

Fundamental awareness: A framework for integrating science, philosophy and metaphysics

Neil D. Theise^{a,b} and Menas C. Kafatos^{c,†}

^aDepartment of Pathology, Icahn School of Medicine at Mount Sinai, New York, NY, USA; ^bDepartment of Medicine, Icahn School of Medicine at Mount Sinai, New York, NY, USA; ^cSchmid College of Science & Technology, Chapman University, Orange, CA, USA

ABSTRACT

The ontologic framework of Fundamental Awareness proposed here assumes that non-dual Awareness is foundational to the universe, not arising from the interactions or structures of higher level phenomena. The framework allows comparison and integration of views from the three investigative domains concerned with understanding the nature of consciousness: science, philosophy, and metaphysics. In this framework, Awareness is the underlying reality, not reducible to anything else. Awareness and existence are the same. As such, the universe is non-material, self-organizing throughout, a holarchy of complementary, process driven, recursive interactions. The universe is both its own first observer and subject. Considering the world to be non-material and comprised, a priori, of Awareness is to privilege information over materiality, action over agency and to understand that qualia are not a “hard problem,” but the foundational elements of all existence. These views fully reflect main stream Western philosophical traditions, insights from culturally diverse contemplative and mystical traditions, and are in keeping with current scientific thinking, expressible mathematically.

ARTICLE HISTORY

Received 28 December 2015
Revised 9 February 2016
Accepted 10 February 2016

KEYWORDS

awareness; complementarity; consciousness; cosmology; emergence; idealism; monism; mysticism; philosophy; process; quantum physics

Introduction



Three primary domains of human investigation and experience offer insights into the nature and origin of what is generally termed as consciousness: philosophy, contemporary (hypothesis driven) science based on third person or objective perspective, and first person metaphysical experiences arising from contemplative and other (e.g. ecstatic, psychopharmacologic) spiritual practices. The most fundamental unanswered question is that of the “hard problem:”

Why is it that when our cognitive systems engage in visual and auditory information-processing, we have visual or auditory experience: the quality of deep blue, the sensation of middle C? How can we explain why there is something it is like to entertain a mental image, or to experience an emotion? It is widely agreed that experience arises from a physical basis, but we have no good explanation of why and how it so arises. Why should physical processing give rise to a rich inner life at all? It seems objectively unreasonable that it should, and yet it does.¹

Another way to ask this: how is it that conscious beings are aware of qualia, i.e. the experiences of

consciousness? And how do we know that our experiences conform to others? As yet, none of these domains of human knowledge have resulted in a convincing, integrative solution to the hard problem of qualia, though extensive reporting of first person experiences points in a possible direction.

We feel that a generalized framework for considering the nature of consciousness can solve the hard problem if it considers inputs from all three investigational domains: scientific, philosophical, and metaphysical. We will also argue that reductionist, materialist science has hit a dead end and a radical approach departing from the practices of the last century needs to be adopted. A systemic failure to prioritize this kind of truly broad spectrum, cross-cultural engagement is identifiable among many, if not most practitioners in all three domains. However, not only should every possible resource be taken advantage of, but a theory that incorporates all three may best serve to create a language with which all participants working in the field of consciousness studies can engage each other in meaningful dialog despite the

CONTACT Neil D. Theise  ntheise@chpnet.org  Department of Pathology, Mount Sinai Beth Israel Medical Center, First Avenue at 16th Street, New York, NY 10003, USA.

[†]Fletcher Jones Endowed Professor of Computational Physics

© 2016 Neil D. Theise and Menas C. Kafatos. Published with license by Taylor & Francis.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>), which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. The moral rights of the named author(s) have been asserted.

significantly different backgrounds, world views, and training. In fact, we argue here that what is needed is an integrated approach, a transdisciplinary framework allowing different perspectives and integration across widely different disciplines.

For such a synthesis we here specify a monistic form of idealism, that we call Fundamental Awareness. Monistic views posit that everything in existence, all “reality,” is comprised of a single substance: material (the reigning paradigm in contemporary science, other than perhaps quantum physics), ideal (comprising of non-material “mind” or “spirit”), or neutral (neither material nor non-material). In this paper, we present a synthesizing philosophical and scientific (e.g., physics, biology, neuroscience, etc.) statement that can be explanatory of the hard problem and lend insight to a diverse group of metaphysical traditions. We argue that even for the so-called physical world, any attempt of a Theory of Everything will fail outside the framework proposed here. We will first briefly describe concepts and practices from the scientific and metaphysical domains that we believe, at minimum, need to be incorporated into this philosophical tradition. We will then weave these into a statement of Fundamental Awareness beginning with a primary axiom and associated statements to define the “one substance” underlying existence as non-dual “pure awareness” or “awareness of awareness,” a discussion of the initiating symmetry breaking (of non-duality into the initiating duality of self and other, subject and object), the three inherent, scale independent, universal organizing principles which act as natural laws for all levels of reality implied by this framework (i.e., complementarity, process, recursion), and will finish by returning to a brief summary of some close affinities of these concepts for the scientific, metaphysical and philosophical domains.

Central themes of Fundamental Awareness

The following bodies of knowledge and experience are the essential elements from which we build our framework. We believe that any framework to understand consciousness that does not incorporate these bodies of knowledge, at least, or attempts to link them in an integrated manner is, at best, incomplete and most likely circular and inconsistent with quantum mechanics and the nature of experience itself.

Quantum mechanics

Understandings of quantum mechanics (QM) from the Copenhagen Interpretation (CI) of Bohr and his early quantum physicist peers, through subsequent elaborations and extensions by Heisenberg, Born, Pauli and still

later on von Neumann, Wigner, Stapp and Kafatos indicate the central and essential role of the conscious observer in the moment by moment evolution of the universe.²⁻⁸ The essential core experiment demonstrating such intertwining of observer and observed is the famous “double slit experiment” in which a conscious observer makes a free choice regarding how to examine the system of a beam of quanta (e.g. electrons, photons) passing through two parallel slits to produce an impact pattern on the screen beyond the slits. If the experimenter makes an observation of the electrons passing through one of the slits, by knowing that indeed it passed through that slit using a probing interaction, then the observed pattern behaves like that produced by particles following a defined trajectory straight through the slit hitting the screen and assembling into two bands directly opposite the slits, as expected for particle behavior. On the other hand, in the absence of direct observation, as they pass through one slit or the other, the screen shows an interference pattern indicating the wave-like nature of the electrons.

In the orthodox CI and in subsequent enhancements by von Neumann, the wave function that describes possible outcomes of a quantum event is a complete description of all such possibilities and therefore, prior to observation, all these possibilities exist in superposition. The “collapse of the wave function” into a single “actual” event is triggered by a specific measurement which is set up by an observer, or a conscious observation of the system. The (in)famous example of Schrödinger’s Cat being both “alive and dead” until the quantum event which would trigger the release (or non-release) of poison into the cat’s box is directly observed in recent quantum experiments.^{9,10} Whether we focus on the wave/particle duality of light or the alive/dead state of the cat, it is conscious measurement that creates the actual outcome of the system being observed. In this sense, quantum phenomena are contextual. One cannot speak of “independent” outcomes without the measurement context used to examine such phenomena.

The implications of these views were hotly debated with, most notably, Einstein. His most significant attempt to undermine the views of Bohr and CI in general, was the work with Podolsky and Rosen in the so-called “EPR paradox” which they made to provide arguments for the incompleteness of QM.¹⁰ However, they assumed that the result, namely “entanglement,” was impossible, thinking they had therefore found a way to undercut the orthodox interpretations of QM. As we know, the opposite has occurred, with entanglement repeatedly being demonstrated in many experiments spanning several decades in well controlled experiments, not only in the

quantum realm, but now in the macroscopic realm with entanglement within diamond crystals.¹¹⁻¹⁴ A possible way out remained if one could prove that there were “hidden variables” linking the two particles that would account for the correlations of seemingly entangled structures.^{15,16} However, such hidden variable theories have proven untenable.

Specifically, in 1964 John Bell proposed a theorem and mathematical formalism to test for the existence of local realism that would require hidden variables implied by the EPR paradox. This achievement then pointed to methods for testing quantum mechanical predictions, developing what has now come to be known as “Bell’s Inequalities:” the basis for determining whether there are hidden variables within a system.¹⁵ A full description of the logic of derivation and logic of Bell’s Inequalities is beyond the scope of this paper; however, the important point is that he showed that if the inequalities were ever not satisfied, then it would be impossible to have a local hidden variable theory that accounted for the QM findings and, therefore, the EPR critique of the Copenhagen Interpretation would also be wrong.

As pointed out in “The Consciousness Universe: parts and wholes in modern physical theory:”⁸

1. In an attempt to preserve the classical view of one-to-one correspondence between every element of the physical theory and physical reality, some physicists have assumed that the wave aspect of a quantum system is real in the absence of observation or measurement. Based on this assumption, several well-known physicists have posited theories with large cosmological implications in an attempt to obviate or subvert wave-particle dualism and quantum indeterminacy. [...] however, Bell’s theorem and the experiments testing that theorem have revealed that these attempts to preserve the classical view of correspondence are not in principle subject to experimental proof, and must, therefore, be viewed as little more than philosophical speculation.
2. When we properly evaluate the observational conditions and results of experiments testing Bell’s theorem, it becomes clear that wave-particle dualism and quantum indeterminacy are facts of nature that must be factored into our understanding of the nature of scientific epistemology. In doing so, we are obliged to recognize that any phenomena alleged to exist in the absence of observation or measurement in quantum physics cannot be viewed as real.
3. In words often attributed to John Archibald Wheeler, “no phenomenon can be presumed to be a real phenomenon until it is an observed phenomenon.”

There are now several experiments performed over the years by A. Aspect and collaborators in Paris,¹⁷ by N. Gisin and collaborators in Geneva¹⁸ as well as several other laboratories in the US and elsewhere, vindicating quantum predictions to a surprising degree of accuracy. Thus, while there are some alternate interpretations of QM that differ significantly from the line of thought that descends through Bohr, Heisenberg, Pauli, Born and von Neumann in particular, many of these do so only out of an urge to preserve a classical world view (see http://en.wikipedia.org/wiki/Interpretations_of_quantum_mechanics#Summary_of_common_interpretations_of_quantum_mechanics). This, we believe, in part represents the imperative of the dominant philosophy of science of the 20th century, most robustly developed by the Vienna Circle: logical positivism. In this philosophical system, only statements verifiable either logically or empirically would be cognitively meaningful. Developed in the absence of a knowledge of or acceptance of the findings of QM already coming out of Copenhagen, these philosophers reified a materialist view of the world that closed the door on metaphysical speculations.^{19,20}

While logical positivism eventually declined in influence within the world of philosophy itself, its influence in the halls of academic and popular science remains supreme. It remains the dominant contemporary world view: the world is material and empirical science is the only appropriate method for understanding the world. Thus, we now find that, for the most part, there is a tacit belief in contemporary culture that only empirical science can explain consciousness itself. However, for the purposes of this Fundamental Awareness framework and remaining unhindered by the skeptical prejudices of this world view, we consider the Copenhagen Interpretation, particularly in the orthodox forms elaborated by von Neumann, to be the most relevant to understanding consciousness in the universe. As Henry Stapp has said (personal communication):

The radical innovation of standard quantum mechanics, relative to its classical forerunner, is that it is intrinsically a psychophysical theory in which our conscious mental intentions are not predetermined by the physically described aspects of the theory, yet play an essential causal dynamical role in the theory, which generates predictions about phenomena in physically described contexts, and hence effectively solves the “hard problem.”

The universe is a self-organizing system

The universe is comprised of self-organizing systems, in which every part, at every level of scale, contributes to the emergent properties of the whole.²¹⁻²⁹ Thus, according to generally accepted, consensus opinions regarding

the sciences, the physical universe arises and manifests from interactions between space and time, matter and energy at the smallest (Planck) scale. While there is as yet no confirmed and comprehensive view of the Planck scale of existence, we consider a generalized view that a quantum foam of entities arises within or from the vacuum. These entities, by interacting with each other, give rise to (at least) the wave/particle entities described by the Standard Model of particle physics. (Self-organizing entities which comprise dark matter and dark energy are implicitly included in all these discussions, though the absence of details concerning their nature precludes further inclusion in our framework; to be continued!)

As such, time and space emerge with the quantum foam and the universe begins its rapid, exponentially expanding evolution.^{30,31} When in permissive physical conditions of this evolving inflationary universe, the resultant self-organizing wave/particles in turn self-organize into larger wave/particles and then into atoms and from this point on proceeds the evolution of the universe according to standard cosmology. This self-organization is of course mediated by the known forces: weak, strong, electromagnetic and gravitational which apply throughout, though their relative importance is scale dependent. Some of these self-organized (and self-organizing) entities, in permissive conditions such as the temperate, highly aqueous world of our own planet, also give rise to living systems which on Earth have taken the form of cells, multicellular organisms, and thence to local or planetary ecosystems (“Gaia”).

Whether the self-organization arises from linear systems of interaction (e.g., in primarily quantum field and thermodynamic processes) or in non-linear systems (e.g. all known biological entities, multi-body gravitational systems), emergent phenomena develop at higher levels of scale that arise from the interactions at lower levels of scale. What these generalized forms of self-organizing complexity have in common are:

1. All systems – at every level of scale, quantum and classical - are comprised of potentially interactive entities. (Given that “interactions” at this level of scale are based on the non-local nature of all phenomena, the construct intra-activity is probably more accurate; however, for the sake of simplicity here and later we will encompass non-local and local behaviors as interactions and interactivity.)
2. The nature of self-organization is dependent on the numbers of interacting entities and the richness of the modes of possible interaction.
3. There is a necessary role for limited randomness (“quenched disorder”) at all levels of scale which allows for structural stability and/or adaptive self-organization in the face of changing

environmental conditions. Too much disorder and there can be no self-organization; too little and there is no ability for an adaptive change in the forms of self-organization in response to a changing environment.

In all of these systems, the properties of the whole are not predicted by the characteristics of the lower scale parts that comprise them, as long as there are sufficient numbers of these parts and the conditions of interaction and environment are appropriate to allow for self-organization, relatively stable higher scale, emergent structures will arise.⁸ The sum is not just the collection of all parts; it is much more than that. So at the quantum scale there are interactions between wave/particle entities to give rise to such emergent structures as plasmas, Bose-Einstein condensates, or larger wave/particle entities or atoms, etc. At higher scales, atomic and molecular self-organizations yield the emergent properties of the substances and materials of our own, usual level of scale: wetness of water, hardness of diamonds, softness of talc.

And then, in biological systems, we find the emergent properties of autopoietic, living beings which, according to Maturana and Varela³³ and their scientific/philosophical descendants,^{33,34} includes cognitive capacities such as sentience and sense making (eventually inclusive of animal and human minds), possibilities for reproduction, and adaptive, evolutionary change in response to changing environments. Such autopoietic systems then further self-organize into communities (e.g., cities, cultures, ecosystems) with similar capacities for adaptive change (though, given the technically unbounded nature of such communities, it is difficult to class them as strictly autopoietic).

Conceptualizing the world, then, as a nested hierarchy undermines the idea of a materialist universe, a universe that in some sense is knowable from some initial conditions and through the application of dynamical equations of physics, made of “stuff” such as matter and energy, or even time and space through which matter and energy move and interact. However, it is in total resonance with the view of a quantum universe which eventually appears to conscious observers as the classical world. *The appearance of material stuff is scale dependent.* Two examples of appearances that are scale dependent (and which may be reified by an observer as having inherent existence):

1. A “bait ball” of fish appears from a distance as a single, unified, albeit moving globe-like entity, but on closer view resolves into, not a *thing* per se, but a phenomenon arising from smaller things, the fish themselves (Fig. 1A).
2. A murmuration of starlings appears like moving shapes in the sky, but these also, like the bait ball, resolve at

closer inspection into a phenomenon made up of smaller things (Fig. 1B).

In turn, the bodies of each fish or bird (or, for that matter, of you, our reader), in turn, are also not things at all: at the microscopic level each body resolves into a phenomenon arising from the interactions among the community of component cells comprising the organism. Thus “thingness,” the *appearance* of materiality, even of living things, is dependent on the scale of observation.²⁶⁻²⁸

(In all of these there is a role for randomness, not complete disorder, but quenched disorder. These are definitional in the behaviors of quantum systems: the wave functions which define possible behaviors are not purely random, but by definition are display a constrained stochasticity. Such limited randomness is then necessary in biological systems for what Stuart Kauffman has called the development of “adjacent possibles” through which adaptation and evolution can take place. Complete order would prevent adaptive changes; unconstrained disorder would disallow self-organization. In other words, quenched disorder have important consequences for the known issues related to environmental decoherence and quantum biological processes existing in a varying environment, allowing for stable biological structures.)

Also note that *appearance* implies observation. Therefore, observation at all levels is implied, it cannot be taken out of the picture at *any* scale.³⁶ Observation itself further implies sensory experience or qualia, more or less complex depending on scale. It is in this sense that our complexity approach is steeped in the underlying quantum nature of the universe which naturally merges into the participatory role of consciousness.^{3-7,36,37} Materiality, which really means an external reality of distinct objects, becomes important as we rise from the quantum to the classical realm (indeed, materiality defines that transition) (Fig. 2). But there is no fixed material “stuff” of which the universe is constructed. *Thus, the self-organizing universe necessarily is a non-material universe.*

Fundamental Awareness in some metaphysical systems

It is difficult to draw parallels between very different and/or distant metaphysical systems given the cultural and linguistic specificities with which reports of first person experiences are expressed. This linguistic imprecision, in fact, was a primary factor in the rejection of metaphysics by the logical positivists. Nevertheless, the very transdisciplinary nature of conscious phenomena and connections to the physical, quantum world, require levels of imprecision and qualitative arguments. However, we assume the validity of inclusion of these first person accountings as championed by Varela and Shear: “[...]

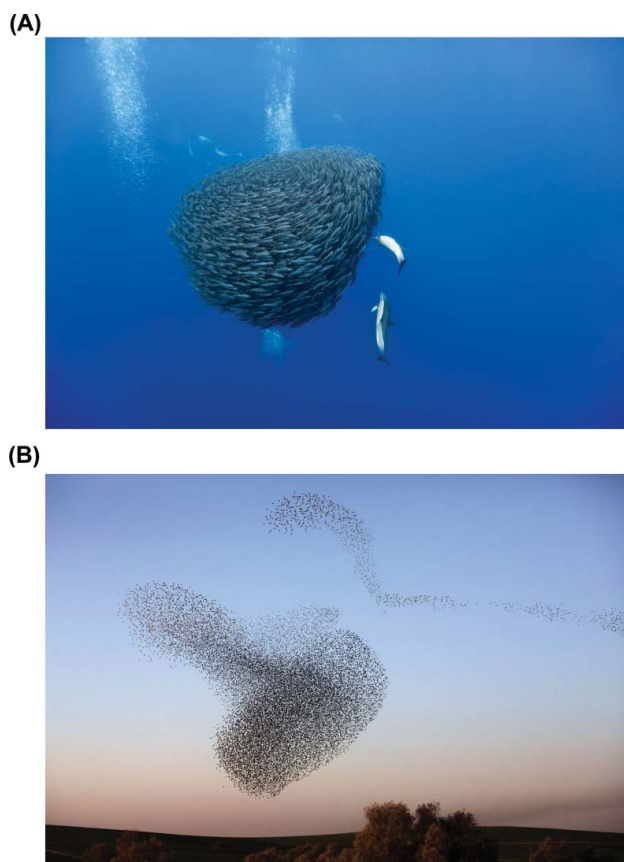


Figure 1. Examples of scale dependent appearances—things vs. phenomena—of self-organizing systems. In self-organizing systems, whether the entities involved appear to be a thing vs. a process arising from the interaction of smaller things depends on the level of scale at which the system is observed. Thus, (A) a baitball of fish appears as an object, a “ball,” at this level of scale, though it is clear from closer observation that the ball is made of interacting fish; likewise, the fish themselves, appear as solid entities at the everyday scale, but are recognized as emergent phenomena of interacting cells at the microscope level (Photographer: Christopher Swann). Another familiar example is how flocks of birds, in this case a murmuration of starlings (B), appear like moving, shifting objects in the sky, though they are clearly also interactions of the birds themselves, which in turn are emergent phenomena of interacting cells, etc (Photographer: Menahem Kahama, Getty Images).

dealing with subjective phenomena is not the same as dealing with purely private experiences, as is often assumed. The subjective is intrinsically open to intersubjective validation (second person interactivity), if only we avail ourselves of a method and procedure for doing so.”³⁹

Their “pragmatic” “method and procedure for doing so” involves acknowledging important caveats: the validity of first person experiences as data does not imply that they are privileged over other forms of experience; first person experiences worth studying are derived not from

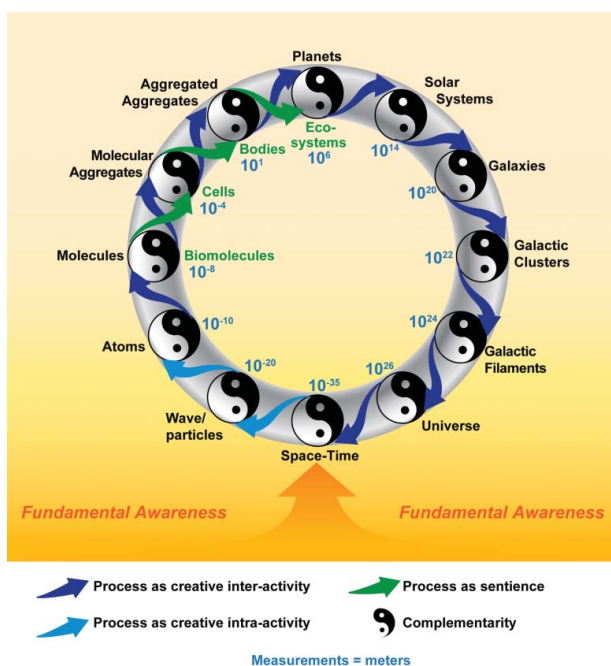


Figure 2. Schematic of the self-organizing universe as it arises from non-dual, Fundamental Awareness: a monistic, non-dual, field of pure awareness. The emergence of the dualistic universe from this Fundamental Awareness is characterized, at the first and all subsequent levels of scale, by process (as creative *intra*-activity in non-local scales, as creative *inter*-activity at higher, material scales, and as sentience in biological systems); complementarity; and recursion. As in some mathematical formulations of physical theory descriptions of existence (e.g., M-theory), the most small and the very largest scales are indistinguishable.

tentative or introductory applications of an introspective or contemplative practice, but from deep experience over time; methodologies that can provide “an open link to objective, empirically based description” must be developed. In regards this last point, in particular, it often “implies an intermediate mediation, a second-person position.” Thus, Varela and Shear hope that “overall results should be to move toward an integrated or global perspective on mind where neither experience nor external mechanisms have the final word.”

The “second person” mediation, in this sense, is exemplified, by the nature of teacher to student transmission of insights, validated by common experiences, by both participants. One doesn’t read a book on “how to meditate” and then just do it; while occasional practitioners may have interesting experiences to report, the deep practice requires a second person perspective, i.e. a mediator who speaks to the practitioner’s experience from within her own first person experience, the interaction, the reporting and response between the two serving to guide and develop a robust, deep, and usefully insightful set of experiences.

Through such iterative interactions, they reach a common framework and agreement, to then be integrated with third person investigations and hypothesis formation.

We describe insights from four such traditions selected not because of the particular clarity or authority with which these traditions speak, but because these are the ones with which the authors are most familiar from personal (first person) practice or through academic study of first person reports. What all of these share is that first person experiences point to what we would describe as an underlying, monistic, non-dual Fundamental Awareness. They are not the only formulations found in the larger diversity of metaphysical traditions in the world; indeed, even within single communities of belief, these experiences may be explained or described differently. Nonetheless, we find the commonalities between these different perspectives—and their resonance with our own personal experiences—to present a compelling case (bearing the above caveats in mind) for Fundamental Awareness as a framework for the nature of consciousness in the universe and the relationship between them.

Vedic traditions

Many Indian philosophical systems trace their origin to the ancient Vedas; in particular there is Vedanta. Within Vedanta there is Advaita Vedanta, which means non-dual Vedanta, perhaps the best-known school of non-duality, wherein Atman (the individual) and Brahman (the Absolute) are the same. The basic principles of nondual Vedanta are summarized in Adi Śankarā’s Viveka Chudamani (Crest-Jewel of Discrimination)³⁹: a) “Brahman is Reality” b) “The world is an illusion” (*Ishvara*) and, c) “The individual Self is nothing but Brahman.”

We note that Śankarā’s “illusion” is a term emphasizing that a separate world from Brahman is illusory. It does not deny objective reality, but instead means that a separate reality from the experience of consciousness is non-existent. To see the world as independent and separate from the Self (Brahman), is an illusion as it ultimately denies the very existence of Brahman, the non-dual, monistic ground of existence.

The ancient system of Śaivism also traces its origins to the Vedas and extends many of the principle concepts of Advaita Vedanta. In particular, modern Kashmiri Śaivism constitutes a body of philosophical teachings described as a *Trika* (triadic) system, consisting of *Paramāśiva* or supreme Śiva, the Absolute, undifferentiated Being (akin to Brahman); *Śakti* (universal Energy), also known as Citi (universal Consciousness,

as the creative power of the Absolute Being); and *Nara*, the individual soul.⁴⁰⁻⁴² The triadic teaching holds that there is *no difference* between Śiva and Śakti/Citi, and in fact no difference between Consciousness which is the One Paramaśiva/Citi and the individual; in other words this is a key point of departure from Advaita Vedanta. In the Śaivist view, there is a kind of complementarity between the Absolute and the individual, between the ground of being and the existent universe as we perceive it.

Śaivism is quite specific about levels of reality, processes and relationships which provide objective descriptions of basically subjective realms, the *tattvas*. This detail is in line with western scientific and philosophical approaches. *Paramaśiva* is Absolute Reality, the undifferentiated universal Being and substratum of all existence. As Citi, the creative energy of the Absolute Being, unfolds the universe without need of any substance other than Herself as pure Awareness, She (the Creatrix of the universe) is the ultimate source of all created manifestations, all objects, and all experiences of the subjective individual selves. As such, She is also the source of the mind. The dynamical aspect of Awareness, Citi, gives rise to countless beings and countless worlds. Citi represents the immanent aspect of existence, while *Paramaśiva* is the transcendent aspect of existence, the pure Being.

Lurianic kabbalah

There are no singular, universal and authoritative views in Jewish texts or lore to define the nature of “God” and of God’s relationship to the universe; the Biblical text and subsequent commentaries and embroiderings in the textual traditions are varied and inconsistent (though always colorful). However, a particular thread of discernment came with the development of Lurianic Kabbalah, the 16th century mystical tradition and practice system developed by Isaac Luria and his associates and disciples.^{43,44} This system describes the Ayn Sof (variously: “without end,” “without limitations,” “infinite”) as the non-dual, monistic substance out of which the world arises. The paradox of a finite world, with definable, dualistic qualities, arising from a non-dual infinity without features amenable to description is solved in this system by the concept of *tzimtzum*, or *withdrawal*, whereby Ayn Sof makes a (non-temperospatial) “clearing” into which the dualistic world can emanate. The emergence of our phenomenal world then proceeds to arise/manifest through four stages: Atzilut (“emanation”), B’riah (“creation”), Yetzirah (“formation”) and Assiyut (“action”).

Buddhism

We turn to a branch of Tibetan Buddhist philosophy/practice called Dzogchen (related in content and practice to Chan/Zen Buddhism, whether not they had actual influence on each other’s development). In Dzogchen, *Rigpa* is defined as a “reflexively self-aware primordial wisdom.”⁴⁵ *Rigpa* is the ultimate substratum of the “mind stream,” consisting of clear and luminous awareness. Berzin describes this:

The subtlest level of mental activity (Mind), which continues with no beginning and no end, without any break, even during death and even into Buddhahood. It is individual and constitutes the mental continuum of each Being. It is naturally free of conceptual cognition, the appearance-making of true existence, and grasping for true existence, since it is more subtle than the grosser levels of mental activity with which these occur. It is named the Light.⁴⁶

Also according to Berzin there are three aspects to *rigpa*:

1. The essential nature of *rigpa*: primal purity. *Rigpa* is primordially without stains, both being self-void and other-void;
2. The influencing nature of *rigpa*: the manner in which *rigpa* influences others. *Rigpa* is responsiveness. It responds effortlessly and spontaneously to others with compassion;
3. The functional nature of *rigpa*: *rigpa* effortlessly and spontaneously establishes “appearances.”

The first of these reflects *Rigpa*’s non-dual nature. The third reflects the spontaneous way in which it gives rise to the phenomenal world, i.e., it is not only the deepest substratum of mind, but also of the phenomenal world itself in which dualities and “appearances” arise.

Fundamental Awareness

Primary axioms

Our approach to consciousness, this framework of Fundamental Awareness, thus rests on insights from QM and studies of self-organizing systems and reflects a decision to take “pure awareness,” as it is described and refracted through the experiential lenses of the above (and other, undescribed) contemplative traditions as axiomatic. Thus, what we propose here, Fundamental Awareness, begins with these primary axioms:

1. The substratum of existence is Fundamental Awareness, i.e. pure awareness which is reflexively self-aware.
2. Fundamental Awareness is non-dual and non-material.

How to define Fundamental Awareness immediately becomes a question for which, necessarily, all answers are inherently insufficient. As Fundamental Awareness is non-dual, any attempt to make a complete linguistic or mathematically formal system to define and describe it will inevitably contradict itself or, conversely, any consistent description, with words or mathematics, will necessarily be incomplete. And therefore, we would suggest, it can only be truly known experientially (as through metaphysical practices) rather than conceptually (through empirical science or philosophy). Nonetheless, we must try. So: if awareness may be generally defined as “the state of knowing or perceiving,” Fundamental Awareness, tautologically, is “the state of knowing/perceiving the state of knowing/perceiving.”

Some associated statements considered as refinements or commentaries then follow:

1. Emanation of the phenomenal universe is initiated by a first symmetry breaking wherein Fundamental Awareness, as it begins to manifest/perceive the possibility of Self and Other, moves from a self-reflexive “I Am” to “I and That,” or Self and the Universe.
2. This primary symmetry breaking results in the dualistic phenomenal universe with the emanation of space-time, matter and energy.
3. The emergence of the dualistic universe from the non-dual Fundamental Awareness is characterized, at the first and all subsequent levels of scale, by process (as creative *intra*-activity in non-local scales, as creative *inter*-activity at higher, material scales, and as sentience in biological systems), complementarity and recursion (Fig. 2).

Core principles of the self-organizing universe

The initial emanation of space and time, matter and energy that comprise both the initiating events (Big Bang) of the universe as well as its moment by moment maintenance represent the initiation of duality in contrast to the substratum of non-duality. This is *complementarity*, in Bohr’s sense of the term, and one core principle of Fundamental Awareness, i.e., it is irreducibly present at every scale and from every perspective. One might ask, of course, whether this is truly fundamental because prior to the initiating symmetry break there is, by definition, no ability to assign qualities to the non-dual awareness, including complementarity. However, what pre-exists the initiating symmetry break is also therefore beyond description and, de facto, to describe it we are already an observer that has arisen from it. Our presence to interrogate its nature necessarily implies that this non-dual pure awareness is in complementarity with the dual, phenomenal universe. Thus complementarity is fundamental in this sense.

At the Planck scale we still do not have a clear understanding of the nature of existence, though terms often applied with varying degrees of precision are quantum vacuum and quantum foam. The smallest entities that arise at this smallest scale, inclusive of quanta of space and time, of energy (and therefore matter, in whatever form[s] it manifests at this scale), interact with each other giving rise to acts of creation, to higher level, emergent structures. We refer to this as *process* (with scale and self-organizational subclasses to be further defined, below). These higher level structures (e.g. the particle/wave entities of the Standard Model) can then interact to give rise to higher level structures and, therefore, the universe manifests in *recursive* patterns, unfurling as inflationary cooling allows for stability at every higher level of scale. Thus, these three principles—complementarity, process, and recursion—are seen operating together, working within and throughout the unified whole, the holarchy, of the cosmos and of its component parts, in many different ways, in the purely physical and biological realms.

Complementarity

The concept of complementarity was first expressed for QM in Bohr’s Como lectures.³⁷ It is so essential to understanding Bohr’s Copenhagen Interpretation that Bohr actually referenced it in his own coat of arms with the Yin-Yang symbol. Essentially, quantum phenomena exhibit complementary aspects that are revealed by specific observational modes or perspectives, i.e. there are a range of possible states prior to observation and any single observation is unable to simultaneously capture all aspects of the complete physical situation.

Interestingly, it is often forgotten that Bohr also felt that complementarities existed at higher levels of scale, including the biological and cosmological realms.^{2,36} He did not intend it to be a purely quantum organizing principle, although the emerging QM attracted most of his energies in the formulation of complementarity. We have described similar *quantum-like* complementarities in all larger scale structures.³⁶ As mentioned above, the nature of an observed “event” (to employ, intentionally, a Whiteheadian term)—thing vs. phenomenon arising from smaller things—depends on the selected observational scale.^{26,27}

As a particular “horizon of knowledge” is approached, prescribed by a physical constant (e.g., Planck’s quantum of action for the quantum scales; the speed of light for rapidly moving objects, etc.), complementary constructs need to be brought into the picture to present a fuller depiction of the underlying reality.^{8,35,47} Far away from a horizon of knowledge, one of the constructs (e.g. classical mechanics) can operate well but close to the horizon,

classical description breaks down. At these levels, relativity or QM, has to be brought in.

In fact, the whole exists not at any single level of scale, nor in a *hierarchy* of systems, but, to use Koestler's term,⁴⁸ as a *holarchy*, a holistic (quantum-like) superposition of all levels of scale.

Thus, the bait ball of fish, described above; our bodies which are comprised of human and non-human cells. At the nanoscopic scale, cells themselves disappear from view to reveal atoms and molecules self-organizing in aqueous suspension. *No single scale of observation can reveal the whole; at the moment selection is made of a scale of observation, the features of other levels of scale are hidden from view.*³⁵ which comprise the system. And such a holarchy privileges no particular scale as prime over any other. This is the same as the “part-whole complementarity” described by Nadeau and Kafatos.⁴⁹

Similarly, at cosmological scales, the horizons of knowledge are defined by the scale of the universe (the so-called Hubble radius) and the age of the universe (the Hubble age). As these scales are approached complementary constructs such as the open/closed universe; evolving/steady-state universe, single universe/multiverse, etc. emerge and are both needed to more fully describe the whole universe.^{8,47,49} It is in this approach that the flat universe would be seen as the observational “choice” or middle way between these complementarities.

It is important to emphasize the role of observation when a horizon of knowledge is approached: Whereas far away from such a horizon, the behavior of objects is well described by an existing (single) perspective, as the limits of observation are reached, a single perspective cannot work anymore. On this basis, Kafatos and Nadeau (as well as others) have argued that the fine tuning in the universe cannot be understood until the observer is fully brought into the picture.^{8,47,49}

We also emphasize that *no scale dependent or perspective dependent view is prioritized or privileged over any other*. They all have equal value, weight, or importance within the larger whole. For this reason “holarchy” is a preferred term to “hierarchy.” *There is no absolute hierarchy within all the (potentially infinite) sets of complementary pairs*. Whatever hierarchy is presented, it is contextual and dependent on observational choices. As such, *all complementarities exist in superposition*. In the quantum realm these are “true” superpositions, in the classical world holarchy provides the corresponding, quantum-like concept.

A mathematical and logical reflection of these complementarities is that Gödel's incompleteness theorems apply.⁵⁰ Since the self-organizing features of any system can be modeled as an axiomatic system, Gödel's incompleteness theorems indicate that every modeling by an

observer is necessarily incomplete. Alternate, complementary models are always necessary for successful capture of all the qualities of the entire system. Given that the entire cosmos reflects a holarchy which can at least hypothetically be modeled as such, however vast it is, complementarity is always, at every scale and within every scale, an irreducible feature. And thus it is, also, that we can acknowledge that *the limitations on linguistic and mathematical definitions of the non-dual Fundamental Awareness are the very same limitations asserted by Gödel's incompleteness theorems*.

Process

As noted, implicit in our understanding of the universe as a holarchy of self-organizing systems is that the entities comprising these systems, from quantum foam to cosmological scales, can interact with each other and thereby self-organize, giving rise to emergent structures at higher levels of scale. Thus, they are both *interactive* and *creative*. In this way, non-dual awareness gives rise to a dynamic, ever changing universe that is neither inert nor insentient (i.e., not a material entity as typically conceived in our culture). Broadly, we would consider this creative interactivity to be largely the same as that described by Alfred North Whitehead and, thus, choose the word *process* to describe the general class of these activities.⁵⁰ There are three forms of process we identify relating to different levels of scale and different modes of self-organization. While we have previously referred to all of these as “sentience”³⁰ we now restrict that word to biological entities.

Process may be described as involving three general activities:

1. sensing of the environment;
2. internal processing (within each entity) of the sensed information, necessarily a stochastic process (e.g., quantum stochasticity of the quantum realm at lower levels of scale, “quenched disorder” of complex systems at higher levels of scale);
3. emergence of a response.

These activities have distinctive features particular to different levels of scale, not only regarding the nature of stochasticity as part of the “internal processing,” but also pertaining to other issues, such as non-locality. Thus, we would now apply three terms to these processes based on the scale of entities described and the nature of self-organization whereby entities produce new, emergent phenomena: *creative intra-activity*, *creative inter-activity*, and *sentience*.

Process as creative intra-activity

In the quantum realm (meaning elements of the quantum foam and the tiers of subatomic particles of the

Standard Model) non-locality pertains, so that while, as particles, each of the entities participating in the self-organizing may be considered a well-defined, i.e. bounded particle, they also, complementarily, are unbounded waves. Thus, the words “environment” and “internal” in the above definitions, in the quantum realm, are not reified as distinct domains separated by a distinct boundary. The environment is internal; the internal is environment. Non-locality leads these aspects to be complementary to each other. Thus, we chose intra-activity to describe this form of process. Its mediators comprise the fundamental tetrad of weak, strong, electromagnetic, and gravitational processes (though gravitation to probably a lesser extent, pending verifiable theories of “quantum gravity”) (Table 1).

Process as creative inter-activity

As we move into higher levels of scale, such as those at which we find atoms and molecules, entities start to become more bounded. We are at the transition between the quantum realm and the classical world, a boundary which is arbitrary in the view of von Neumann.⁵ While non-locality certainly applies to atoms and molecules, the “internal” aspect becomes more focused, shall we say. The external, while still extending as an infinite wave function with ever more distant, potential electron shells, their probability becomes rapidly minimized. Even more so for molecules and larger scale aggregates

of molecules. In all of these systems, the stochasticity of information processing is that of the quenched disorder of the quantum world. The primary mediators at this level of scale are weak and strong forces in the organization of nuclei and electromagnetism for evolution of electron shells and molecule associated electron clouds (Fig. 3).

Atoms and molecules can then begin to self-organize in two different ways. The first has been termed “thermodynamic complexity” by Peter Cariani⁵¹ which results in most of the material aspects of the classical world: of stars, planets, and planetary fragments: water (ice, liquid or steam), rock (magma, lava, or solid), etc. Electromagnetism continues, of course, to be of primary relevance, though gravity now becomes a truly dominant effect (Figs. 2 and 3).

Process as sentience

The other mode by which atoms and molecules (and now biomolecules) self-organize is that of biological/living systems. This takes place when ions, molecules and biomolecules begin to self-organize in the liquid environments (aqueous environments on earth, at least) in which life arises. In these systems, process becomes what is readily apprehended as “sentience” (Figs. 2 and 3).^{32-34,52,53} The boundary between inside and outside becomes a defining principle of living systems. The stochasticity within these structures, single cell or

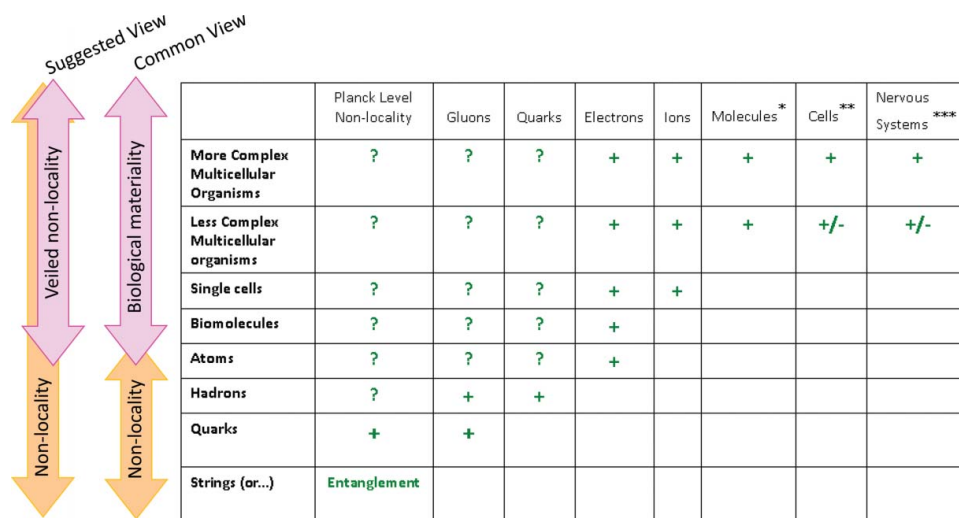


Figure 3. Some mediators of process (“creative intra-activity,” “creative interactivity” and “sentience”) at different levels of scale and complexity. In the common view, non-locality predominates at the smallest, quantum levels of scale, in which realm we term the form of process “creative intra-activity;” at higher levels of scale, with the emergence of reified boundaries in which non-locality is superseded by materiality, process consists of “creative interactivity;” and, finally, in biological forms, process presents as true “sentience.” (A recent “suggested” view indicates that non-locality is present throughout, but is “veiled;” see Kafatos and Kak⁶⁰). Biomolecules, depending on the species, include molecules such as neurotransmitters, hormones, antibodies, leptins, etc. Cells may belong to organisms (e.g. immunocytes, neurons) or microbial flora living in synergistic mutualism (e.g., gut and skin flora). Nervous systems in multicellular organisms may be, for example, in the form of nerve nets in lower species like Radiata, or central and/or peripheral nervous systems in Bilateria. (Table adapted from Theise and Kafatos²⁹)

multicellular organisms, we relate to the quenched disorder of complex systems at the “edge of chaos.”⁵⁴ In cellular autopoietic systems, the internal processing is comprised of the self-organizing interactions of the organelles, molecules and ions within the cytoplasm and the cell wall/membrane (Fig. 3). Thus defined, sentience is not separate from the physical nature of the system, it is not something between or above or underlying the components of the system, it is the process itself occurring between the component parts as expressed at the level of the whole (Fig. 2).

We are left with some interesting possibilities for reframing old questions. Are the qualia each one of us experiences as “my mind” a reflection of the arising of sentience within levels of scale in which non-locality ceases to predominate and boundedness of systems becomes reified for some species into a sense of self and other, of separation? Is the “problem of consciousness” then, not only a reflection of the seeming, bounded nature of entities in the classical realm, but also of evolutionarily adaptive development – *for some species* – of a concept of self? After all, for some species, such as bees and ants, the “being which is sentient” seems to be at the level of the hive/colony rather than at the level of the individual. We would note, too, that these seeming boundaries are merely a reflection of complementarities between scales as we have previously emphasized, having no truly inherent existence.³⁶

Recursion

Recursion is a fact of both classical and quantum realms. Scale invariance is inherent in non-linear dynamical systems as evidenced by fractal structures, which apply to classical systems.²⁴ In general relativity, on the other hand, we have holographic information stored on the surface of a black hole; given that the universe in its entirety can be considered a black hole, the universe itself is holographic.⁵⁵⁻⁵⁷ At the quantum realm, recursion operates in quantum statistics for both bosons and fermions. So, for example, the different spin (integer or half integer) quantum numbers for particles give rise to similar structures extending over many orders of magnitudes. Were it not for the Pauli principle, there would be no molecules and, therefore, no macro scale structures of any kind, living or otherwise. The Pauli principle is itself a consequence of quantum statistics, it applies to fermions (which are half-integer spin particles), a complementary type of statistics to classical statistics, wherein all particles are identical and no limitation as to how they bind together (in fact the very concept of binding is itself a quantum phenomenon) ever arises.

In biological organisms and subcomponents of them, such as neuronal systems, leaves, root systems, etc. fractal scaling operates over many orders of magnitude. In fact, dendritic patterns seem to be dominant in the brain, in trees, as well as streams of luminous matter connecting galaxies in clusters of galaxies, indicating an underlying principle which cannot be just assigned only to certain scales. Recursion, like complementarity and process, is present across all scales (as evidenced by the Universal Diagrams, Fig. 4). For example, the structure of objects made of bosons (integer spin particles) is also recursive but *appears* completely different from fermion-based structures. Fermions and bosons are also complementary and give rise to recursive structures, which are in creative interactivity with themselves and other surrounding structures.

Recursion (accepting for the simplifying concept of temporal flow) can be thought of as “deriving” from complementarity combined with process. The quantum vacuum/quantum foam complementarity results in agents that, through creative intra-activity, creative inter-activity or sentience, create higher level emergent structures; these in turn create a higher level of emergent entities on upward to the highest scales of the Universal Diagrams.

Two special features of these concepts, related to quantum “weirdness,” need to be emphasized. The first is that from the perspective of the Quantum Vacuum the universe is actually atemporal, existing in a kind of grand, all-encompassing, holarchical simultaneity, the flow of time being more a function of our human nervous systems and the stories they create, than of the physics which describe the world. The second is that the very large is contained in the very small and the very small in the very large (Fig. 2). This is the basic understanding involving superstrings: the universe comprises them but is also composed of them.⁵⁸ And in fact, here we again encounter non-locality (in the superstring field) and locality (giving rise to particles and all local objects in the universe). As has been said: “As above, so below.”

Fundamental Awareness and the three domains of inquiry

Scientific domain

Fundamental Awareness is wholly in keeping with the orthodox von Neumann interpretation of QM. It encompasses all established contemporary sciences through the lens of self-organizing systems at all levels of scale, including living and non-living systems. There are no contradictions between Fundamental Awareness and contemporary science.

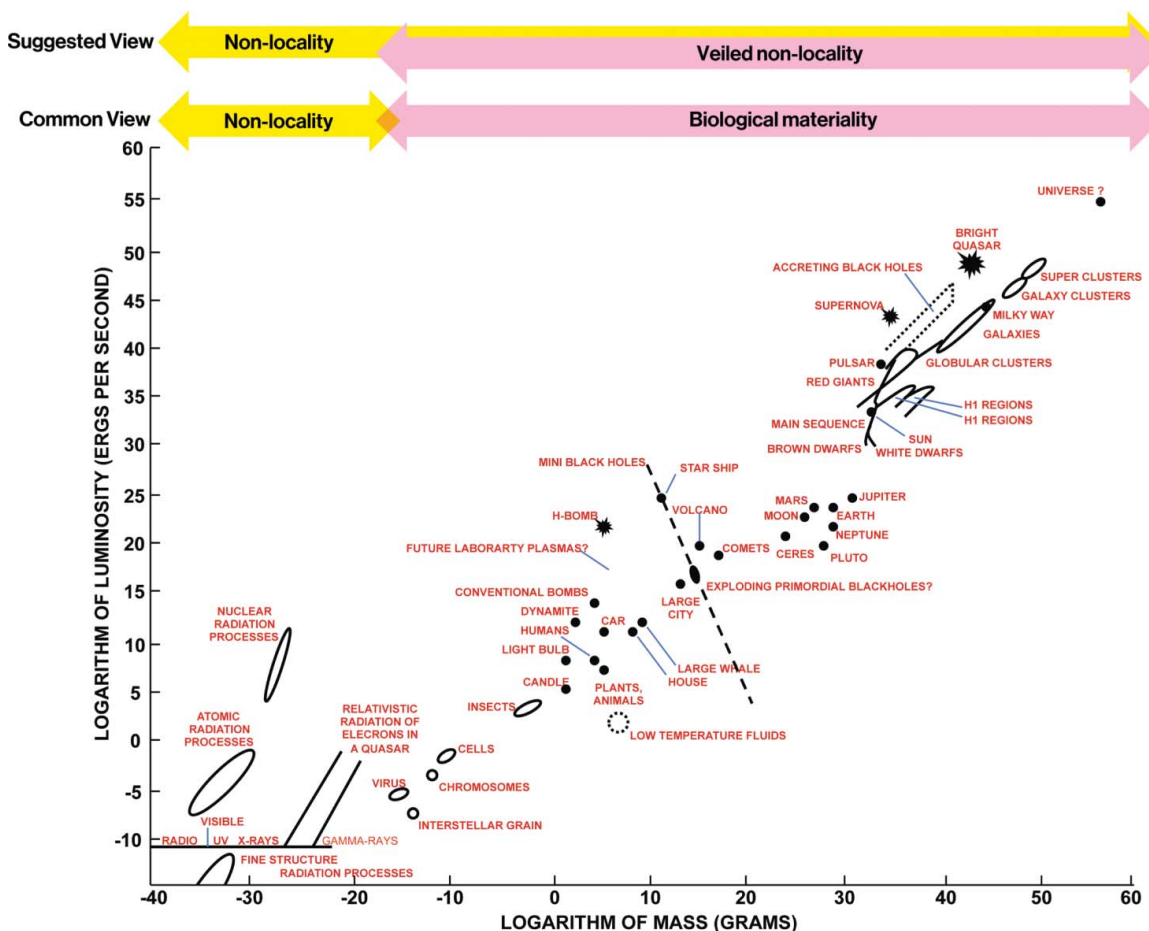


Figure 4. A universal diagram of luminous power radiated as a function of mass of objects in the universe. The scales extend over 70–100 orders of magnitude, from the quantum realm to the universe. Note the tight relationship followed by most objects (diagonally, bottom left to top right) with bright, explosive events and quanta being outside the main diagonal relationship. Similar diagrams can be drawn for other physical parameters of objects.

That being said, however, there are insights of value from this perspective. The first, already mentioned, is that the universe is inherently non-material. *Materiality is merely a scale dependent phenomenon.* To reify this materialist perspective as the only “scientific” view—as do many contemporary, self-proclaimed “skeptics”—is in fact to take a non-scientific stance, wholly in keeping with the ideas of Logical Positivists which have been thoroughly and rigorously undermined by their own quiet, backbencher, Platonist Kurt Gödel.⁶⁰ The emergence of locality from non-locality, also recently referred to as “veiled non-locality,” of the appearance of materiality from the non-material, is a readily demonstrable property of the known universe.⁶¹

Likewise, *boundaries between objects are scale dependent* as well which has implications for design of experimental systems, the acceptance of which necessitates a move from the purely reductionist scientific approaches toward a systems approach, particularly when considering biology.³⁵ Such a shift of methodology and focus is

already clear as systems theory finds ready applications throughout the sciences in this millennium. A fuller consideration of this issue is beyond the scope of this paper, but can be found in prior published discussions.³⁶

The axiomatic approach to Fundamental Awareness we begin to express herein also provides interesting possibilities for mathematization that we hope will lead to formal statements with computational and predictive power. Possible ways in which this may be accomplished, for example, include modeling the initiating symmetry break and the emergence of self/other dualities through Hilbert space analyses and applications of sheaf theoretic algebraic topology and category theory.

Currently, Kafatos has developed a mathematical formalism that ties together the observer with the observed in the most primary of relationships, the I Am and all derivatives such as I Am That statements.⁶² In summary, the mathematical formalism accepts the view that awareness is primary, operating through the three principles discussed in the present

work, all of which apply at all scales. Five logical statements are developed wherein the object and the subject are unified but in consecutive steps, the beginning of differentiation is set up. As such, the mathematics allows for a rudimentary formalism of the qualia of experience that is a simplified version of Hilbert space convention encountered in quantum mechanics, using the bra and the ket generalized vectors corresponding to the subject and the object. This approach has the advantage of bringing forward a familiarity with quantum formalism.

As quantum mechanics is the only physics we have that fundamentally relates to observation, the connection to Hilbert space is natural. The mathematical formalism does, however, go beyond specific interpretations of quantum mechanics and has strong philosophical foundations in Western philosophy as well as monistic systems of the East. Kafatos explores the full development of this axiomatic mathematical approach through when the identity of object and subject breaks down.⁶²

Metaphysical domain

Fundamental Awareness and the core principles of complementarity, process, and recursion, along with the principles inherent in a self-organizing universe find a surprising array of reflections back to the metaphysical systems described above. In mapping concepts across these different domains, we show that Fundamental Awareness is capable of providing a language for mediating the cross-cultural and cross-disciplinary interchanges.

Vedic traditions

In the Vedic traditions, as we have noted, there is tension between some of the concepts of Advaita Vedanta and Saivism. In the former, the ground of being, Brahman, is the “real” and everything of the phenomenal world arising from that is illusion, Ishvara; in the latter, the ground of being, Paramsiva, is identical with all aspects of the phenomenal world, Sakti. The tension between these concepts dissolves in the view of Fundamental Awareness in which complementarity is an irreducible aspect. Complementary states that these views are not in a relationship of either/or, but one of both/and. The Advaita Vedantist point of view is merely the complementary aspect of the Saivist view.

The detail of the Saivist view now also begins to illuminate the process whereby the non-dual substratum of reflexive awareness gives rise to the dual nature of the phenomenal universe. It is not through a sudden, cusp-like emanation in which the non-dual arises all at once. Rather, there is a process even within this emanation. The first 5 pure levels of the Saivist scheme reveal this

unfolding as the non-dual, awareness of awareness (“I-Am”) generates three sequential levels of separation leading to duality (“I-[Am]-That” or *Unlimited Will*; “That-[Am]-I” or *Unlimited Knowledge*; and I-Am-That or *Unlimited Action*). This process does not, however, lead to a full differentiation until the great power of limitation, *Maya*, limits the unlimited powers of I-ness, giving rise to space and time and still higher levels of tattvas. These processes are amenable to mathematical formalism (see above) and therefore may potentially lead to a truly formal statement of a theory of Fundamental Awareness.

Buddhism

Having stirred Buddhist views of “mind” and “awareness” into our formulation of Fundamental Awareness and the self-organizing nature of the universe that emanates from the substratum of self-reflexive awareness, we can then, in turn, use the concepts of this view to shed light on other Buddhist metaphysical concepts (summarized in Table 1).^{63,64} For example, the fact that the nature of emergent structure(s) depend(s) on every creatively interacting member of every component of the holarchy is another way of stating the Buddhist notion of “interdependence.” Given that quenched disorder/limited randomness is an inherent aspect in creative interactions at all levels of scale (providing the adaptive capacities that make living systems *alive*), there is an inevitability of mass extinction events, i.e., “impermanence.” The fundamental nature of complementarity is a direct statement of the Buddhist concept of “emptiness of inherent existence.” And that all interactive is *creative*, recursively giving rise to higher level scales of entities which in turn are creatively interactive, is analogous to Buddhist notions of Karmic law, that all effects are dependent on prior causes and these effects, themselves, then become the causes of future effects.

Lurianic kabbalah

One of the paradoxes of this Kabbalistic view of creation is that what links us and our world to the divine is also

Table 1. Comparison of complexity concepts of the universe with corresponding Buddhist concepts.

Complexity Concepts	Buddhist Concepts
Materiality or “thingness” is scale dependent	Emptiness of inherent existence
Inevitable mass extinctions	Impermanence
Nature of emergent structures depends on interactions between every member of the system, at all levels of scale	Interdependence
Creative interactivity results in recursive cycles of further creativity	Karmic law of cause and effect

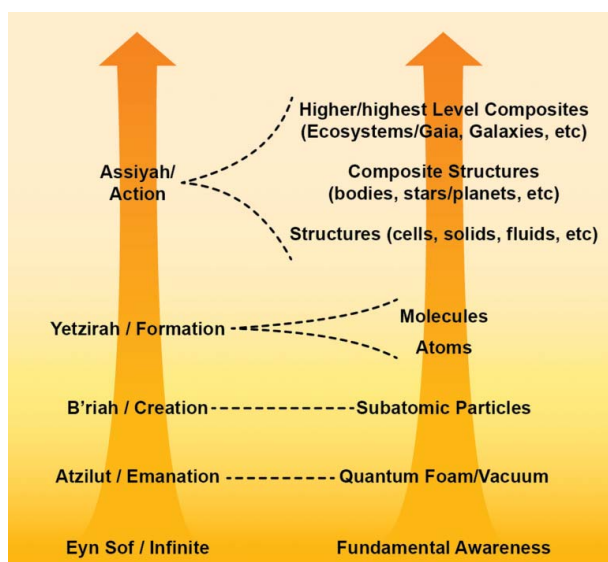


Figure 5. Complementary structures and parallel, recursive processes of Lurianic Kabbalah and contemporary science. The terms for the recursive emergence of the universe from the Eyn Sof actually reflect our scientific understandings. Atzilut/emanation: the Planck scale, dual universe emanates directly from the non-dual rather than being comprised of lower scale creatively interacting units; B'riah/creation: the Planck scale units, through creative interactivity, literally create material from the non-material, an apparent “ex nihilo”—though only apparent; Yetzirah/formation—the material substance of the universe now creatively interacts as atoms and molecules to create larger scale structures (including biologies); Assiyah/doing—the everyday world of activities, reified notions of self and other which allow evolutionary, adaptive behaviors.

what precludes our easy, direct experience of the divine. It is very similar to the issues raised in Vedic traditions regarding the relationship between Brahman/Isvara, Siva/Sakti. As in those traditions, the principle of complementarity illuminates this paradox, since the simultaneous linking to the Eyn Sof and its concealment from view relate to the scale dependent nature of existence (Fig. 5). Of particular interest is that the terms for the recursive emergence of the universe from the Eyn Sof actually reflect our scientific understandings. Atzilut/emanation: the Planck scale, dual universe emanates directly from the non-dual rather than being comprised of lower scale creatively interacting units; B'riah/creation: the Planck scale units, through creative intra-activity, literally create material from the non-material, an apparent “ex nihilo”—though only apparent; Yetzirah/formation—the material substance of the universe now creatively interacts as atoms and molecules to create larger scale structures; Assiyah/doing—the everyday world of activities, reified notions of self and other which allow evolutionary, adaptive behaviors.

The concept of *tzimtzum*⁴³ is also illuminated by the concepts of Foundational Awareness, refracted back through the Shaivist teachings: the transition from the non-dual to the dual involves, in the language of Kabbalah, a “withdrawal.” This seems no different than that of the Saivist progress from I-Am to I-Am-That. Both are the progression from seamless non-duality into a perceived, complementary state of Self and Other.

Philosophical domain

While Fundamental Awareness may be considered a core concept, or rather a core *experience* of metaphysical traditions, the concept of a universal conscious plenum in Western philosophy was by no means excluded from scientific discourse until the recent exception of the 20th mid-century onwards. However, various aspects of Fundamental Awareness can be correlated with understandings from diverse eras and stances.

Fundamental Awareness is, clearly, a form of monistic idealism. As such, it has clear relationships to other forms of idealism, reflective of some Platonic and neo-Platonic thought. In terms of Platonism, specifically, we believe that the mathematical structures that will be used to formalize the emanation of the dual universe from the non-dual, are equivalent to the Platonic ideals.⁶⁷ It should therefore come as no surprise that the features of complementarity are reflective of and reflected in the incompleteness theorems of that supreme modern Platonist, Kurt Gödel. It is also certainly compatible with aspects of the German idealism of Kant, Schopenhauer and others that were perhaps the dominant philosophical perspectives in the 19th century. This remained a useful view for many orthodox scientists in the 20th century—not only the founders generation of QM (Einstein not withstanding)—but other prominent scientists as well, even as logical positivism came to hold increasingly popular sway. For example, as Sir James Jeans stated:

The stream of knowledge is heading toward a non-mechanical reality; the Universe begins to look more like a great thought than like a great machine. Mind no longer appears to be an accidental intruder into the realm of matter we ought rather hail it as the creator and governor of the realm of matter.⁶⁵

And, of course Fundamental Awareness is a form of monism. Thus, Fundamental Awareness can be seen as staunchly within the tradition of that supreme rationalist Spinoza's world view and his "one substance."⁶⁶ Interestingly, the first and most vociferous direct critique of Spinoza, that of Leibniz' monadology, while purporting to offer a distinctly opposing view can, instead, be seen to be in direct (fundamental) complementarity to the views of Spinoza.⁶⁷ Thus, the Fundamental Awareness framework and its core principles provide links to important Western philosophical traditions, but also have the potential to clarify strong, but theoretically contradictory positions, through the instantiation of the complementarity principle.

Particular attention should be paid to two important contemporary theories/philosophies of consciousness: "Orch OR" of Hameroff and Penrose⁶⁸ and the Conscious Realism of Donald Hoffman.⁶⁹ In both of these views, small or smallest interactive units are imbued with some form of *proto-consciousness*, the self-organizing assembly of which into larger scale structures results in what we take to be consciousness, however defined, in whatever species context. A significant difference between these models and Fundamental Awareness is that this current framework specifies what can be known about this proto-consciousness and what must remain unknown. What is known: it is non-material, pure, non-dual reflexive self-awareness. Beyond that, nothing about it can be described. To call this "proto-" consciousness is to relegate it to so simplified a form of consciousness that it cannot even be recognized as consciousness, per se; on the other hand, we would argue that it is, in fact, the most all-encompassing, universal manifestation of consciousness.

However, beyond these differences, Fundamental Awareness does not, in fact, inherently contradict either Orch OR or Conscious Realism; rather, these models may be considered further specifications of some possible modes of the process we label "creative interactivity." So, for example, we view sentience to be a specific form of creative interactivity arising in the subclass of self-organizing, biological entities, i.e. those considered to be alive. Likewise, these other approaches offer specific mechanisms of creative interactivity between the specified interacting agents: wave/particle entities at the lowest levels of scale (Hoffman's conscious agents) or

between material structures (microtubules) and Platonic values embedded in space-time (Orch OR). These creative interactions, in both models, then propagate recursively through higher levels of scale as described by their authors. Thus, both models, in conjunction with Fundamental Awareness, demonstrate mechanisms whereby self-assembly allows – or even mandates – evolution first of living systems themselves, and then of species specific consciousness such as that shared by humans.

We also note that all fundamental mathematics, including algebraic geometry, category theory, etc. from which Hilbert space algebra arises, are as close as possible to Fundamental Awareness, as they reveal more primary relationships rather than models of physical or even mental realms.⁶² In fact, the three principles that are part and parcel of the mathematics, constitute the *primary qualia* as all qualia or conscious experiences are based on the subject-object relationship.⁶²

Finally, one cannot speak about Fundamental Awareness without reference to the most fully and rigorously developed philosophical system which embraces rather than hides from the implications of orthodox QM, namely, the work of Alfred North Whitehead.^{50,70} As he stated in *Science in the Modern World*:

There persists. [a] fixed scientific cosmology which presupposes the ultimate fact of an irreducible brute matter, or material, spread through space in a flux of configurations. In itself such a material is senseless, valueless, purposeless. It just does what it does do, following a fixed routine imposed by external relations which do not spring from the nature of its being. It is this assumption that I call "scientific materialism." Also it is an assumption which I shall challenge as being entirely unsuited to the scientific situation at which we have now arrived.⁷⁰

His view was that things, per se, are not the units of existence, but rather that *processes* and *events*—embodying *creativity* and *freedom* (which we see as reflective of universal, but limited randomness in self-organizing systems that allows for recursion)—are the fundamentals of existence. Thus we have adopted Whitehead's *process* as one of the fundamental principles of Fundamental Awareness. Moreover, we suggest that sensing, internal processing, and responding, activities comprising our versions of *process*, as described above, are another way of describing Whitehead's *concrecence*.

Whitehead also refers to three notions of the Category of the Ultimate: creativity, many, and one. The creativity he describes is none other than that which we ascribe to Fundamental Awareness. The relationship of his *many* to the *one* and his *one* to the *many* is none other than what we recognize as the overarching global form of

complementarity as well as smaller complementarities between adjacent levels of scale.

Thus, both Process Philosophy of Whitehead and our Fundamental Awareness framework emphasize continual *becoming* rather than a static, instantiated *being*. Further evaluation of the relationships of key themes of Whiteheadian philosophy and Fundamental Awareness, in particular an elaboration of how his “ontological principle” relates to the themes of Fundamental Awareness are beyond the limited scope of this summary paper, but merit deeper, more detailed exploration.

If qualia are all there is

We thus offer this Fundamental Awareness framework, in which an axiomatic, pure, self-reflexive, non-dual awareness is the substratum of existence. With pure awareness itself as the fundamental root from which all phenomena emerge, a proper understanding of human qualia reflects that qualia are not a “hard problem” to solve, but the foundational nature of all existence—every field, every wave/particle, every atom and molecule, every living and non-living aggregate of such, anything and everything observed, experienced, or imagined is, in fact, nothing but qualia within the awareness that is the ground of existence. In this view the human brain is not the creator of our conscious experiences, but the transducer of the fundamental, non-dual, non-material awareness into our own, personal, human minds.

The *new hard problem*, though perhaps not quite so hard, is how to understand the structures and mechanisms whereby the human brain transduces awareness into what we experience as our individual minds. The well-known radio metaphor is of use here: a radio transduces radio waves into (usually) sound (though other outputs are possible) as the brain transduces awareness into the specificities of our human minds. The “neural correlates of consciousness” are not clues to how the brain creates awareness, but to how the brain transduces awareness. A second new hard problem immediately follows: how can the human brain itself be constructed of the very awareness from which it arises? To extend the metaphor: what are the implications of a radio constructed from radio waves?

These notions also raise the question of what kinds of transducers and transductions exist in the universe. Are only human brains capable of this? Are some other mammalian brains (e.g. dolphins, elephants, porpoises) capable of it? All central nervous systems? All nervous systems? All living things, single celled or multicellular (as per autopoietic theory)? So, not surprisingly, qualia are species dependent. The appearances of a wall to a

bacterium, to a bat, to a human, are not the same. But in the end, the same laws of quantum physics apply to all species. All species would interact with quanta, whether through the visual, auditory or other sensory systems. Even the apparent division of the world into objects is itself bound to the specific structures and mechanisms of species specific sensory-nervous systems. Given that the human brain can be trained to experience the world without such divisions into separate objects, of self and others (mystical experiences of “one-ness,” of “the Absolute”), might there be species for which that view is actually normative?

Conclusions

Fundamental Awareness is not only consistent within the complete framework of 21st century knowledge, but is more complete in its inclusivity of that complete framework than other models; in fact, no aspect of contemporary scientific investigation is potentially left out. It offers a self-consistent framework to reflect the implied wholeness of the universe (that science assumes in its operational workings). Moreover, prominent emergentist theories of consciousness, such as autopoietic theory³² or integrated information theory,⁶⁹ are not invalidated by Fundamental Awareness, but may be viewed as possible elucidations and specifications of the ways in which process, complementarity, and recursion are involved in manifestations of consciousness in particular settings and scales, namely those within biological systems. Furthermore, leading panpsychist approaches, such as Orch OR and Conscious Realism may likewise be seen as specifications of processes and mechanisms within the overall framework of Fundamental Awareness.

This framework is also fully reflective of substantial lines of Western philosophical thought from Plato to Spinoza to Kant to Schopenhauer to Whitehead and Gödel and can, we believe, provide useful conceptual and linguistic bridges to the philosophical domains of discourse. It also further emphasizes the emptiness of the arguments for scientific materialism. The utility of this shift in stance is the recognition of areas for scientific study that remain outside the currently acceptable bounds of scientific discourse, important areas such as biofields, Psi phenomena, and non-Western methods of health and healing.⁷²⁻⁷⁴ Likewise Fundamental Awareness creates a set of concepts, images, and terminology that can, as we have shown, potentiate dialog between Western philosophical and scientific traditions and metaphysical insights derived from an array of Western and non-Western culture. Thus, all three domains with a stake in the understanding of consciousness can find useful, translational modes of thought and expression in

Fundamental Awareness to further consciousness studies in the coming years.

In summary, Fundamental Awareness is a formalized version of an oft-stated, though as often neglected point of view: that non-dual awareness is foundational to the universe, not arising from the interactions or structures of higher level phenomena. This framework, based on the most rigorous, successful insights of contemporary science and mathematics, shows that the universe is non-material, self-organizing throughout, comprised of a holarchy of complementary, process driven, recursive phenomena. The universe is both its own first observer and subject. The cosmos therefore, can be understood to derive *from* awareness rather than being suffused by it or giving rise to it. To say that the world is non-material and composed, a priori, of awareness is to privilege information over materiality, action over agency. In such manner, a proper understanding of human qualia reflects that qualia are not a “hard problem” to solve, but the foundational nature of all existence. All views and experiences are, in fact, nothing but qualia within the awareness that is the ground of existence.

Disclosure of potential conflicts of interest

No potential conflicts of interest were disclosed.

Acknowledgments

We are very grateful for figure art provided by Jill K Gregory, MFA, CMI (Manager, Academic Medical Illustrator, Mount Sinai Health System, New York, NY, USA) and for generous and constructive insights from Deepak Chopra, Subhash Kak, Bernardo Kastrup, and William Bushell.

References

- [1] Chalmers D. Facing up to the problem of consciousness. *J Consciousness Studies* 1995; 2:200-19.
- [2] Bohr N. The quantum postulate and the recent development of atomic theory. *Nature* 1928; 121:580-90; <http://dx.doi.org/10.1038/121580a0>
- [3] Stapp H. Quantum theory and the role of mind in nature. *Found of Phys* 2001; 31:1465-99; <http://dx.doi.org/10.1023/A:1012682413597>
- [4] Stapp H. *Mindful universe: quantum mechanics and the participating observer*. New York: Springer-Verlag; 2007.
- [5] von Neumann J. *Mathematical foundations of quantum mechanics*. Princeton, NJ: Princeton University Press; 1955.
- [6] Wigner EP. *Symmetries and reflections: scientific essays of Eugene P. Wigner*. Bloomington Indiana: Indiana University Press; 1967.
- [7] Heisenberg W. *Physics and philosophy*. New York, New York: Harper & Row; 1958.
- [8] Kafatos M, Nadeau R. *The conscious universe: parts and wholes in physical reality*. New York, New York: Springer-Verlag; 2000.
- [9] Monroe C, Meekhof DM, King BE, Wineland DJ. *Science* 1996; 272:1131; PMID:8662445; <http://dx.doi.org/10.1126/science.272.5265.1131>
- [10] Einstein A, Podolsky B, Rosen N. Can quantum-mechanical description of physical reality be considered complete? *Phys Rev* 1935; 47:777; <http://dx.doi.org/10.1103/PhysRev.47.777>
- [11] Ringbauer M, Duffus B, Branciard C, Cavalcanti EG, White AG, Fedrizzi A. *Nat Phy* 2015; 11:249-54; <http://dx.doi.org/10.1038/nphys3233>
- [12] Ma XS, Zotter S, Kofler J, Ursin R, Jennewein T, Brukner Č, Zeilinger A. Experimental delayed-choice entanglement swapping. *Nature Physics* 2012; 8:479-84.
- [13] Megidish E, Halevy A, Shacham T, Dvir T, Dovrat L, Eisenberg HS. Entanglement swapping between photons that have never coexisted. *Physical Rev Letters* 2013; 110:210403; <http://dx.doi.org/10.1103/PhysRevLett.110.210403>
- [14] Lemos GB, Borish V, Cole GD, Ramelow S, Lapkiewicz R, Zeilinger A. Quantum imaging with undetected photons. *Nature* 2014; 512:409-12; PMID:25164751; <http://dx.doi.org/10.1038/nature13586>
- [15] Lee KC, Sprague MR, Sussman BJ, Nunn J, Langford NK, Jin XM, Champion T, Michelberger P, Reim KF, England D, et al. Entangling macroscopic diamonds at room temperature. *Science* 2011; 334:1253-6; PMID:22144620; <http://dx.doi.org/10.1126/science.1211914>
- [16] Bell JS. *Speakable and unspeakable in quantum mechanics*. Cambridge: Cambridge University Press. 1988; 14 p.
- [17] Bohm D, Aharonov Y. Discussion of experimental proof for the paradox of Einstein, Rosen, and Podolsky. *Phys Rev* 1957; 108:1070-1076; <http://dx.doi.org/10.1103/PhysRev.108.1070>
- [18] Aspect A, Grangier P, Roger G. Experimental realization of Einstein-Podolsky-Rosen-Bohm gedankenexperiment: a new violation of Bell's inequalities. *Phys Rev Lett* 1982; 49:91-4; <http://dx.doi.org/10.1103/PhysRevLett.49.91>
- [19] Tittel W, Brendel J, Zbinden H, Gisin N. Violation of Bell inequalities by photons more than 10 km apart. *Physical Review Letters* 1998; 81:3563-6; <http://dx.doi.org/10.1103/PhysRevLett.81.3563>
- [20] Friedman M. *Reconsidering logical positivism*. Cambridge: Cambridge University Press; 1999.
- [21] Richardson AW. *The scientific world conception: logical positivism*, in Baldwin T, editor, *The Cambridge history of philosophy, 1870–1945*. Cambridge: Cambridge University Press; 2003:391-400. pp
- [22] Kurakin A. Self-organization vs Watchmaker: stochastic gene expression and cell differentiation. *Dev Genes Evol* 2005; 215:46-52; PMID:15645318; <http://dx.doi.org/10.1007/s00427-004-0448-7>
- [23] Kurakin A. Self-organization versus Watchmaker: stochastic dynamics of cellular organization. *Biol Chem* 2005; 386:247-254; PMID:15843170; <http://dx.doi.org/10.1515/BC.2005.030>
- [24] Kurakin A. Self-organization versus Watchmaker: molecular motors and protein translocation. *Biosystems* 2006; 84:15-23; PMID:16384632.

- [25] Kurakin A. Scale-free flow of life: on the biology, economics, and physics of the cell. *Theor Biol Med Model* 2009; 6:6; PMID:19416527; <http://dx.doi.org/10.1186/1742-4682-6-6>
- [26] Kurakin A. The self-organizing fractal theory as a universal discovery method: the phenomenon of life. *Theor Biol Med Model* 2011; 8:4-66; PMID:21447162; <http://dx.doi.org/10.1186/1742-4682-8-4>
- [27] Theise ND. Now you see it, now you don't. *Nature* 2005; 435:1165; PMID:15988502; <http://dx.doi.org/10.1038/4351165a>
- [28] Theise ND. Implications of 'post-modern biology' for pathology: the cell doctrine. *Lab Invest* 2006; 86:335-44; PMID:16482099; <http://dx.doi.org/10.1038/labinvest.3700401>
- [29] Theise ND, Harris R. Postmodern biology: (adult) (stem) cells are plastic, stochastic, complex, and uncertain. *Handb Exp Pharmacol* 2006; 174:389-408; PMID:16370336.
- [30] Theise ND, Kafatos M. Sentience everywhere: complexity theory, panpsychism & the role of sentience in self-organization of the universe. *J Consciousness Exploration Res* 2013; 4:378-90.
- [31] Guth A. *The inflationary universe: the quest for a new theory of cosmic origins*. New York, New York: Perseus; 1997.
- [32] Linde A. Particle physics and inflationary cosmology. *Contemp Concepts Phys* 2005; 5:1-362.
- [33] Maturana H, Varela F. Autopoiesis and cognition: the realization of the living," in Cohen RS, Wartofsky MW, editors, *Boston studies in the philosophy of science*. Dordrecht D. Reidel Publishing Co; 1980.
- [34] Thompson E. *Mind in life: biology, phenomenology, and the sciences of mind*. Boston: Harvard University Press; 2007.
- [35] Varela F, Thompson E, Rosch E. *Embodied mind: cognitive science and human experience*. Boston, Massachusetts: MIT Press; 1991.
- [36] Theise ND, Kafatos M. Complementarity in biological systems. *Complexity* 2013; 18:11-20; <http://dx.doi.org/10.1002/cplx.21453>
- [37] Bohm D. *Wholeness and the implicate order*. New York: Routledge Press; 1980.
- [38] Bohr N. Causality and complementarity. *Philosophy Science* 1937; 4:289-98; <http://dx.doi.org/10.1086/286465>
- [39] Varela FJ, Shear J. First-person methodologies: what, why, how? *J Consciousness Studies* 1999; 6:1-14.
- [40] Prabhavananda S, Isherwood C. *Shankara's crest-jewel of discrimination (Viveka-chudamani) by Śāṅkarācārya*. Hollywood, California: Vedanta Press; 1978.
- [41] Dyczkowski MSG. *Spandakārikā ("The Stanzas of Vibration")*. Varanasi: Dilip Kumar Publishers; 1994.
- [42] Dyczkowski MSG. *The Aphorisms of Śiva*. Albany, New York: SUNY Press; 1992.
- [43] Singh J. *Pratyabhijñā-hṛdayam ("The Secret of Self-recognition")*. Delhi: Motilal Banarsidass; 1980.
- [44] Scholem G. *Major trends in Jewish mysticism*; New York: Schocken Books; 1941.
- [45] Idel M. *Kabbalah: new perspectives*. New Haven and London: Yale University Press; 1988.
- [46] Klein AC, Wangyal T. *Unbounded wholeness*. Oxford: Oxford University Press; 2006.
- [47] Berzin A. *Berzin Archives Glossary*. Source (March 6, 2008): http://www.berzinarchives.com/web/en/about/glossary/glossary.html_80737397.html
- [48] Kafatos M. Complementary and cosmology, in: Kafatos M, editor. *Bell's theorem, quantum theory and conceptions of the universe*. Dordrecht, Netherlands: Kluwer Academic Publishers; 1989:195-210 pp.
- [49] Koestler Arthur. *The ghost in the machine*. New York, New York: Penguin Group; 1999.
- [50] Nadeau R, Kafatos M. *The non-local universe: the new physics and matters of the mind*. Oxford: Oxford University Press; 1999.
- [51] Nagel E, Newman JR. *Gödel's proof*. Revised edition, Hofstadter DR, editor. New York: New York University Press; 2002.
- [52] Whitehead AN. *Process and reality*. New York: The Free Press; 1978.
- [53] Cariani P. *On the design of devices with emergent semantic functions*. PhD thesis, Doctor of Philosophy in Advanced Technology in the Graduate School of the State University of New York at Binghamton; 1989.
- [54] Thompson E. *Life and mind: From autopoiesis to neurophenomenology. A tribute to Francisco Varela*. *Phenomenol Cognitive Sci* 2004; 3:381-98; <http://dx.doi.org/10.1023/B:PHEN.0000048936.73339.dd>
- [55] Margulis L, Sagan D. "Sentient symphony," in *The nature of life: classical and contemporary perspectives from philosophy and science*. Bedau MA, Cleland CE, editors. Cambridge: Cambridge University Press; 2010:340-354 pp.
- [56] Lewin, R. *Complexity: Life at the edge of chaos*. Chicago, Illinois: University of Chicago Press; 1999.
- [57] 't Hooft G. *Dimensional reduction in quantum gravity*. arXiv:gr-qc/9310026; 1993.
- [58] Susskind L. *The World as a Hologram*. *J Mathematical Physics* 1995; 36:6377-96; <http://dx.doi.org/10.1063/1.531249>
- [59] Bousso R. *The holographic principle*. *Rev Modern Physics* 2002; 74:825-874. 58. Greene, B. *The elegant universe: superstrings, hidden dimensions, and the quest for the ultimate theory*. New York, New York: Vintage Series, Random House Inc; 2000.
- [60] Goldstein R. *Incompleteness: the proof and paradox of Kurt Gödel*. New York: W. W. Norton & Company; 2005.
- [61] Kafatos M, Kak S. *Veiled nonlocality and cosmic censorship*. 2014; arXiv:1401.2180.
- [62] Kafatos MC. *Fundamental mathematics of consciousness*. *J Natural Social Philosophy* 2015; 11:1-14.
- [63] Theise ND. *Microscopes and mystics: a response to Stuart Kauffman's "Call to Re-Enchantment."* 2016 [In press]
- [64] Theise ND. *From the bottom up: complexity, emergence, and Buddhist metaphysics*. *Tricycle* 2006; 15:24-26.
- [65] Jeans J. *The Mysterious Universe*. Cambridge: Cambridge University Press; 1937:137 p.
- [66] Spinoza B. *Ethics*, in Edwin Curley, translator, *The collected writings of Spinoza*. Volume I. Princeton: Princeton University Press; 1985.
- [67] Stewart M. *The Courtier and the heretic: Leibniz, Spinoza, and the fate of god in the modern world*. New Haven Connecticut: Yale University Press; 2006.
- [68] Hameroff S, Penrose R. Reply to criticism of the 'Orch OR qubit' - 'Orchestrated objective reduction' is scientifically justified. *Physics of Life Rev* 2014; 11:94-100; <http://dx.doi.org/10.1016/j.plrev.2013.11.013>

- [69] Hoffman DD. Conscious realism and the mind-body problem. *Mind Matter*. 2008; 6:87-121.
- [70] Whitehead AN. *Science and the modern world*. New York: Macmillan Company; 1925.
- [71] Tononi G, Koch C. Consciousness: here, there and everywhere? *Philosophical Transactions of the Royal Society London B*; 2015.
- [72] Bushell WC, Olivo EL, Theise ND, editors. *Longevity and optimal health: integrating eastern and western perspectives*. Annals of the New York Academy of Medicine. New York New York: New York Academy of Medicine; 2009.
- [73] Kafatos MD, Chevalier G, Chopra D, Hubacher J, Kak S, Theise ND. Biofield science: current physics perspectives. *Global Adv Health Med*. 2015; 4(suppl):25-34; <http://dx.doi.org/10.7453/gahmj.2015.011.suppl>
- [74] Radin DI. *The conscious universe: the scientific truth of psychic phenomena*. New York, New York: Harper Collins; 2009.