

Article

Substratum Reality & Consciousness

Alex Vary*

Abstract

In this article, the author explores the role of entropy, chance and choice in the nascency, emergence, and evolution of consciousness which putatively sprang from the elementary raw materials and inanimate minerals of the cosmos - instantaneously from a profound void. Given the nucleating concepts and related factors cited in this paper, it is consistent to presume that the foundation of the physiostratum and the cosmos is a universal energetic substratum where the laws that generate the cosmos are written. The reality of the substratum is evident and that it contains a modality that not only generated the cosmos but the consciousness which contemplates it.

Key Words: human consciousness, nothingness, evolution, cosmos, emergent consciousness, energetic substratum, negentropy, chance, choice.

Introduction

Cosmologists declare: There was nothing - then bang! - there was something: atoms, stars, planets, galaxies, and so on. Of course, there are but a few who question the currently accepted theory of the spontaneous beginning and the minutely detailed evolution of the Big Bang. After all, the mathematics involved is explanatory, consistent, and elegant. Among those who dispute Big Bang theory based on the cosmic microwave background and red-shift and is Halton Arp (*Seeing Red*); but neither Arp nor others offer sufficient statistical-observational evidence which can successfully contradict the current theory. So we provisionally accept the notion that the cosmos suddenly emerged, expanded, and evolved from nothingness.

The sudden appearance of somethingness from nothingness has inspired inquiry into the nature of that somethingness which became endowed with consciousness. Research and empirical explanations abound regarding the biological implementations, modulations, and manifestations of consciousness. Essays in this paper explore the role of negative entropy, chance and choice in the nascency, emergence, and evolution of consciousness which putatively sprang from the elementary raw materials and inanimate minerals of the cosmos which, in turn, apparently sprang instantaneously from a profound void.

Cosmology theory holds that the cosmos emerged in stages, perhaps randomly, stochastically. Subsequently, consciousness somehow emerged; that is, consciousness in humans. Among those humans are individuals who facetiously assert: I know that I'm conscious, but I'm not at all sure about you. Others thoughtfully wonder: How and why did this immense material cosmos spring into being and why am I here to ask? The latter question presumes an answer based on an

* Correspondence: Alex Vary, PhD, Retired NASA Scientist & Independent Researcher. Email: axelvary@wowway.com

Note: An abstract version was presented at Toward a Science of Consciousness 2014.

existentialist premise. This paper avoids that sort of speculation and focuses instead on a review of ideas about the knowable factors connecting the cosmos, consciousness, and the singular nothingness, the energetic substratum, from which they sprang.

Grand Design?

Our tiny globular habitat, our world, clearly formed from the tangible stellar dust and debris of the cosmos, but the entire material content of the cosmos apparently emerged from an intangible void. Most physics theorists and cosmologists are quite content with the notion that the material content of the cosmos popped out of an antecedent void. The nature of this void and its tangible products are interesting because human consciousness is one of those products. This omnipotent void has been described by Heinz Pagels in his book *Perfect Symmetry* as, “The most complete void that we can imagine . . . no space, time or matter. It is . . . without place, without duration or eternity, without number . . . yet this unthinkable void converts itself into the plenum of existence . . .” perhaps as a consequence of preexisting physical laws.

Pagels then wonders, “Where are these laws written into the void?” and he then infers, “It would seem that even the void is subject to law, a logic that existed prior to time and space.” Perhaps the universal void contains the physics, logic, design, energy, and infinite dormant potentialities needed to spawn the cosmos - even uncountable coexisting cosmoses. Does the void indeed contain a library of instructions, formulae, and processes for the formation of habitable worlds, each complemented with unique sentient beings?

A virtually unchallengeable observation is that it requires an immense dynamic cosmos and a tremendous amount of time to produce minuscule pockets of intelligent consciousness on congenial life-friendly globular habitats. According to Stephen Hawking it also requires a grand design. In *The Grand Design* Stephen Hawking explains how “. . . understanding of the laws governing us and our universe [may] lead to a unique theory that predicts and describes a vast universe full of the amazing variety that we see.” Hawking’s *laws of the universe* are putatively so exquisitely formulated that they govern the assembly of the cosmos down to the minutest details of forces, fields, and quantum particles.

Hawking does not explain where the grand design and laws of the universe originate, reside, or how they initiate the cosmos. He avoids suggesting a consciousness or entelechy that conceives and directs the process. Instead, Hawking advocates the idea that, “Spontaneous creation is the reason there is something rather than nothing, why the universe exists, why we exist. It is not necessary to invoke God to light the blue touch paper and set the universe going.” But, implicit in Hawking’s universal laws and grand design is the conjecture that they preexist the emergence of the material cosmos. Sir Roger Penrose in *The Road to Reality* offers a complete guide to the laws of the universe!

The reasoned supposition regarding the preexistence of the laws of the universe may be moot if they self-formulated coincidentally with the emergence of the cosmos. This would be the case for what might be termed Darwinian cosmology or non-deterministic stochastic cosmology. Accordingly, Hawking alleges a multi-universe because it allows the means by which a particular

finely tuned universe, such as ours, may evolve and survive as one among many, if it is fit to survive. In their struggle to survive, some universes may succeed, others may fail. Some enjoy extended lives, while many collapse, become extinct due to poor or profligate use of available energy and resources beyond permissible parameters. The most interesting of those fit to survive are universes possessing physical properties that produce environments for evolving and sustaining self-aware conscious beings like us. All this is putatively from a random process.

Sir Martin Rees (*Just Six Numbers*) identifies key parameters that combine to govern the shape, size, and texture of our cosmos. There is an inexplicable random aspect to the conjunction of these specific numbers; but the values of the Rees parameters apparently assure the origination and survival of our kind of cosmos.

Somethingness from Nothingness

The ancient Romans rightly observed that *ex nihilo nihil fit* (nothing is created from nothing). Let us provisionally agree that the universal void contains nothing (no-thing) and still generates the cosmos which ultimately contains no-thing. The cosmos does, at its basic subatomic level, consist of quantum entities, but these are just no-things. Quantum no-things agglomerate gravitationally to manifest as tangible contents of the cosmos: gas, dust, galaxies, stars, accompanied by energetic fields, and forces and their interactions. Quantum no-things coalesce – ultimately forming the physiostratum, the cosmos with its habitable worlds and endless varieties of amorphous and organized entities, including thinking beings.

The *nothingness* of the universe may be presumed to be unbounded and transfinite; and perhaps within this nothingness there are potentialities, virtual designs, and mathematical objects that define basic quantum entities, their attributes, and interactions in the cosmos – or at least sustaining energies or motivating forces. This omnipotent nothingness produces the tangible *somethingness* of the universe – somehow generates space, time, and physical content and laws of the cosmos – putatively in a Big Bang.

So maybe it is true that nothing comes from nothing, because the universe which contains no-things spawns a material cosmos which in basic essence contains no-things. Although the cosmos contains no-things, these no-things are abundant, ubiquitous and fill an incredibly immense but bounded spatiotemporal domain. We are composed of these no-thing entities, perceive them as things because we are made of them, interact with them, and manipulate them; albeit quite often by expending considerable energy doing so.

The elemental no-things have names. They are electrons, protons, atoms, and quarks that the Standard Model of quantum physics posits as the basic building blocks of matter. There are also photons and other bosons which, according to the Standard Model, constitute electromagnetic waves, fields, forces that form and modulate the elemental no-things and their gravitational agglomerations: molecules, muck, microbes, and mountains.

I refer to particulate elemental no-things as *quantumthings* because they are abstract and resist geometric description. Quantumthings, though possessing specific physical attributes such as

mass, spin, and charge, cannot be pinned down regarding their precise form or locus. Electromagnetic waves, fields, bosons, and nuclear forces require a different designation. I term them *continuumthings* – they transpire exclusively in a postulated substratum, a hyperspacetime continuum, as opposed to the physiostratum *discontinuum*; as explained in Vary's *My Universe - A Transcendent Reality*, where the substratum is termed the mesostratum.

Lee Smolin, in *The Three Roads to Quantum Gravity* notes that, according to loop quantum gravity, there is an atomic structure to space, describable in terms of the nodal spin networks suggested by Roger Penrose (*The Road to Reality*). Smolin acknowledges that the most improbable and puzzling aspect of this atomized space is its apparent smooth and continuous nature. Smolin explains the smoothness by proposing that the granularity of space and concordant discontinuity of time are on the scale of Planck length (10^{-33} centimeter) and Planck interval (10^{-43} second). We, by default, regard spacetime as a smooth uninterrupted mathematical continuum while *that* attribute resides *only* in the substratum hyperspacetime continuum.

Observable Reality

It is logically inconsistent that the terms *universe* and *cosmos* are used interchangeably in the scientific and popular literature. The cosmos is more properly called the *observable (portion of the) universe*. This concept presumes that the cosmos (our cosmos or any coexisting cosmos) is but a subset of *the universe*. The cosmos is thus a knowable, tangible, measurable, observable aspect of the universe. It follows that the universe in its totality is ultimately unknowable – unobservable. But, if it is not observable, is it an extant reality – or merely a transcendent or potential reality? I suggest that this basic reality is the energetic *substratum* of our observable reality – of our *physiostratum*, our world, our cosmos. It is from the substratum that the basic elemental quantum particles emerge and populate the cosmos, as explained later in this essay.

During the early decades of the twentieth century, theoretical physicists Niels Bohr, Werner Heisenberg and others introduced the Copenhagen interpretation which is the generally accepted view in physics and the most commonly taught interpretations of quantum mechanics. The Copenhagen interpretation holds that quantum mechanics does not yield a description of an objective reality but deals only with probabilities of observing, or measuring, various aspects of energetic quantum entities that fit neither the classical idea of particles nor the classical idea of waves. Quantum electrodynamics describes the propagation of energy in terms of wavefunctions; calculating *only the probability* of where their energy quanta will appear, without offering a good model of how it actually happens. The act of measurement somehow causes the set of predicted probabilities to randomly exhibit only one of all the possible values. The measurement *observes* the *collapse* of the particle wavefunction.

John Archibald Wheeler summarized the Copenhagen interpretation as, “No phenomenon is a real phenomenon until it is an observed phenomenon.” John von Neumann in *The Mathematical Foundations of Quantum Mechanics* concluded: Only a conscious observer doing something that is not encompassed by physics can cause *wavefunction collapse* to be apprehended, because only a conscious observer can actually make an observation . . . famously adding that, during wavefunction collapse, “a miracle happens.” The John von Neumann miracle is exemplified by

the measurement problem associated with the transit of a quantum particle, say a photon, from source to detector, which evolves according to the Schrödinger wavefunction and *spreads out* in space. But actual measurement in physical reality finds it deposited at a unique spot on a detector surface. The measurement does something to the process under examination. That something is unanticipated by the Schrödinger wavefunction's probabilistic evolution, it is the wavefunction collapse.

When distinguished scientists like John von Neuman and John Wheeler insist that a phenomenon is real only if and when it is observed – one need ask: just what are they talking about? Clearly, it is not the tangible objective reality which encompasses us and constitutes our embodiment. They are speaking about an unseen, unobservable reality – a parallel reality – an *energetic substratum* that includes mathematically imagined quantum wavefunctions that *collapse* into the material world. The observation of wavefunction collapses is an auxiliary issue. Consideration should be given the wavefunction prior to its collapse, while it spans the substratum. Resolution of this issue requires a conceptual framework, a model, that establishes the relation between the physical world and an experimentally evident substratum.

The actual act of observation is rather mundane – literally, as in the case of light wavefunction collapses on the retina (perhaps of the order of trillions per square centimeter per second) which produce, replenish, and sustain the dynamical images (of the world) that we *see* – in our brain. Photons in transit, that is light waves, or wave packets, are not observable because they traverse the substratum mentioned previously. When photons (light wave packets) traverse the substratum, they are decoupled from the physiostratum while *in transit* from a physiostratum source/emitter to a physiostratum receptor/detector (photo emulsion, CCD array, or human retina) where they are detected – observed. The decoupling is self-evident because the *velocity of light* is a constant independent of the velocity of the photon source/emitter. The decoupling was famously demonstrated by the Michelson–Morley experiment in 1887. Photons (light waves, electromagnetic radiations) return to the observable objective reality of the physiostratum as quanta of energy – absorbed (detected, sensed, amplified) by agglomerate gravitational matter of the physiostratum.

One can posit a cosmic energetic substratum in place of the aether, which early in the last century was considered a substance that carries light waves (this was disproved and abandoned). It can be demonstrated that light waves, indeed all electromagnetic waves and fields, transpire in the substratum (a hyperspace, not a substance, transcending gravitational physicality by definition). The reality of the substratum has been evident since Thomas Young's double slit experiment and the Michelson–Morley interferometer experiment.

Energetic Substratum and ZPF

Are the emergence of life, a thoughtful brain, and consciousness perhaps potentiated by phenomena inherent to the cosmic milieu? This life and consciousness-generating activity may involve the emergence of signals devoid of and not requiring a physical network – not any 'hard wiring' at all. It can be argued that the life-generating process began spontaneously as random statistical fluctuations of the energetic substratum – which may be taken as identical to the zero-

point field (ZPF) – the theoretical substrate which produces an omnipresent quantum foam.

The concept of zero point field energy was developed by Albert Einstein and Otto Stern in 1913, as a corrective term added to a zero grounded formula developed by Max Planck in 1900. Zero point energy is the lowest possible energy that a quantum mechanical physical system may have; it is the energy of its ground state. All quantum-mechanical systems undergo fluctuations - even in their ground state – have a zero-point energy – a consequence of their wave-like nature.

Joachim Keppler (*Frontiers in Psychology* 4:242, 2013) suggests that fluctuations in the ZPF may also provide the fundamental mechanism for consciousness. The essential function of this mechanism is the formation of stable attractors; cohesive dynamic systems with a set of physical properties toward which the systems tend to evolve. When realized physically, the attractor may be a fractal structure known as a strange attractor. According to Keppler, suitable quantum waveform-signal inputs induce a transition to an ordered phase that prompts a neural network assembly to become an attractor; a pattern of conscious activity.

If the ZPF - is involved, then what is the nature of the dynamic systems involved – how do they generate quantum wavefunctions or signals that impinge on the physiostratum? The proponents of string and M-theory suggest that certain kinds of *mathematical objects* – oscillating continuumthings – comprise signals that generate quantumthings – the elemental raw materials that aggregate and compose the material cosmos.

Mathematical Objects

Euclid and other ancient geometers gave spatial dimensions, meaning by positing mathematical objects such as lines, triangles, circles, spheres, cubes, and other regular and irregular geometric solids. Descartes recognized relations among geometric points and temporal instances, giving them meaning by means of algebraic coordinates and equations. This was followed by the notion of multidimensional spaces. Then, physicists elaborated on the geometric properties by imbuing space and time with material meaning. In string theory, *synthetical* space topologies are conjectured for producing quantum particles and force fields that interact with their materialized clusters (*Shape of Inner Space*, Shing-Tung Yau).

Various non-Euclidian abstract spaces of Gauss, Lobachevsky, Bolyai, and Riemann maintained the notion of three obvious spatial dimensions along with the notion of four-dimensional spacetime – the union of the three dimensions of space with the single dimension of time to create a combined entity. The deformation of synthetical spacetime ostensibly explains gravitation. Indeed, Einstein's relativity theory succeeds so well because it treats *spacetime* as a deformable substance! Current theoretical concepts of spacetime are not restricted to just four dimensions. In an attempt to explain elementary particles, string theory posits a ten-dimensional hyper-spacetime. M-theory unifies five string theories in an eleven-dimensional hyperspace.

Calabi-Yau manifolds constitute an interesting class of synthetical geometric spaces, that is, mathematical objects – which Shing-Tung Yau showed to be possible upon proving the Calabi conjecture. These space topologies are based on *complex* coordinates which bifurcate into even

numbers of *real* dimensions. The six-dimensional case is of special interest to string theory, where it serves as a candidate for the geometry of the theory's six hidden, or extra *compactified* dimensions. They are presumed to be compactified because they are not observed. They are infinitesimal in relation to the metrics of three dimensional space. This compactification notion is really an unnecessary ploy. After all, if we can assign four pseudo dimensions to spacetime, then we can keep adding more dimensions as needed to satisfy, perhaps never quench, the thirst analytical geometers have for more spaces.

Geometric compactification, the rolling up of a space so that it is minute yet definable, is considered necessary for a viable string theory. In string theory, different ways of compactifying the extra dimensions lead to the notion that their modulations comprise elementary physical objects such as electrons and photons. In this sense, synthetical spacetime manifolds are considered to be *able* to manifest as physical objects. Various vibrational modes of these spacetime manifolds have been taken as being the origins and constituents of quantum particles, fields, and forces that pervade the cosmos. Thus, spacetime *origami* has emerged as a tool to fold-forge physical particles.

Embodiment of Consciousness

Our embodiment is primarily a *survival machine*, an automaton, with no inherent need for self-analytic consciousness. It is a communal super-colony consisting of trillions of cells. The evolutionary push for evermore complex communities of cells reflects the biological imperative to survive, to control and to make better use of the environment. Complexity leads to more awareness, that is, to a greater capability to react and adjust to the environment and thence to improve the probability of survival. When cells band together, differentiate, organize and communicate, there is an exponential increase in the organism's global self-awareness and ability to adjust to environment and change. Over time, this pattern of differentiation – the distribution of the workload among the members of the community – became embedded in the genes of every cell in the community, significantly increasing the organism's efficiency and its ability to survive. A command center, the brain, governs the super-colony and its ambulation and responses to chance events and encounters, confrontations and struggles with choice.

In *The Conscious Mind* David Chalmers describes an isomorph, "A zombie [that] is just something physically identical to me but which has no conscious experience - all is dark inside." Perhaps, but after all, the first duty of this zombie, this survival machine, automaton, is self-maintenance, maintenance of its surroundings and infrastructure, securing and consuming food, digestion, habitat construction, security, reproduction; with no urgent need to engage in social intercourse or to assume human consciousness. But this is contradicted by the emergence of a consciousness that craves social order and develops language for communication and declaring and defining a unique selfness.

Are human survival machines just byproducts of a random stochastic process that coincidentally generates a consciousness having the ability to observe, experience, and evaluate the selfsame process? Many acquire a deeply contemplative, imaginative, analytic consciousness. Regarding *that* mode of consciousness; the majority seem to be quite superfluous – save perhaps for a few

scientists, innovators, artists, philosophers, mathematicians, historians – like Einstein, Tesla, da Vinci, Spinoza, Ramanujan, Durant. Of the rest, a small proportion is sufficient for creating and maintaining infrastructures needed to provide comfort and resources for such prodigies and observers of the cosmic process. Beyond these, are the masses that, along with some key players, participate in the side-shows of history: the Golden Age of Greece, the Renaissance. This should not be taken to demean the flora and fauna which form the primordial, past, recent, and contemporary foundations and complements to human evolution, sustenance, experimentation, and consciousness.

Time, Entropy, Consciousness

Probably, a paramount function of consciousness is that aspect of it which gives meaning to the perceived flow of time. It is something so familiar to us that it comes as a shock to learn that our theories of the physical world have had, up to this point, virtually nothing to say about it – or why time needs to *flow* at all.

The body consists of a collection of ticking biological clocks but, like the cuckoo clock on my wall, they know not *what time* it is. The configuration of the cuckoo clock hands at any instant depend on my setting of the pendulum bob. Like the cuckoo clock, the brain perseveres, in an eternal *now*, devoid of *knowing* the flow of time. Yet biological timekeepers keep on ticking, setting the timing and pacing of embryonic development and maturation. We are not intimately aware of the multi-cellular timekeeping; it seems to be programmed, presumably as a result of trial and error and a push toward organic efficiency.

Above and beyond cellular self-awareness and biological timekeepers, human consciousness assigns meaning to duration and distance, while ostensibly *outside* its perception of time and space. Consciousness is distinct from mathematical manipulation and measurement of Cartesian spatiotemporal coordinates so descriptive of our physics experiments. Consciousness is ‘above the fray’ always endeavoring to put things in order by insisting: ‘this must have happened before that happened’ - ‘this belongs here, that belongs there’ - ‘this thing persists even when it is not observed’. It is my consciousness that puts these words in the order you see; my consciousness writes equations; my consciousness arranges lines and symbols in the figures I draw; my consciousness assigns temporal context and nuance to the words I choose.

Roger Penrose in *Cycles of Time* comments on the relation between the flow of time and the increase of entropy. Penrose posits that in its initial state the cosmos exhibited an extremely low state of entropy, that is, a high state of order. Entropy has subsequently increased continually with time, in accordance with the precept of the Second Law of Thermodynamics. Penrose points out that “. . . our experience of the passage of time is dependent upon an increasing entropy as part of what constitutes our conscious feeling of the passage of time; so whatever time direction we believe to be the ‘future’ must be that in which entropy increases.” Penrose argues, “our psychological experiences of the passage of time would always be such that the Second Law holds true, irrespective of the physical direction of the progression of entropy.” Our conscious experiences of time is such that the Second Law always holds true and thus establishes the relation between time and entropy.

Life and Negentropy

Let an egg drop from a table and crash asunder on the floor. We do not expect the egg to self-assemble because that is inconsistent with the Second Law and would be such an enormously improbable sequence of events that we can simply reject it as a realistic possibility. This contrived incident (egg crashing asunder) is simply the interruption of a non-random process destined to produce an increasingly organized living entity that, given the right circumstances, could become the founder of a dynasty of purposeful, self-aware, replicating living creatures. What is exemplified in this case is a pocket of *negentropy* in the midst of increasing entropy (time flow) - seemingly directed and informed by an entelechial consciousness. What happens in this case may be stochastic but not randomly stochastic as is being presumed for the emergence and evolution of the cosmos!

In *What Is Life?* Erwin Schrödinger described a theoretical awakened, growing, evolving potentiality as utilizing *negentropy*. Schrödinger elaborates on the marvelous faculty of living organisms, to delay decay towards thermodynamic equilibrium (heat death) by feeding upon negative entropy, attracting, consuming a stream of negative entropy into itself - to compensate the entropy increase it produces by living and maintaining itself on a stationary and fairly low entropy level. The physical results of this negentropy are sentient thinking creatures and beings endowed with the capacity to contain/exhibit consciousness.

In *What Is Thought?* Eric Baum argues that the mind is programmed by DNA. He proposes a computational explanation of consciousness and thought. Baum maintains that the complexity of mind is simply the outcome of evolution and that to understand the mind, we need to understand the evolutionary process that produced it in computational terms. He assumes that evolution discovered corresponding subroutines and shortcuts to speed up its processes and to construct creatures whose survival depends on quickly making right choices. Baum concludes that the structure and nature of thought, meaning, sensation, and consciousness simply emerge from a non-deterministic evolutionary process.

It may well be argued that generation of thoughtful life and consciousness in the cosmos requires a reversal of entropy. But, this leads to the paradox of how a seemingly chaotic cosmos or random stochastic process can produce isolated pockets of order and organization – a localized reversal of entropy. This organized entity is putatively spawned in pockets of order out of chaos – it manifests as a living consciousness that contemplates its origin and its mission in the entropy-generating milieu that spawned it.

Chance, Choice, Improbability

When we tie together the ideas of negentropy, the energetic substratum, the zero point field, wavefunction collapse, and tangible attributes of mathematical objects, we presumably approach discovery of the nature of the cosmic materialization process and the resulting emergence of human consciousness. What we lack, principally, is knowledge about the stochastic processes that combined these factors. This knowledge is unavailable because of the randomness of the stochastic process involved. The non-deterministic stochastic process is a collection of variables,

representing the evolution of systems of random values over time.

Unlike a deterministic stochastic process which can evolve only one way, in a random stochastic process there is indeterminacy (as in the case of previously-mentioned wavefunctions collapses) – even if the initial conditions are known. There are usually infinitely many directions in which the process may evolve. Although we may have discovered basic building blocks, we are stymied about how they assemble; producing seemingly improbable outcomes in unpredictable successions of random stages.

In *The Improbability Principle*, David J. Hand explains that virtually all seemingly random coincidences associated with chance events and conscious choice are explained by the improbability principle. He asserts that extremely improbable events are commonplace; a consequence of a collection of more fundamental laws which all tie together to lead inevitably and inexorably to the occurrence of extraordinarily unlikely events. According to these laws, and the improbability principle, “the universe is in fact constructed so that these coincidences are unavoidable: the extraordinarily unlikely must happen; events of vanishingly small probability will occur.” In *The Improbability Principle* Hand endeavors to resolve the apparent contradiction between the sheer unlikeliness of such events, and the fact that they nevertheless keep on happening.

Hand notes that the improbability principle is not a single equation, such as Einstein's famous equation, but a collection of strands which intertwine, braiding together and amplifying each other, to form a rope connecting events, incidents, and outcomes. The main strands are the law of inevitability, the law of truly large numbers, the law of selection, the law of the probability lever, and the law of near enough. Putatively, anyone of these strands is sufficient, by itself, to produce something apparently highly improbable, but it is when they combine and work together that their real power takes hold. Hand insists that when these laws - the intertwining strands - are put together, virtually every simply unbelievable coincidence may be explained.

But, there is an adjunct to the improbability principle and laws that transcends the coincidental intertwining of chance events: It is choice – inspired, informed, uninformed, or random – by a self-aware consciousness.

Improbable Loop Tangled Entelechy

The improbability of abiogenesis and evolution of higher life forms has been compared to the improbability of a tornado sweeping through a junkyard and assembling an airplane. From the modern evolutionary standpoint, while the sudden appearance of cellular and higher life forms are improbable, evolution proceeds nevertheless, slowly, stepwise, stochastically. Viewing the human body as a communal super-colony consisting of trillions of differentiated cells moves our attention to an exploration of symbiosis; mutually-beneficial living-together, by choice, of unlike organisms – of interdependent cell populations and organs.

Some symbiotic relationships are obligate in that both symbionts entirely depend on each other for survival. Others are facultative, meaning that they can but do not have to live with the other

organism. Symbiotic relationships include those associations in which one organism lives on another, or where one partner lives inside the other (such as lactobacilli bacteria in humans). Strange symbiosis loops prevail wherever life appears, down to the level of individual cells which cannot exist viably without the presence of symbiosis among enzymes, amino acids, cell membranes, and nuclei.

The raw materials, minerals, molecules of life and sustenance may come together by chance, but the living entity consists of much more than a fortuitous assemblage of those things. The assembly needs to be just right. It must follow a strict pattern, a template which assures that the entity is fully equipped to function and make choices. The improbability principle attempts to explain how all these factors combine coincidentally, spontaneously. But, does it explain how the first free-living cell, that may have alighted on a grain of sand, successfully sought and found nourishment and perhaps a cooperative genetically compatible or symbiotic partner? If it needed no mate to reproduce, it still needed a genetic code of instructions to replicate.

Even the simplest free-living cell has 482 genes coding for all the necessary enzymes. The enzymes are composed of about 400 amino acids. The genes are functional only in the presence of preexisting genetic factors, for example, a cell membrane. But even a simple mycoplasma cell can survive only by parasitizing more complex organisms, which provide nutrients it cannot manufacture for itself. Of course, it may be argued from the improbability principle that multitudes of compatible, symbiotic cells – together with all the necessary amino acids, enzymes, and genes – emerged spontaneously, adjacently, synchronously.

One of the most improbable symbiosis loops is described by Douglas Hofstadter in *Gödel, Escher, Bach: an Eternal Golden Braid*. Hofstadter describes a paradox which he entitles “which came first—the ribosome or the protein?” He writes: Ribosomes are composed of two types of things: (1) various kinds of proteins, and (2) a kind of RNA, called *ribosomal RNA* (rRNA). In order for a ribosome to be made, certain kinds of proteins must be present, and rRNA must be present. For proteins to be present, ribosomes must be there to make them. Hofstadter asks, “Which comes first – the ribosome or the protein? Which makes which? Of course there is no answer because one always traces things back to previous members of the same class, just as with the chicken-and-the-egg question, until everything vanishes over the horizon of time.”

We discover an improbably entangled entelechy when we ask: which came first, the ribosome or the protein? – or ask which came first, the chicken or the egg? In the grand scheme of things they are one and the same: an improbable unity. The egg *is* the chicken, the chicken *is* the egg, the one is nothing without the other. The egg alone in the universe is meaningless. The yolk without the shell is meaningless. The embryo without the yolk is meaningless. It is senseless for eggs or chickens to exist separately and apart in the cosmos. Entelechy as represented by egg/chicken/egg loop is a realization of a potentiality that may reside in a substratum hyperspace of concepts. There, templates for ribosome-protein and chicken-egg loops ostensibly exist full-blown. The material physiostratum provides the venue for ontogenetic realization over time.

The realization of a potentiality suggests that a loop template or some sort of genetic wavefunction pre-exists the realization – programmed by DNA templates – specified by genes. Are the physiological genes, in turn, instructed by non-physical substratum entities, namely,

memes? In *The Selfish Gene*, Dawkins urges us to take the idea of meme evolution literally. Memes are replicating ideas. Not just simple ideas, but quite complex templates that form themselves into distinct units that influence and engender genetic evolution. Physiologically, they produce alleles, or alternative genes, that compete with existing genes and when successful, cause hereditary variations. The original genes will attempt to repudiate these newcomers, but after many replications, successful alleles may prevail in a new branch of species evolution. This paper suggests that memes are informational waveforms in the energetic substratum; acting as a communication medium that influences and informs epigenesis and engenders intrinsically improbable symbiosis loops.

Conclusion

The reality of the energetic substratum as the foundation of the physiostratum and the cosmos is evident. That reality answers Heinz Pagels regarding where the laws that generate the cosmos are written in the void. The substratum reality also provides a residence for M-theory mathematical objects and Stephen Hawking's laws of the universe. An exploration of that reality should be a rich venue for consciousness research. Given the nucleating concepts and related factors cited in this paper, it is consistent to presume that the universe is imbued with an profound substratum waveform modality that can generate a cosmos and consciousness.

It appears that we humans are ancillary to non-deterministic spontaneous stochastic processes that evolve and continuously renew and reconstitute the cosmos. The amazing thing is that the processes putatively arose from nothingness, from an unknowable antecedent void. We can designate the purely energetic foundation and non-material building blocks from which consciousness may have emerged and became manifested in humans. Although we theorize how continuumthings, such as mathematical objects, produce quantumthings that agglomerate as gravitational objects which then evolve as conscious biological entities – we have only provisionary abstract knowledge and an inadequate mathematical language for describing the process.

With regard to superfluous humans, mentioned previously, one might say that the improbability principle and its law of truly large numbers assures genetic diversity and the chance that prodigies like Socrates, Leonardo da Vinci, Mozart, John von Neuman, and Srinivasa Ramanujan will occasionally emerge. The Golden Age of Greece, the Renaissance, and other notable nuances of civilization are worth studying, not as mere by-products of chance or randomness, but as products of conscious choice, specified and directed by yet unknown, perhaps unknowable, universal laws or templates. More than simply observing the historic passing parade or detailed workings of our physiology; brilliant, enlightened individuals are needed to seek and discover the evidence, imprint, and reality of those universal laws or templates.

References

- Seeing Red*, Halton Arp, Apeiron, Montreal, 1998
Perfect Symmetry, Heinz Pagels, Simon and Schuster, 1985
The Grand Design, Stephen Hawking and Leonard Mlodinow, Bantam Books, 2010
The Road to Reality - A Complete Guide to the Laws of the Universe, Roger Penrose, Knopf, 2005
Just Six Numbers: The Deep Forces That Shape The Universe, Martin Rees, Basic Books, 2001
My Universe - A Transcendent Reality, Alex Vary, Xlibris, 2011
Three Roads to Quantum Gravity, Lee Smolin, Basic Books, 2001
Shape of Inner Space, Shing-Tung Yau and Steve Nadis, Basic Books, 2010
The Trouble with Physics, Lee Smolin, Houghton Mifflin, 2006.
The Conscious Mind, David Chalmers, Oxford Univ. Press, 1997
Cycles of Time - An Extraordinary New View of the Universe, Roger Penrose, Knopf, 2011
What Is Life?, Erwin Schrödinger, Cambridge University Press, Canto edition, 1992.
What Is Thought? Eric Baum, Bradford Books, 2004
The Improbability Principle, David J. Hand, Farrar, Straus and Giroux, 2014
Gödel, Escher, Bach, Douglas Hofstadter, Basic Books, 1999.
Selfish Gene, Richard Dawkins, Oxford University Press, 1990.
The Man Who Knew Infinity: Ramanujan, Robert Kanigel, Washington Square Press, 1991.
The Story of Civilization, Will and Ariel Durant, Simon & Schuster, 1963