoinformational view of consciousness based on the holonomic theory of brain function and quantum brain dynamics developed by Karl Pribram, Sir John Eccles, Hameroff, Jibu and Yasue, and on the quantum-holographic and holomovement theory of David Bohm. This conceptual framework is integrated into the non-local information property of the Quantum Field Theory of Umesawa, to the concept of negentropy, order, and organization developed by Shannon, Wiener, Szilard and Brillouin, and to the theories of self-organization and complexity of Prigogine, Atlan, Jantsch and Kauffman. Wheeler's "it from bit" concept of a *participatory* universe, and the developments of the physics of information made by Zurek and others with the concepts of statistical entropy and algorithmic entropy, related to the number of bits being processed in the mind of the observer, are also considered. This new synthesis gives a self-organizing quantum non-local informational basis for a new model of consciousness in a participatory universe. In this synthesis, consciousness is conceived as a meaningful quantum non-local information interconnecting the brain and the cosmos, by a holoinformational field (a field at the same time non-local holistic (quantum) and local (Newtonian). We propose that we are this very non-local quantum-holographic cosmos that manifests itself through our consciousness, interconnecting in a participatory holistic and indivisible way the human brain to all levels of the self-organizing holographic multiverse.

Keywords: *quantum-informational model of consciousness, quantum information, non-locality, self-organization, medicine, transpersonal psychology*

1. Introduction

"The Tao obscures when we only see small fragments of the existence"
Chuang-Tzu

Models that try to explain the nature of consciousness, generally share the Cartesian-Newtonian paradigm by insisting on an approach exclusively reductionist. This reductionism has been impairing the grasp of the true essence of what consciousness is since the seventeenth century. Hameroff [1] believes that such dispute *"may potentially be resolved by views which contend that consciousness has a distinct quality, but one which emerges from brain processes which can be accounted for by natural science".* As a solution he proposes a consciousness model based upon the emergence of quantum coherence in neural microtubules, which he developed with Penrose [2]. These models use a traditional interpretation of quantum mechanics, and as Clarke [3] shows, *"start from a basically quantum-mechanical position but then impose modifications of the quantum formalism so as to ensure that the net result is basically Newtonian ... Strong emphasis is placed on the wave function as the fundamental object of quantum theory and a "collapse" is invoked to pass to a Newtonian picture. As a result, they are very firmly bound to a spatial picture."* By transforming the quantum logic into a Newtonian logic, they leave aside the non-locality function that is quantum logic's essence, and the universe's fundamental property - and, as we shall see, also consciousness fundamental property that links us to the Universe. Wilber [4] considers that an integral theory of consciousness should embody all the essential characteristics of the main schools that study consciousness, *"not as an eclecticism but rather a tightly integrated approach that follows intrinsically from the holonic nature of the Cosmos"*. Such holonic nature of the Cosmos is based upon the self-organizing holoarchy described by Jantsch [5] that correlates the co-evolutionary interactions amongst the microevolution of the holons described by Koestler [6], to the macroevolution of its collective/social forms. Wilber's theory, however, leaves open what we consider the key point in the understanding of consciousness, that is, the way by which information, order, negentropy, are transmitted amongst the infinite levels of organization of the cosmic-brain holoarchy, giving meaning to them. This common ground capable of integrating consciousness and Cosmos in an ordered and indivisible whole, can only be fulfilled by a holoinformational (Newtonian local information + quantum non-local information), model of consciousness that connects the universe's non-local quantum-holographic informational structure

with the brain's non-local informational quantum-holographic fields and also with the classic local neural networks of the brain [7-10].

Wheeler [11] realized how important information is in such context. With his genius, Wheeler describes an elegant information-participatory Universe that is the most brilliant and fundamental model of interaction brain-mind and Cosmos ever described in the science of consciousness. With his famous "the it from bit" concept he unite quantum information theory to consciousness and physics: *"...every it - every particle, every field of force, even the space-time continuum itself - derives its function, its very existence, entirely - even if in some contexts, indirectly - from the apparatus-elicited answers to yes-or-no questions, binary choices, bits". "It from bit symbolizes the idea that every item of the physical world has at bottom – at a very deep bottom, in most instances – an immaterial source and explanation; that which we call reality arises in the last analysis from the posing of yes-no question and the registering of equipment-evoked responses; in short, that all things physical are information-theoretic in origin and this is a participatory universe".*

2. Order Information Self-Organization and Negentropy

A more wide conception of order, organization, information and negentropy that goes beyond the classical works of Wiener [12], Shannon [13], Szilard and Brillouin [14] is essential for the development of our holoinformational model capable of integrating consciousness to nature. Leon Brillouin, in his famous theorem, showed the equivalence between information and negentropy. Norbert Wiener put this identity on the very conceptual basis of cybernetics stating that *"information represents negative entropy"*, and prophetically for the first time in the history of science emphasizing that *"information is information, not matter or energy".* Chalmers [15] states that information is an essential property of reality, as matter and energy, and that *"conscious experience must be considered a fundamental feature, irreducible to anything more basic*". Bateson [16] defines information as *"the difference that makes a difference"*, a conception that Chalmers [17] retakes stating that this is *"the natural way to make the connection between physical systems and informational states".* The equivalence/identity between order, negentropy and information, is the way that allows us to build upon and understand the whole irreducible and natural flow of order transmission in the universe, organized in a meaningful and intelligent informational mode. In the classical thermodynamic theory, the definition of order is probabilistic and dependent on the entropy concept, which measures the degree of disorder of a system, reducing to uncertainty the immense dimension of natural meanings. For Atlan [18,19], and Di Biase [20-22], *"entropy shouldn't be understood as a disorder measure, but much more as a measure of complexity"*. In order to do this, it is necessary to consider that the notion of information implies a certain ambiguity, meaning the bit capacity of a physical system as Shannon put it, or the semantic content (meaning) conducted by the bits during a communication. In the information theory, the organization, the order expressed by the amount of information in the system (Shannon's H function) is the information measure that is missing to us, the uncertainty about the system. Relating this uncertainty, this ambiguity to the variety and the non-homogeneity of the system, Atlan could solve certain logical paradoxes of self-organization and complexity, widening Shannon's theory and defining organization in a quantitatively formal mode. Atlan showed that the system's order corresponds to a commitment between the maximum informational content (i.e. the maximum variety) and the maximum redundancy, and showed also that the ambiguity can be described as a noise function, or even a time one, if we consider the time effects as related to the random factors accumulated by the environment's action. Such ambiguity, peculiar to self-organizing systems, can be manifested in a negative way (*"destructive ambiguity"*) with the classical meaning of disorganizing effect, or in a positive way (*"autonomy producer ambiguity"*) that acts by increasing the relative autonomy of a part of the system in relation to the others, that is reducing the system's natural redundancy and increasing its informational content. Atlan developed this self-organizing theory of complexity for biological systems. Jantsch [5] studying the evolution of the universe, showed that cosmological evolution is also a self-organizing process, with the microevolution of the individual systems (holons) co-evolving towards macrosystemic collective structures better organized, with a big reduction in the amount of these collective systems. This whole self-organizing process represents, actually, universal expression of a bigger acquisition of variety or informational content that, as Atlan demonstrated, is a consequence of a reduction of redundancy in the totality of the system.

3. Information and Dissipative Structures

Ilya Prigogine [23,24] Nobel Prize winner, developed an extension of thermodynamics that shows how the second law can also allow the emergence of novel structures, and indicates the ways in which order can emerge from chaos. This type of self-organization generates dissipative structures that are created and maintained through the energy's exchanges with the environment in non-equilibrium conditions. These dissipative structures are dependent upon a new order, called by Prigogine "*order from fluctuations"*, which corresponds to a *"giant fluctuation"* stabilized by the exchanges with the environment. In these self-organizing processes the structure is maintained through an energy-information dissipation that displaces itself, simultaneously generating (*in-formating*) the structure through a continuous process. The more complex the dissipative structure, the more information is needed to keep its interconnections, making it consequently more vulnerable to the internal fluctuations, which means a higher instability potential and higher reorganization possibilities. If fluctuations are small, the system accomodates them and does not change its organizational structure. If the fluctuations reach a critical size, however, they cause disequilibrium in the system, generating new intra-systemic interactions and reorganization. *"The old patterns interact between themselves in new ways, and establish new connections. The parts reorganize themselves in a new whole. The system reaches a higher order"* [24].

4. Consciousness Self-Organization and Information

Seager [25] states that consciousness, self-organization and information are connected at the level of semantic significance, not at the level of "bit capacity", and that *"as the classical theory of information is situated at the level of "bit capacity" it would seen unable to provide the proper connection to consciousness"*...and *"we can begin to move towards a more radical view of the fundamental nature of consciousness with a move towards a more radical view of information"*. Seager still reminds us that in the famous two-slit experiment, and in the quantum eraser experiment, what is at stake is not the bit capacity, but the semantically significant correlation of *information laden* distinct physical systems, in a non-causal mode.

Chalmers [15] argues that each informational state has two different aspects, one as conscious experience, and the other as a physical process in the brain, that is, one internal/intentional and the other external/physical. This view finds support in the present developments of the so-called "information physics", developed by the physician Wojciech Zurek [26] and others, that propose that the physical entropy would be a combination of two magnitudes that compensate each other: the observer's ignorance, measured by Shannon's statistical entropy, and the disorder degree of the observed system, measured by the algorithmic entropy which is the smallest number of bits needed to register it in the memory. During the measurement, the observer's ignorance is reduced, as a result of the increase in bit numbers in its memory, remaining, however, constant the sum of these two magnitudes, that is, the physical entropy.

In this informational view of the universe, the observer remains included as part of the system, and the quantum universe changes because the observer's mind unleashed a transfer of information at a subatomic level. From this all results a *Law of Conservation of Information*, as well as or more fundamental than the law of conservation of energy.

Also Stonier [27,28] identifies information with the structure and organization of the universe, arguing that information is the *cosmic organizational principle* with a "status" equal to matter and energy.

In this holoinformational view I propose that what self-organizes significantly the cosmic evolution is the relationship between the physical entropy and the universe's quantum-holographic informational content, through a process in which the complexity using the pre-existing informational content reaches each time higher organizational levels and variety. In this way, complexity in the universe grows gradually, from gravity and nuclear powers, intensifies with the emergence of the self-organizing macromolecular systems of the biosphere, and reaches an almost infinite antientropic state of complexity, variety and informational content with the emergence of the noosphere with its quantum-holographic neural networks consciousness. As we shall see soon ahead, there is a quantum holographic physical theory of the universe that has implicit in its conceptual framework, besides the mechanistic local interactions, a non-local quantum informational unfolding, that self-organizes matter, life and consciousness in a meaningful way.

5. Transpersonal Consciousness

Consciousness' as non-local information and something essential, primary and irreducible as we are proposing, is also found in the consciousness maps obtained from thousands of very consistent and converging psychotherapeutics experiences reports, observed by several researchers of the medical and psychological areas like Di Biase [22,29-31], Jung [32], Grof [33], Moody Jr. [34], Ring [35], Sabom [36], Kubler-Ross [37], Weiss [38]. These researches with persons submitted to altered states of consciousness, through various methods, like hypnosis, relaxation, meditation, holotropic breathing, near-to-death experiences, etc. Surprisingly, such maps reveal *"an ontology and a cosmology in which consciousness cannot originate from, or be explained in terms of any other thing. It is a primordial factor of existence and from it emerges everything that exist"* as states Grof, in Capra [39]. Presently, there are available a series of psychotechnologies that are usually ignored and/or marginalized by the academic community, which allow us to use the human mind as a reliable system of investigation and elucidation of the nature of consciousness, that are possible of replication an corroboration. I also emphasize here the numerous philosophical psycho-spiritual systems that during the history of humanity have been exploring through meditation and others psychotechnologies the nature of consciousness, having described a vast and systematized *cannon* of experiential knowledge and wisdom about consciousness (see for instance the interface between Buddhism and Neuroscience that is being studied by western neuroscientists with the Dalai Lama and buddhist *scholars* at the Mind and Life Institute).

6. Nature, Information and Consciousness

We understand like Weil [40] that *"intelligence's nature is nature's intelligence"* and like Atkins [41] that *"consciousness is emergent information itself at the moment of its generation, ongoing, self-organizing change in a self/world model"*. It follows that only a holoinformational and self-organizing theory, capable of integrating intelligence and consciousness to the non-local quantum-informational tessitura of the universe, can solve the question of consciousness nature. Fortunately, there is a quantum theory of the universe that integrates consciousness as an irreducible dimension of nature in its conceitual framework. Nevertheless, this theory has been inexplicably considered in a insufficient way by the scientific world, going unnoticed its revolutionary implications about the consciousness-universe interaction. It is the quantum-holographic theory of the holomovement developed by the physicist David Bohm [42] that mathematically demonstrates the existence of a hidden, spectral, implicit order in the universe, that is a primary reality. Matter, life and consciousness (the explicate order), would originate from this common ground (the implicate order) by means of a continuous movement of unfolding and enfolding of the cosmos called holomovement. Bohm [43] states that *"in the implicate order everything is folded into everything. But it's important to note here that the whole universe, is in principle enfolded into each part actively through the holomovement, as well as the parts. Now this means that the dynamic activity - internal and external - which is fundamental for what each part is, based on its enfoldement of all the rest, including the whole universe. But of course, each part may unfold others in different degrees and ways. That is, they are not all enfolded equally in each part. But the basic principle of enfoldment in the whole, is not thereby denied. Therefore enfoldment is not merely superficial or passive but, I emphasize again, that each part is in a fundamental sense internally related in its basic activities to the whole and to all the other parts. The mechanistic idea of external relation as fundamental, is therefore denied. Of course such relationships are still considered to be real, but of secondary significance. That is, we can get approximations to a mechanistic behavior out of this. That is to say, the order of the world, as a structure of things that is basically external to each other, comes as secondary and emerges from the deeper implicate order"*. So, we can say that we live in a quantum-holographic universe in which reality is essentially non-local, and the classical Newtonian world with its external local interactions, emerges as a special case from this deeper quantum order. According to Bohm [44], the analogy with the hologram in which each part of the system is an image of the total object, even if it is a static image that does not transmit the ever dynamic nature of the infinite unfolding and enfolding which at each moment create our universe, is a functional metaphor, because *"the mathematical laws of the quantum theory that apply to these waves, and therefore to all matter, can be seen to describe just such a movement in which there is a continual enfoldment of the whole into each region, along with the unfoldment of each region into the whole again. Although this may take many particular forms - some known, and others not yet known - this movement is universal as far*

as we know". This universal movement of enfoldment and unfoldment is Bohm's "holomovement". Bohm states - *and this is of supreme importance* - that these laws are also capable of being compatible with the theory of relativity, and therefore the implicate order is able to have support from the two most fundamental theories of modern physics, the theory of relativity and the quantum theory. In a posterior development, Bohm [44] postulated the existence of a superimplicit order, a still more subtle dimension of the universe's organization. In this model, a quantum superinformation field of the totality of the universe would organize the implicate first level in multiple wave-like structures which would unfold in the explicate order. According to Bohm [see Weber, 45] *"there is a physical model developed by De Broglie that proposes a new type of field, which activity is dependent upon the information content that is conducted to the whole experimental field, which, if extended to the quantum mechanics, results in the superimplicit order"*. This De Broglie-Bohm *information field* is the non-local informational field that can interact with the brain's non-local quantum-holographic fields.

7. Consciousness and Non-Locality

Adding to its equations a Quantum Potential that satisfies Schrödinger's equation, that depends on the form but not on the amplitude of the wave function, Bohm [44] developed a model in which the quantum potential, carries *"active information"* that *"guides"* the particle along its way. The quantum potential has inedited characteristics unknown up to then, because differently from the other nature's forces, it is subtle in its form, and does not decay with the distance. Such interpretation allows communication between this "pilot wave" and the particle, to be processed in a higher speed than the light, unveiling the quantum paradox of non-locality[73], i.e., of the instantaneous causality, fundamental in the holoinformational view of consciousness. In 1982, Alain Aspect and col. experimentally proved the existence of non-local actions, and more recently, in July 1997 Nicolas Gisin and col. (cf. Science, vol. 277, pg. 481 [46]) proved the existence of this non-local quantum informational instantaneous action in large scale.

For Bohm, differently from Bohr, the elementary particles do not have dual nature wave/particle but are particles all the time, and not only when observed. Actually, the particle originates from a global quantum field fluctuation, being its behavior determined by the quantum potential *"that carries information about the environment of the quantum particle and thus informs and affects its motion. Since the information in the potential is very detailed, the resulting trajectory is so extremely complex that it appears chaotic or indeterminist"* [47]. Any attempt of measuring particles properties, changes the quantum potential, destroing its information. Actually, according to Bohm, Bohr had interpreted the uncertainty principle as meaning "not that there is uncertainty, but that there is an inherent ambiguity" in a quantum system [see Horgan, 48]. As John Bell [49] observed, *" the De Broglie-Bohm's idea seems... so natural and simple, to resolve the wave-particle, dilemma in such a clear and ordinary way, that it is a great mystery... that it was so generally ignored"*.

In the quantum-holographic theory, as Bohm [45] put it, *no field organized the implicate order, and it was consequently linear and difficult to unfold. The implicate order is a wave function, and needs a superimplicate order or superior informational field, that is a function of the wave function, i.e. a superwave function that makes the implicate order non-linear organizing it in complex and relatively stable structures. Besides that, the holographic model as a way of organization of the implicate order was dependent upon the quantum informational potential field, that did not have capacity for self-organization and transmission of the information, essential for the understanding of the genesis and development of matter, life and consciousness. The superimplicate order fills this need, allowing the understanding of consciousness, energy and matter as expression varieties of a same informational order. As a result consciousness would already have been present since the beginning of creation in the various levels of nature's unfolding and enfolding*.

8. Towards a Holoinformational Model of Consciousness

The quantum potential guides by means of active information the particle alongside its course. As any elementary particle is united to the whole cosmos by means of a non-local quantum potential capable of change the structure of the universe, information then starts to be understood as nature's fundamental process. This active non-local information that organizes the particle's world reveal that the whole nature is informational, organized in a meaningful way. In the brain, this means that informational process is at the

same time non-local quantum holistic and local classical Newtonian and mechanistic i.e. holoinformational. This is crucial to understand the holoinformational nature of consciousness and intelligence in the universe. Matter, life and consciousness are meaningful activities, intelligent quantum-informational processes, order transmitted through the cosmic evolution, originated from a generating informational field beyond our perception limits. A universe full of quantum potential and meaning activity, is an intelligent universe *functioning like a mind*, as Sir James Jeans already had observed. So, as consciousness has always been present in all nature's levels of organization, matter, life and consciousness cannot be considered as separated entities, capable of being analyzed under a fragmentary Cartesian-Newtonian framework. Actually, it must be considered as an indivisible unity, with quantum informational processes interacting by means of non-local holistic relationships, and simultaneously by local Newtonian mechanistic relationships, generating self-organization, complexity intelligence and evolution. Such view of a holoinformational intelligent "continuum", a fundamental generating order with a quantum-holographic informational creative flow permeating the whole cosmos, permits to understand the basic nature of the universe as an intelligent self-organizing unbroken wholeness, i.e. a *cosmic consciousness*. A kind of universal consciousness unfolding in an infinite holoarchy. As a quantum-holographic system this universal consciousness is distributed in every part of the cosmosphere, and each part of this holosphere contains the information of the whole cosmos in a holistic indivisible way. Quantum-informational fluctuations generated from this universal consciousness through a non-local holoflux self-organizes the universe's basic informational levels:

- The *Cosmosphere* with the *Atomic-Nuclear Code* that organizes energy and matter. It is the physical level and information is stored in atomic structures.
- The *Biosphere* with the *Genetic Code* that organizes life. It is the biological level and information is stored in the DNA molecules.
- The *Noosphere* with the *Neural Code* that organizes the brain and mind. It is the psycho-social level and information is stored in neural networks
- The *Technosphere* with *Artificial Intelligence Codes*. It is the technology level and information is stored in hardware and software designs
- The *Consciousphere* with the *Quantum-Holographic Code*. It is the consciousness level that organizes the interconnectivity between the mind and the universe. Spiritual level. Information is stored in quantum-holographic networks of the brain and the cosmos. This religation (latin *religare* and english *religion*) between us and the universe connects us with our primordial source, and has been described in a symbolic way in all humanity religious metaphors like "*the father is within us"; "as above so below";"as in earth so in heavens",* or the beautiful buddist metaphor of the Indra network . Such informational codes, this order that is transmitted in a meaningful and intelligent way through all levels of complexity of the universe, is the negentropic self-organization nature of the information-consciousness, an irreducible physical dimension of the cosmos as energy and matter.

9. Quantum Brain Dynamics

Experimental research developed by Pribram and other consciousness researchers like Hameroff [1] and Penrose [2], Jibu and Yassue [50], and Ho [51] confirm the existence of a Quantum Brain Dynamics in neural microtubules, in synapses and in the molecular organization of the cerebrospinal fluid. This Quantum Brain Dynamics can generate Bose-Einstein condensates and the Fröhlich effect. Bose-Einstein condensates consist of atomic particles, or in the case of the Fröhlich effect of biological molecules, that can assume a high level of coherent alignment, functioning as a highly ordered and unified informational state, as seen in lasers and superconductivity. Eccles's psychons operate on synapses by way of quantum coherence processes. These quantum dynamics show us that the interaction process between dendrons and psychons are not limited to the synaptic cleft, as stated by Eccles, but have a much wider embodiment throughout the whole brain, and as some researchers (see Popp), are saying, also throughout the whole body. Ho [51] has been demonstrating that " *Highly polarized multiple layers of liquid crystalline water molecules form dynamically coherent units with the macromolecules, enabling them to function as quantum molecular energy machines that transform and transfer energy with close to 100 percent efficiency. This liquid crystalline continuum of intimately associated polarized water and macromolecules extends throughout the extracellular matrix into the interior of every single cell, enabling each cell, ultimately each molecule, to intercommunicate with every other".* Pribram

[52,53] demonstrates good evidence that Eccle's dendrons make up receptive fields in cortical sensory units. Dendrons are composed of pre-synaptic teledendrons, synapses and post-synaptic dendrites, and they compose the fine fiber structure wherein brain processing occurs. As Pribram states [54], "*as sensory generated receptive fields they can be mapped in terms of wavelets, or wavelet-like patterns such as Gabor Elementary Functions. Dennis Gabor (1946) called these units Quanta of Information. The reason for this name is that Gabor used the same mathematics to describe his units as had Heisenberg in describing the units of quantum microphysics. Here they define the unit structure of processes occurring in the material brain"*. I see this quantum holographic brain interactions as a natural extension [1,10,22,31] of Eccles ideas of an interactionism between dendrons and psychons [55-60].

Dejan Rakovic from Serbia, points out how *Quantum-Holographic and Classically-Reduced Neural Networks can model psychosomatic functions* [61]: *"The prevailing scientific paradigm considers information processing within the central nervous system as occurring through hierarchically organized and interconnected neural networks. However, it seems that this hierarchy of biological neural networks is going down sub-cellular cytoskeleton level, being according to some scientists a kind of interface between neural and quantum levels. At the same time it appeared, within the Feynman propagator version of the Schrödinger equation, that the quantum level is described by analogous mathematical formalism as Hopfield-like quantum-holographic associative neural network. The mentioned analogy opens additional fundamental question as to how the quantum parallel processing level gives rise to classical parallel processing level, which is a general problem of the relationship between quantum and classical levels within the quantum decoherence theory as well. The same question is closely related to the fundamental nature of consciousness, whose in-deterministic manifestations of free will and other holistic manifestations of consciousness like transitional states of consciousness, altered states of consciousness, and consciousness pervading body – necessarily imply that some manifestations of consciousness must have deeper quantum origin, with significant psychosomatic implications*".

I expanded my conjecture that the interconnectedness between brain and cosmos is an instantaneous holistic nonlocal connection and proposed the concept of a holoinformational flux, from which both mind and matter are in-formed, that resembles Bohm's holomovement. But in this new concept, quantum holographic brain dynamic patterns are conceived as an active part of the universal quantum-holographic informational field, and capable of generating an informational interconnection that is simultaneously nonlocal quantum-holistic (mind-cosmos holographic connection), and local Newtonian-mechanistic (brain-mind neural networks connections), i.e., holoinformational. Taking yet in consideration the basic mathematical property of holographic systems in which the information of the whole system is distributed in each part of the system, plus Bohm's holographic quantum physics data, and the experimental data of the holonomic theory of Pribram, we propose that this universal interconnectedness [9,10,31] could permit us to access all the information coded in the wave interference patterns existing in all the universe since its origin [7,21,29,30]. This quantum-holoinformational nature of the universe interconnects each part, each brain-mind-consciousness, with all the quantum information stored in the holographic patterns distributed in the whole cosmos, in an indivisible irreducible informational cosmic unity [9,10,31,42,44,45].

10. Consciousness and the Human Mind

The cybernetic networks of cyclical hierarchical relations through which we try to characterize life and consciousness, interrelate themselves in a multilevel dynamic of *"hypercycles"* [62], organizing in *"self-cathalitic"* cycles [32,54] in the *"edge of chaos"* [63]. Self-cathalitic cycles can organize in higher levels, by means of cathalitic hypercycles, (e.g. a virus) capable of evolving to more complex and more efficient structures, until the *"emergence of sets, of sets of... of sets of neurons"* [72]. In this way, the network generate *"creative loops"* [50] and *"hyperstructures"* [64] integrating themselves in systems with patterns of connectivity distributed and parallels, as the *"Global Workspace"* [65] and the "Extended Reticular-Thalamic Activation System"- ERTAS [66].

Dynamic non-linear systems like the human brain, with all these "neural correlates of consciousness" are generated not only by such complexifications of matter's mechanistic external relations, but as we already saw, also as a prime reason by an harmonic unfolding of an indivisible universal holoinformational field. This quantum-holographic intelligent self-organizing field, is self-referred and continuously creates (unfolds) and

recreates itself as a holographic distributed medium, and goes on experiencing continuously new possibilities of existence and non-existence, in an eternal and ever new unfolding-enfolding cycle. The *"self-consistent non big bang cosmology"* of Prigogine-Geheniau et al., describes the main features of this multi-cyclic learning scenario in which the cosmic evolution is the result of an interaction between the quantum vacuum (a *plenum*) and the particles of matter that are synthesized in it. Laszlo [67] adds to this scenario *"the postulate according to which the quantum vacuum is the fifth universal field interacting with matter"* stating that *"the field acts as a holographic medium, registering and conserving the scalar wave-transform of the 3n-dimensional configuration spaces assumed by matter in space"* (pp. 204).

This universal fifth field is not inferred from space-time interactions like the gravitational, the electromagnetic, the strong and the weak nuclear forces. In this new type of field, space and time become implicate, enfolded, as described mathematically by Bohm, in a spectral and holographic organized medium, made of the energy present in the interference patterns of the waveforms. The transformations from space-time order to this spectrum dimension are described by holographic mathematical formulations. This type of formulations was first described by Leibniz that created the conception of monads. Dennis Gabor in last century described the mathematical principles of holography and defined a quantum of information he named *logon*, a channel which can carry a unity of communication with the least amount of uncertainty.

11. Quantum-Holographic Neural Network Fields

Pribram in his Holonomic Brain Theory [52-54,68-70] proposes that there is a holographic process of information treatment, he named *multiplex neural hologram* distributed by the whole brain's cortex, dependent of neurons of local circuit that do not show long fibers and do not transmit the common nervous impulses. *"They are neurons that work in ondulatory way, and are overall responsible for the horizontal connections of the neural tissue's layers, connections in which holographicoides interference patterns can be built"* [52]. He describes a *"neural wave equation"* [53] resulting from the workings of the brain's neural networks, similar to the Schrödinger wave equation of the quantum theory.

Pribram has also demonstrated that hiperstimulation of the fronto-limbic brain allows primates including humans to operate in a holistic, holographic-like mode. The electric excitation of these brain areas relaxes the Gaussian constraints, as Laszlo put it. *"While during ordinary levels of excitation of the frontolimbic system the signal processing creates the usual narrative consciousness, when the excitation of this system exceeds a certain threshold, conscious experience is dominated by unconstrained holographic processes. The result is timeless, spaceless, causeless, 'oceanic' sensation"*. In these states the nervous system becomes, *'attuned to the holographic aspects of - the holograph-like order- in the universe'* [67]. Electroencephalographic and brain mapping studies made during altered states of consciousness as meditation, prayer, and others brain-mind relaxation techniques, shows a high synchronization of the brain waves as if all the neurons of all brain centers were all playing the same symphony. In this highly synchronized states of consciousness the holographic brain treatment of information is optimized facilitating the interaction of the quantum-holographic brain network with the quantum holographic cosmic network [8,29].

Pribram have demonstrated that the receptor field of the cortical neurons reacts selectively to multiples sensorial modes making the harmony curves of adjacent receptors fields to mix as in a piano. In this way the harmony field of the cortex originates a resonance as a string instrument. The mathematical formulations that describes the resulting harmony curve are the Fourier transformations that Gabor applied in the creation of the hologram enriching these transformations with a model that can be reconstructed by the application of the inverse process. That holographic organization is what Bohm calls implicate order, a model that includes space and time in its structure as an enfolded dimension. Functioning in this holograph mode our brain "mathematically builds the objective reality" interpreting frequencies originally from a spectral dimension, a fundamental order, a informational field located beyond time and space.

12. Eccles Interactive Dualism and Pribram's Monism

Sir John Eccles described in the brain fine fibers structures he called dendrons composed of pre-synaptic teledendrons, synapses and post-synaptic dendrites connections, that he postulated could interact with the mind side of the interaction by way of units he called psychons. He proposed that these psychons could

operate on synapses through quantum processes, and with Beck developed a beautiful and logical quantum interpretation of the synaptic function. Pribram [53] demonstrated that Eccles' dendrons make up receptive fields in cortical sensory units, that *"as sensory receptive fields they can be mapped in terms of wavelets, or wavelet-like patterns such as Gabor Elementary Functions. Dennis Gabor (1946) called these units Quanta of Information. The reason for this name is that Gabor used the same mathematics to describe his units as had Heisenberg in describing the units of quantum microphysics. Here they define the unity structure of processes occurring in the material brain. However, Gabor invented his function, not to describe brain processes, but to find the maximum compressibility of a telephone message that could be sent over the Atlantic Cable without destroying its intelligibility. The Gabor function thus describes both a unit of brain processing and a unit of communication. Brain is material, communication is mental. The same mathematical formulation describes both. The elementary structure of processing in Eccles' material dendron is identical to the elementary structure of processing of a mental (communication) psychon. There is a structural identity to the dual interactive process.*

Pribram proposes a monistic basis for Eccles dualism, showing that *there is a interactive mind/matter duality that is a "ground" from which both matter and mind are "formed" and the "dual" emerges*. That ground functions as a potential reality similar to Heisenberg potential world. *"This flux provides the ontological roots from which our experience regarding matter as well as mind (psychological processing) itself become actualized in spacetime".* To illuminate this claim, Pribram relates the following story: *"Once, Eugene Wigner remarked that in quantum physics we no longer have observables (invariants) but only observations. Tongue in cheek I asked whether that meant that quantum physics is really psychology, expecting a gruff reply to my sassiness. Instead, Wigner beamed a happy smile of understanding and replied, "yes, yes, that's exactly correct". If indeed one wants to take the reductive path, one ends up with psychology, not particles. In fact, it is a psychological process, mathematics, that describes the relationships that organize matter. In a non-trivial sense current physics is rooted in both matter and mind. Communication depends on being embodied, instantiated in some sort of material medium. This convergence of matter on mind, and of mind on matter, gives credence to their common ontological root. My claim is that this root, though constrained by measures in spacetime, needs a more fundamental order, a potential order that underlies and transcends spacetime. The spectral basis of both matter and communication portrayed by the Fourier relationship delineate this claim.*

The holonomic brain theory of Pribram, and the holographic quantum theory of Bohm, added with Laszlo's fifth field contribution quoted above, shows us that we are part of something much greater and vast than ours individual mind. Our mind is a subsystem of a universal hologram, accessing and interpreting this holographic universe. We are interactive resonant and harmonic systems with this unbroken self-organizing wholeness. We are this holoinformational field of consciousness, and not observers external to it. The external observer's perspective made us lose the sense and the feeling of unity or supreme identity, generating the immense difficulties we have in understanding that we are one with the whole and not part of it. In this holoinformational model of consciousness the non-local quantum-informational flow in a continuous holomovement of expansion and enfoldment, between the brain and the superimplicate order, is the universal consciousness self-organizing itself as human mind. We are this very non-local quantum-holographic cosmos manifesting itself through our consciousness, seeing itself through our eyes, and interconnecting in a participatory holistic and indivisible way the human brain to all levels of the self-organizing multiverse.

13. Qualia and the Hard Problem

Also, the essential characteristic of quantum non-local information of this dynamic process makes the question about the phenomenal quality (qualia) of conscious experience raised by Chalmers [15,17,71], multicontextual, multidimensional, relative not only to the observer, but also to the observation process and to what one observes, that is, to the holographic distributed information of the whole in question. The hard problem of consciousness proposed by Chalmers is only difficult and problematic in a mechanistic and reductionist Cartesian-Newtonian context in which consciousness and universe are considered separated entitities. In a holoinformational context of internal relations, indivisible and non-local, it ceases to exist, because the self-organizing sublevels of the universe that get structured in a mechanistic-local way are understood as secondary manifestations of the harmonic, holistic and non-local nature of the universal

holoinformational "continuum". Matter, life and consciousness, are expressions of this holoinformational field, with fundamental non-local quantum relations, unfolding in myriads of possibilities.

As symbolical beings we can better understand this process going through the flower and fruit's metaphor. We can say the fruit comes from the flower. However, the fruit is already implicit in the seed, making it impossible for us to state that it only and essentially comes from the flower. This would be a reductionism, a perceptive fragmentation of reality. Actually, not even the seed originates the fruit. The fruit comes from an indivisible totality, clearly intelligent and holo-related: sun, rain, earth, air, wind, cosmic rays, seasons, weather, microorganisms, insects, birds, seed, sap, steam, leaves..."ad infinitum", in an irreducible holoinformational order.

14. Final Considerations

This approach also gives the directions for understand information as the unifying principle, capable of connecting consciousness to the universe and to the totality of space and time. It also allows a better understanding of phenomena and theories related to consciousness which up to now we could not explain or understand adequately, such as synchronicities, archetypes, collective unconscious (Jung), unconscious complexes (Freud), near-death experiences (Moody Jr.), premonitory dreams, psychocinesia and telepathy (Rhine), morphogenetic fields and morphical resonance (Sheldrake), out-cerebral memory (Stevenson), memories of previous existences (Weiss), amongst others.

Brian D. Josephson, Nobel Prize in physics, believes that Bohm's theory of the implicate order can even lead someday to the inclusion of God in the science network. We believe that the holoinformational view of consciousness which has in Bohm's quantum theory one of its very foundations, implies in the inclusion in science's framework of a Cosmic Consciousness. An Universal Intelligence that originates, permeates, maintains and transforms the universe, life and mind, through the holoinformational process.

Finally, we would like to state that in the Cartesian-Newtonian reductionist paradigm, the question about consciousness nature is unanswerable. It can be useful to unfold new knowledge and generate new questions and answers. However, the inherent fragmentation to this perspective, obscures more and more our understanding of what reality and consciousness are.

References

1. S. R. Hameroff, Quantum coherence in microtubules: A neural basis for emergent consciousness? *Journal of Consciousness Studies* 1(1) (1994) 91-118.
2. S. R. Hameroff, R. Penrose, Orchestrated reduction of quantum coherence in brain microtubules: A model for consciousness. In *Toward a Science of Consciousness: The First Tucson Discussions and Debates*, S. R. Hameroff, A. W. Kaszniak, A. C. Scott (eds.), MIT Press Cambridge MA, 1996.
3. C. J. S. Clarke, The nonlocality of mind, *Journal of Consciousness Studies* 2(3) (1995) 231-240.
4. K. Wilber, An integral theory of consciousness, *Journal of Consciousness Studies* 4(1) (1997) 71-92.
5. E. Jantsch, *The Self-Organizing Universe*, Pergamon Press, New York, 1980.
6. A. Koestler, *The Ghost in the Machine*, Hutchinson & Co., London, 1967.
7. F. Di Biase, M. S. F. Rocha, Information, self- organization and consciousness: Toward a holoinformational theory of consciousness, In Amoroso R.L. (ed.) *Science and the Primacy of Consciousness: Intimation of a 21st Century Revolution*, Noetic Press, Oakland, 2000; Also published in *The Noetic Journal* 2(3), July 1999, Noetic Press.
8. F. Di Biase, R. L. Amoroso, Holoinformational consciousness: An extension of interactive dualism with anticipatory parameters, *International Journal of Computing Anticipatory Systems* 22 (2008), D.M. Dubois (ed.), CHAOS, Liège, Belgium.
9. F. Di Biase, A holoinformational model of consciousness, *Quantum Biosystems* 3 (2009) 207-220, Italy.
10. F. Di Biase, Quantum-holographic informational consciousness, *NeuroQuantology* 7(4) (2009) 657-664.
11. J. Wheeler, Information, physics, quantum: The search for links", in *Complexity, Entropy and the Physics of Information*, W. H. Zurek (ed.), Addison-Wesley, Reading MA, 1990.

12. N. Wiener, *Cybernetics, or Control and Communication in the Animal and Machine*, Technology Press & John Wiley & Sons, New York, 1948.
13. C. E. Shannon, W. Weaver, *The Mathematical Theory of Communication*, University of Illinois Press, Urbana, III, 1949.
14. L. Brillouin, *Vie Matière et Observation*, Editions Albin Michel, 1959.
15. D. J. Chalmers, The puzzle of conscious experience, *Scientific American*, Dec. 1995.
16. G. Bateson, *Mind and Nature: A Necessary Unity*, Dutton, New York, 1979.
17. D. J. Chalmers, *The Conscious Mind. In Search of a Fundamental Theory*, Oxford University Press, New York, 1996.
18. H. Atlan, *L'Organization Biologique et la Théorie de L'Information*, Hermann, Paris, 1972.
19. H. Atlan, *Entre le Cristal et la Fumée, Essai sur L'Organization du Vivant*, Seuil, Paris 1979.
20. F. Di Biase, Auto-organização nos sistemas biológicos, *Ciência e Cult.* 33(9) (1981) 1155-1159, Sociedade Brasileira para o Progresso da Ciência, Brazil.
21. F. Di Biase, M. S. F. Rocha, Information, self-organization and consciousness, *World Futures- The Journal of General Evolution* 53 (1999) 309-327, UNESCO –E. Laszlo (ed.), Gordon & Breach Group, U.K.
22. F. Di Biase, M. S. F. Rocha, *Ciência Espiritualidade e Cura – Psicologia Transpessoal e Ciências Holísticas*, Editora Qualitymark Rio de Janeiro, Brazil, 2004.
23. I. Prigogine, I. Stengers, *La Nouvelle Alliance*, Editions Gallimard, Paris, France, 1979.
24. I. Prigogine, I. Stengers, *Entre le Temps et L'Eternité*, Fayard, Paris, France, 1988.
25. W. Seager, Conciousness, information and panpsychism, *Journal of Consciousness Studies* 2(3) (1995) 272-288.
26. W. H. Zurek (ed.), *Complexity, Entropy and the Physics of Information*, Santa Fé Institute, Studies in the Science of Complexity, Vol. 8, Addison-Wesley, Redwood City CA, 1990.
27. T. Stonier, *Information and the Internal Structure of the Universe*. Springer Verlag, New Addison-Wesley, Reading MA, 1990.
28. T. Stonier, *Information and Meaning. An Evolutionary Perspective*, Springer, U.K., 1997.
29. F. Di Biase, *O Homem Holístico, a Unidade Mente-Natureza*, Editora Vozes, Rio de Janeiro, Brazil, 1995.
30. F. Di Biase, M. S. F. Rocha, *Caminhos da Cura*, Editora Vozes, Rio de Janeiro, Brazil, 1998.
31. F. Di Biase, R. L. Amoroso (eds.) *A Revolução da Consciência. Novas Descobertas sobre a Mente no Século XXI*. Editora Vozes, Rio, Brasil, 2005.
32. S. Kauffman, *At Home in the Universe, The Search for the Laws of Self-Organization and Complexity*, Oxford University Press, New York, 1995.
33. S. Grof, *Beyond the Brain: Birth, Death, and Transcendence in Psychotherapy*, State University of New York Press, Albany NY, 1985.
34. R.A. Moody, *Life after Life*, Bantam Books, New York, 1976.
35. K. Ring, *Life at Death*, Quil, New York, 1980.
36. M. B. Sabom, *Recollections of Death*, Harper & Row, New York, 1982.
37. E. Kübler-Ross, *On Children and Death*, MacMillan, New York, 1983.
38. B. Weiss, *Muitas Vidas Muitos Mestres*, Editora Salamandra, Rio de Janeiro, Brazil, 1996.
39. F. Capra, *Uncommon Wisdom*, Simon & Schuster, New York, 1988.
40. P. Weil, Axiomática transdisciplinar para um novo paradigma holístico, in *Rumo à nova transdisciplinaridade: sistemas abertos de conhecimento*, Pierre Weil, Ubiratan D'Ambrosio, Roberto Crema, Summus, São Paulo, Brasil, 1993.
41. A. Atkins, On consciousness: what is the role of emergence?, *Medical Hypothesis* 38 (1992) 311-314.
42. D. Bohm, *Wholeness and the Implicate Order*, Routledge, New York, 1983.
43. D. Bohm, *Unfolding Meaning, a weekend of dialogue with David Bohm*, ARK Paperbacks, Routledge & Kegan Paul Ltd, 1987.

44. D. Bohm, B. J. Hiley, *The Undivided Universe*, Routledge, London, 1993.
45. D. Bohm, F. D. Peat, *Science Order, and Creativity. A dramatic New Look at the Creative Roots of Science and Life*, Bantam Books, New York, 1987.
46. R. Weber, The enfolding unfolding universe: A conversation with David Bohm, in *The Holographic Paradigm*, (ed.) K. Wilber, New Science Library, Boulder CO, 1982.
47. N. Gisin, et al. *Science* 277 (1997) 481.
48. S. D. Peat, *Sinchronicity, the Bridge Between Matter and Mind*, Bantam Books, New York, 1987.
49. J. Horgan, *The End of Science*, Helix Books, Addison-Wesley, 1996.
50. J. Bell, *Speakable and Unspeakable in Quantum Mechanics*, Cambridge University Press, 1987.
51. E. Harth, *The Creative Loop. How the Brain Makes a Mind*, Addison-Wesley, Reading MA, 1993.
52. M-W. Ho, *The Rainbow and the Worm, The Physics of Organisms*, 3rd ed., World Scientific, Singapore, 2008.
53. K. Pribram, Esprit, cerveau et conscience, in *Science et Conscience, Les Deux Lectures de L'Univers*. Éditions Stock et France-Culture, Paris, 1980.
54. K. Pribram, *Brain and Perception: Holonomy and Structure in Figural Processing*, Erlbaum, Hilsdale NJ, 1991.
55. K. Pribram, In memoriam: Nobel laureate Sir John Eccles, *The Noetic Journal* 1, June 1997, pp 2-5. Noetic Press, Orinda CA.
56. J. C. Eccles, *The Neurophysiological Basis of Mind*, Oxford University Press, Oxford, 1952.
57. J. C. Eccles, A unitary hypothesis of mind-brain interaction in the cerebral cortex, *Proc. R. Soc. Lond*. B 240 (1989) 433-451.
58. J. C. Eccles, Evolution of complexity of the brain with the emergence of consciousness, In Pribram, K. (ed.) *Rethinking Neural Networks: Quantum Fields and Biological Data*, Lawrence Erlbaum, Manwah, 1993.
59. J. C. Eccles, *Evolution du Cerveau et Création de la Conscience*, ch. 8.8 Une nouvelle hypothèse sur l'interaction esprit/cerveau à partir de la physique quantique: l'hypothèse des micro-sites, Flammarion, Paris, 1994.
60. J. C. Eccles, Do mental events cause neural events analogously to the probability fields ofquantum mechanics? *Proc R Soc Lond [Biol]* 227 (1998) 411-428.
61. D. Raković, *Integrative Biophysics, Quantum Medicine, and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications*, IASC & IEPSP, Belgrade, 2009; cf. also see www.dejanrakovic.com
62. M. Eigen, P. Schuster, *The Hypercycle. A principle of Natural Self-Organization*, Springer-Verlag, Berlin, 1979.
63. R. Lewin, *Complexity: Life on the Edge of Chaos*, MacMillan, New York, 1992.
64. B. J. Baars, *In the Theater of Consciousness: The Workspace of the Mind*, Oxford University Press, 1997.
65. J. Newman, Putting the puzzle together. Part I: Towards a general theory of the neural correlates of consciousness, *Journal of Consciousness Studies* 4 (1) (1997) 47-66.
66. J. Newman, B. J. Baars, A neural attentional mode access to consciousness: A global workspace perspective, *Concepts in Neuroscience* 4(2) (1993) 255-290.
67. E. Laszlo, *The Creative Cosmos, A Unified Science of Matter, Life and Mind*, Floris Books, Edinburgh, U.K., 1993.
68. K. Pribram, The neurophysiology of remembering, *Scientific American* 220, Jan. 1969, pp. 75.
69. K. Pribram, *Languages of the Brain*, Wadsworth Publishing, Monterey CA, 1977.
70. K. Pribram (ed.), *Rethinking Neural Networks: Quantum Fields and Biological Data*, Lawrence Erlbaum Associates, Hillsdale, 1993.
71. D. J. Chalmers, Facing up to the problem of consciousness, *Journal of Consciousness Studies* 2(3) (1995) 200-219.
72. A. Scott, *Stairway to the Mind. The Controversial New Science of Consciousness*, Copernicus, Springer-Verlag, New York, 1995.
73. H. Umezawa, *Advanced Field Theory*, AIP Press, New York, 1993.