

Article

Cosmic Order: Nested Hierarchical Organization & Its Test

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ABSTRACT

We seek integrating frameworks of understanding that are universally valid and our knowledge has evolved to the point where genuine insight into the workings of the cosmic order is possible. It is shown that a non-linguistic System of representing the nested hierarchical organization of the cosmic order both facilitates and requires direct intuitive insight that meaningfully integrates the empirical data in any circumstance. It renders the creative process intuitively transparent. This is shown to provide a much better fit with the evidence in a way that expands the horizons of science. It bridges the gaps and mends the flaws in our current piecemeal understanding. A better fit is a primary test of any new theory and other tests of its validity are indicated which can further confirm its value. It is a new universal methodology that complements and redirects traditional approaches to the sciences.

Key Words: cosmic order, universal and particular, one and many, nested hierarchies, self-similarity, space and time, atomic theory, quantum of action, relativity theory, quantum mechanics, quantum relativity, the Void, big bang, cosmology, memory sensorium, biological systems, social organization, three brains.

Introduction

Scientific theories seek to claim universal validity as aspects of the cosmic order, however when critically reviewed their fabric begins to fray at the seams. Theories of physics at the atomic and cosmological levels are not compatible. Neither are they capable of integrating into a living whole the diverse fund of empirical data that has been accumulated by the biological sciences. Our social sciences are another flawed patch on our landscape of understanding, yet we need our sciences to cope with the complexity of phenomenal experience.

Generally speaking scientific theories advocate a universal pattern, often expressed in mathematical terms that profess to explain how some facet of phenomenal experience works. All scientific theories thus lay claim to describing some aspect of the cosmic order by which all things work. Tests of theories require accurate predictions of physical behaviour in specific circumstances. In other words, predictions must be consistent with phenomenal experience which includes but is not limited to the factual empirical evidence in the public domain. How this is meaningfully recognized and assimilated in the private domain of each individual person's

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mind is a matter that has remained elusive. Science maintains an objective stance that views things exclusively from the outside, thus excluding subjective aspects of experience from its realm, even when dealing with the workings of the brain.

For example we all agree that water runs downhill and we attribute this to a theory of universal gravitation first devised in mathematical form by Isaac Newton¹. Newton however drew on the empirical evidence of Galileo's work and Kepler's explanation of observed planetary motions as carefully recorded by Tycho Brahe. This all found a fit with the Copernican hypothesis that the sun is at the centre of the solar system.² Physical bodies universally attract one another. They seem to have a common aspect that tends to bring them together as a unity even across the great distances that separate the planets from the sun. There is a tug of gravitational unity implicit in their separateness, although Einstein didn't like the implication of action at a distance. But common sense also tells most of us that it is one universe. Our normal sensory experience of the physical world around us is not fractured. Somehow we integrate it to mean something. We implicitly reconstruct reality and scientific theories help us to do this.

Scientific theories have traditionally been contrived to fit the empirical data gathered directly by our senses albeit often enhanced by instruments such as telescopes. For example Neils Bohr devised a theory of the atom that found a fit with the spectral lines of hydrogen. In doing so he had to hypothesize that some of the traditional laws of physics do not apply within the atom.³ An electron jumps from one orbit to another without traversing the space between them. It must do a "quantum jump" he insisted, consistent with the exact difference in energy level between orbits that corresponds to each spectral line. All the empirical data was there. He just found a theory that fit the empirical evidence even though it didn't fit with established theories. It made no immediate predictions but it was a starting point. His theory gave birth to quantum mechanics and a statistical interpretation of sub-atomic quantum events. This allowed experimental predictions to be made in sophisticated particle accelerators under highly controlled circumstances. Predictable triadic patterns emerge. But does anyone really believe that probability waves actually exist? Are there two sets of universal laws, one inside the atom and one outside? Is the universe two not one? Is it many as some interpretations claim? Is reality nothing more than arbitrary multiple conjectural interpretations of the same sensory data? Is there no such thing as universal truth? If not, then how can that be true?

Einstein objected to this dichotomous split between practice and theory. Quote: "The only justification for our concepts and system of concepts is that they serve to represent the complex of our experiences; beyond this they have no legitimacy. I am convinced that the philosophers have had a harmful effect upon the progress of scientific thinking in removing certain fundamental concepts from the domain of empiricism, where they are under our control, to the intangible heights of the a priori. For even if it should appear that the universe of ideas cannot be

¹ White M. Isaac Newton: The Last Sorcerer. London: Fourth Estate Ltd, 1997:86.

² Holton GJ, Brush SG. [Physics, the Human Adventure: From Copernicus to Einstein and Beyond](#) (3rd paperback ed.). Piscataway, NJ: Rutgers University Press, 2001.

³ Bohr N. Niels Bohr on the Application of the Quantum Theory to Atomic Structure, Part 1, The Fundamental Postulates. Cambridge UK: Cambridge U Press, 2011.

deduced from experience by logical means, but is, in a sense, a creation of the human mind, without which no science is possible, nevertheless this universe of ideas is just as little independent of the nature of our experiences as clothes are of the form of the human body.” (From his "The Meaning of Relativity," 5th Ed.)

There is obviously a problem at the core of current scientific theories about the phenomenal nature of the universe and thus about our current scientific theories that seek to explain it. We nevertheless need to employ theories to help us cope with the flux of circumstance. Karl Popper claimed that theories must be falsifiable to qualify as science, since science is an evolving process that improves over time. Is science evolving toward something? Is there a destination? Is his theory falsifiable too?

Theoretical Flaws that are not Falsified

Probability waves are a mathematical fabrication invented to allow the practice of experimental physics to proceed at the sub-atomic level. The statistical approaches employed can accommodate the fundamental discontinuity of atomic matter evidenced by the “quantum jump” essential to explain spectral lines, and by Max Planck’s universal quantum of action^{4,5} Light must transmit as a series of discrete pulses, each distinct pulse containing a specific quantum of energy depending on its frequency and wavelength. For example higher frequencies toward the ultraviolet end of the electromagnetic spectrum have shorter wavelength and higher energy. The energy is the product of Planck’s constant and frequency. The probability of determining an experimental result in quantum mechanics does not explicitly recognize the fundamental discontinuity of atomic matter. It does not relate to an empirical truth and yet the theory is testable under controlled conditions. Are tests alone enough to verify a theory? Is reality really a mindless game of chance?

Einstein didn’t like it.⁶ Neither did others, including Louis de Broglie, Erwin Shroedinger, David Bohm⁷, and Karl Popper. A divorce between the practice of physics and the interpretation of experimental results followed in which many interpretations of the same evidence are possible.⁸ Although they may exhibit a degree of mathematical fit they are not directly testable. No one will ever directly identify infinitesimal strings, or parallel universes, or invisible dark matter, or a big bang. They are theoretical belief systems.

As Einstein put it, quote: “I see on the one hand the totality of sense-experiences, and, on the other, the totality of the concepts and propositions which are laid down in books. The relations between concepts and propositions among themselves and each other are of a logical nature, and

⁴ Planck M. (1909) <http://www.amazon.com/Eight-Lectures-Theoretical-Physics-Dover/dp/0486697304>

⁵ Heilbron JL. The dilemmas of an upright man: Max Planck and the fortunes of German science. Cambridge: Harvard U Press, 2000:8.

⁶ Bolles EB. Einstein Defiant, Joseph Henry Press, Washington DC. 2004

⁷ Bohm D. *Wholeness and the Implicate Order*, , Roulledge. 1980.

⁸ Popper K. *Quantum Theory and the Schism in Physics*. Hutchinson, London..1982

the business of logical thinking is strictly limited to the achievement of the connection between concepts and propositions among each other according to firmly laid down rules, which are the concern of logic. The concepts and propositions get “meaning,” viz., “content,” only through their connection with sense-experiences. The connection of the latter with the former is purely intuitive, not itself of a logical nature. The degree of certainty with which this relation, viz., intuitive connection, can be undertaken, and nothing else, differentiates empty fantasy from scientific “truth.”(From "Autobiographical Notes," written at age 67.⁹)

The practice of physics came to depend on the language that has come to be used. It does not need to have transcending truth value. And yet the evidence directly indicates that matter itself is discontinuous, that phenomenal experience is presented to us as a very rapid succession of still frames in a cosmic movie. Relative motions involve sequential quantum jumps between discrete still frames in which light is the only activity. Light energy is thus packaged in each frame. It transmits in discrete amounts called quanta consistent with spectral lines.¹⁰

Einstein's General Relativity is based on the assumption of a spacetime continuum with curvatures conditioned by concentrations of gravitational mass. The curvature of the continuum accounts for the action at a distance of universal gravity by attributing it to local dimples in the fabric of spacetime causing separate objects to fall toward each other. General Relativity has never been reconciled with quantum mechanics and yet both are essential to the big bang hypothesis. Einstein repeatedly pointed out that singularities are not consistent with the assumptions on which General Relativity is based.¹¹ He also stated that “One can give good reasons why reality cannot at all be represented by a continuous field.”¹² For example in his remarkable *Essays on the Theory of Numbers*¹³ Richard Dedekind demonstrated how a surface can be both continuous and discontinuous at the same time. In a letter to Michele Besso the year before he died Einstein wrote “I consider it quite possible that physics cannot be based on the field concept, that is, on continuous structures. Then nothing remains of my entire castle in the sky, including the theory of gravitation, but also nothing of the rest of modern physics.”¹⁴ There is no direct evidence whatever that such an independent thing as a spacetime continuum exists. The only alternative is a discontinuous universe.

Nevertheless when Edwin Hubble discovered distant galaxies it was found that their light spectra shifted toward the infrared end of the spectrum with longer wavelengths, lower frequency and thus lower energy. This became explained by increased recessional velocity with distance, such that the whole of the spacetime continuum appears to be expanding with time. By extrapolating backwards this is interpreted to mean that this whole vast universe of billions of galaxies expanded from a point of infinite density nearly 14 billion years ago. At that instant the whole of

⁹ Einstein A. *Autobiographical Notes*. Open Court Publishing. Chicago 1979.

¹⁰ Campbell R. http://www.cosmic-mindreach.com/Atomic_structure.html

¹¹ Einstein A. *The Meaning of Relativity* 5th Ed. New York: MJF Books. Appendix II, 1953.

¹² *ibid*

¹³ Dedekind R. *Essays on the Theory of Numbers* [1858]. New York: Dover Publications, 1963.

¹⁴ Pais A. *Subtle is the Lord: The Science and the Life of Albert Einstein*. Oxford: Oxford U Press, 1982:467.

spacetime was some 20 orders of magnitude smaller than a single proton, with nothing outside it. This was the unifying event of the universe when it exploded into being from absolutely nothing. That is a lot for anyone to swallow.

Not all scientists actually believe this incredible interpretation of a meaningless cosmic order but it nevertheless continues to be preached as gospel truth. Alternative explanations of the red shift and the background radiation present themselves in a discontinuous universe but they are not currently entertained. The well known astronomer Halton Arp identified numerous linked galaxies¹⁵ with very different red shifts but his evidence is generally ignored or discredited by mainstream science. Sir Fred Hoyle who invented the science of astrophysics and was denied a Nobel Prize vigorously contested the big bang and refused to accept it to his death.¹⁶ There is an open letter by 33 top scientists opposing the Big Bang Theory.¹⁷ Nevertheless, a variety of cosmological models have been proposed, most of them variants of the big bang. The nagging contradiction remains about how space and time can have an origin in space and time.

A Fundamental Requirement of Universal Truth

There is a fundamental requirement for there to be such a thing as universal truth or universal wholeness. It requires both a universal inside and a universal outside with processes occurring across active interfaces between them. All we can ever know directly is active interface processes, that is, active surface interactions of some kind. We can never know the universal inside to the exclusion of the universal outside or vice versa. We cannot conceive of the one to the exclusion of the other. This is inherent in the ontological nature of all being.¹⁸

If there is only a universal outside perceived as an *a priori* spacetime continuum as mainstream science currently maintains, then the empirical evidence becomes interpreted as originating in a big bang from which everything ensued as a random accident from nothing, including our own biological evolution on the planet. If physical and biological evolution is really such a meaningless event then there can be no transcending basis to truth as a universal value. This rather makes all efforts at science logically futile.

Can we really reinvent the cosmic order as something exclusively *outside* by dint of our private intelligence *inside*?¹⁹ This divorces us from our own reality. It allows unlimited arbitrary interpretations of the same evidence of our senses that can never find tests of veracity. We become unwitting victims of scientific fantasy. Mainstream science begins to lose credibility inviting pseudo-sciences to sprout like weeds and making arbitrary claims about reality.

¹⁵ Arp H. (1967). "Peculiar Galaxies and Radio Sources". *Astrophysical Journal* **148**: 321–366.

¹⁶ <http://www.theguardian.com/news/2001/aug/23/guardianobituaries.spaceexploration>

¹⁷ <http://renew.com/general53/bbng.htm>

¹⁸ Campbell R. http://www.cosmic-mindreach.com/System_Intro.html

¹⁹ Campbell R. Unified Theories, Fantasy and Cosmic Order. Proceedings of ANPA 26, Cambridge UK, 2008 http://www.cosmic-mindreach.com/Unified_Theories.html

The Cosmic Order as both Universal and Particular

The cosmic order by its nature can allow of no other order more fundamental. Otherwise it could not be universally valid. It must encompass everything to be universal with nothing apart from it. It must exhaust all possible structural varieties of phenomena in nature while allowing of unlimited possible natural behaviours. In this respect it defines the ontological basis of being. It cannot be re-invented using language because the meaning in all languages, including mathematics, derives from the way the cosmic order works, not vice versa. Certain things can nevertheless be said about it.

Active interface processes must be both one and many. They must be one and universal if there is to be universal truth and they must be many if they are to account for the multiple particular things that we encounter in our common experience. These two aspects of being are mutually interdependent and mutually define one another. The universal aspect transcends the particular aspect. The particular aspect such as one specific canary is defined by its relationship to the canary species that is a universal archetype shared by all canaries. The canary species is but one particular archetype sharing the universal archetypal pattern of all birds. Likewise all birds share archetypal features common to all vertebrates and so on. This universal and particular theme runs through human thought for millennia with roots going back to early Vedic, Greek, Egyptian and Taoist traditions.

The evolutionary process unfolds in a proliferation of nested hierarchies over billions of years. The universal archetypes can only physically manifest in multiple particular forms, similar to Plato's Theory of Forms^{20,21}. They are not physical things themselves but they are real archetypal patterns²² that are both implicit within and transcend physical being on many levels. It applies to human creations too. A plan for making a TV set is an archetypal idea that is manifest in the manufacture of many physical TV sets. The plan is not a physical working model but it is a real idea. The mind that entertains ideas is not a physical thing.

The complementary interplay between Universal and Particular imparts a rift or separation between self and other than self. Separate entities mutually interact to bridge their separation by finding reconciliation in the creative process. All creation stems from a need to bridge the rift in unity. We see this directly in evidence everywhere we look. Clouds form to produce falling rain to support plants in their reach for the sun that we harvest for food. We appreciate the process through our creative efforts to sustain ourselves. Everything interacts with its environment from atoms to stars and planets. Everything is interdependent. Sexual union recognizes an element of self in other that invokes the temporary bliss of unity essential to procreation. We intuitively seek a sense of unity in our everyday experience of living.

²⁰ Ryle G. Plato. In: Edwards P, ed. *The Encyclopedia of Philosophy*. London: Macmillan, 1967.

²¹ Ross D. *Plato's Theory of Ideas*. Oxford U Press. 1951.

²² Jung CG. (1934–1954), *The Archetypes and The Collective Unconscious*, *Collected Works* 9 (1) (2 ed.), Princeton, NJ: Bollingen. 1981.

There are also involutory variants²³ that seek unity in pursuing the supremacy of self to the exclusion of others that can take many forms. Physical creation is required to feed on itself and involutory variants tend to get weeded out over great spans of time. There is an evolutionary trend toward progressive stages of refinement evident in the natural historical record.

The Cosmic Order is Implicitly Intelligent

The nested hierarchical organization of the evolutionary process continues to elaborate within itself in a manner that is inherently intelligent. This requires that the System by which the cosmic order works prescribes the structural dynamics of how intelligence works. It is specified by exhausting all possible ways that a given number of active interface processes can mutually interact with respect to their common inside and outside. We can intuitively see into the dynamics of how this works because it is implicitly intelligent.

We can thus speak of Systems 1, 2, 3, 4, 5 and so on, such that the lower Systems transcend and subsume the higher Systems that elaborate on them in an open ended nested hierarchy.²⁴ Each higher System is complete unto itself as well as consistent with the lower Systems. They increase in complexity rapidly, soon becoming beyond the grasp of human intelligence. Nevertheless the first four Systems have been exhaustively delineated. The meaning in language can be intuitively seen to derive from how the System works. This can resolve many theoretical anomalies, direct better research efforts and expand the horizons of science.

Systems 1 and 2 transcend and subsume the physical universe. System 1 requires that universal wholeness consists of active interface processes that are fundamental to the nature of truth and universal values in general. System 2, with two active interfaces, requires that all phenomena have both universal and particular aspects. It allows the cosmic order to reveal itself in phenomenal experience in our search for unity. System 3 specifies the structure of the physical universe from atoms, to suns, planets and galaxies. System 4 elaborates within physical creation on the pattern of biological evolution and related biological processes. Systems 5 and higher elaborate on the complexity of biological processes that allow us to see and appreciate a virtual representation of the physical world in our hearts and minds. In short the System bridges the active divide between inside and outside by fully acknowledging both in all its aspects.

The System as All Inclusive

Since all possible structural varieties of phenomenal experience are encompassed by each higher System it is not possible to conceive of anything apart from how the System of the cosmic order works. It is universal. It is not a theory based on language as other scientific theories are. It is a universal methodology that can complement traditional approaches to the sciences that have

²³ Campbell R. http://www.cosmic-mindreach.com/Human_Values.html

²⁴ Campbell R. <http://www.cosmic-mindreach.com/System3.html>

accumulated such a vast fund of working knowledge. This includes all the sciences, physical, biological and social. Since application of the System requires direct confirmation in phenomenal experience it cannot be a belief system. It both facilitates and requires direct intuitive insight into the mechanics of the creative process according to the contextual circumstances.

Since it is contextual it is not a Theory of Everything contrived in mathematical hieroglyphics that inevitably face limitations about the nature of identity. Because of the way the System elaborates in discrete stages within itself it cannot be reduced to mathematical algorithm. It specifies various kinds of identity only a couple of which allow of direct mathematical treatment. The System is both open and closed. It offers direct intuitive insight into the specifics of particular phenomena in a way that relates them to all phenomena consistent with the evidence.

Because of these features of the System it has great integrative power. The sciences have amassed a huge amount of empirical data that is spelled out like pieces of an incomprehensible jigsaw puzzle but the picture on the cover of the box is missing. The System can fill that role to the extent that we can use it to comprehend the cosmic order. Otherwise we are left to flounder in an ever increasing number of pieces to the puzzle with no coherent means of ever integrating them into a living whole.

Tests of System 3 as it Applies to Physics

The first test of any theory is that it must fit the factual evidence. It must offer an explanation as to why the facts are as they are. A new theory to find acceptance must do this better than existing theories. It is also expected to make more realistic predictions that can further confirm its validity. These are regarded as tests of any new theory.

1. System 3 demonstrates that the electron, proton and photon energy shell of the primary hydrogen atom have mutually closed surfaces or boundaries that are intimately linked in each atom by the universal archetype tunnelling through each member of the triad to bind them in pairs. This requires that all primary hydrogen atoms are universally identical.
2. All atoms synchronously alternate with a quantum state where the electron and proton become open interfaces coalesced together within the open photon interface. This constitutes formless and timeless photon energy equivalents of each physical atom. The quantum equivalents are spatially indeterminate constituents of the boundless Void because their interfaces are open. This means that physical atoms everywhere are discontinuous doing quantum jumps to and from the Void to accommodate relative motions between successive physical still frames in a cosmic holographic movie.
3. Since light is the only action in each still space frame this accounts for the spectral lines of hydrogen when an electron jumps between orbits via the alternate timeless state in the

Void wedged between successive still frames. No discrepancy exists with the laws of physics inside and outside atoms.²⁵

4. The discontinuity of physical matter in a linear series of discrete still space frames alternating with boundless quantum frames also accounts for Planck's universal quantum of action because light is the only action in each space frame and quantum frames are timeless and boundless. Light comes in quantum pulses. Each space frame is discrete with a timeless orthogonal quantum frame between so that successive space frames close ranks giving the appearance of continuous space. There are nevertheless irrational seams between space frames that are bottomless since the Void is boundless.
5. Space and time are quantized by the distance light can transmit to define a primary increment of space in a single frame which likewise defines a primary interval of time.
6. The Coulomb force is a static force of attraction between the separate electron and proton in the space frame of each atom because they are coalesced as one in the timeless quantum frame associated with it. They are both one and separate at the same time. In this way the Coulomb force can exactly balance each quantum jump around the orbit thus being equal to the centripetal force that keeps the electron in orbit.²⁶
7. The electron becomes a free electron if it is energized beyond the 12th orbit in primary hydrogen, which is the ionization limit.²⁷
8. Only certain electron orbits are allowed because there must be a whole number of de Broglie waves around the circumference. In deriving his wave equation of matter Louis de Broglie equated the internal frequency of a moving particle to the external phase of its wave which includes wavelength as an increment of displacement. This means that the wavelength of the particle is synonymous with each quantum jump of an electron around its orbit. There can be no such a thing as part of a jump so each orbit must be a whole number of jumps. The derivation of de Broglie's wave equation is reviewed at http://www.cosmic-mindreach.com/Atomic_structure.html.
9. The primary interval of time can be calculated from the fact that the orbital angular momentum of the electron in the first hydrogen orbit must be zero for the Schrodinger wave equation to work. This requires that the circumference of the first orbit is equivalent to one quantum jump of the electron consistent with its inertial momentum balanced by the Coulomb force such that it recurs in the same place. This primary interval of time is 1.519×10^{-16} seconds. The primary increment of space is thus the distance light can transmit in a single space frame or about 4.6×10^{-8} meters.²⁸
10. It is also relevant that the complex conjugate of the wave function of a moving particle is the quantum energy equivalent in the Void. It is necessary to square the wave function to "collapse the wave," as they say, to get an experimental result. This means that the quantum energy equivalent is orthogonal to the physical wave so the result is the square between them. In other words the wave is a matter wave. Atomic matter oscillates between a quantum frame and a space frame in each primary interval of time. To get a

²⁵ Campbell R. http://www.cosmic-mindreach.com/Atomic_structure.html

²⁶ ibid

²⁷ Hansch W, Schawlow AI, Series GW. The Spectrum of Atomic Hydrogen, *The Laureates Anthology Vol II*, Scientific Am, 1991.

²⁸ ibid

picture of how this works on historic coordinates consistent with a more direct interpretation of both special and general relativity and the Lorentz transformations see the link <http://www.cosmic-mindreach.com/Gravity.html>.

11. Since exact position of a moving particle can only be known in a single space frame and momentum can only be measured over a succession of space frames they cannot possibly be known together. The more one is known the less the other can be known. The Heisenberg uncertainty principle is thus implicit in the discontinuous projection of atomic matter. No other explanation presents itself. This introduces a limit to the differential in the calculus placing limits on the accuracy of mathematical techniques. The discontinuity between space frames is associated with irrational numbers, such as pi. The Heisenberg uncertainty principle is a function of $h/2\pi$.²⁹
12. The menagerie of short lived sub-atomic particles produced by collisions in particle accelerators are not fundamental building blocks of atomic matter created from nothing in a hypothetical big bang. They display patterns of the higher Systems and rapidly transform back to long lived particles associated with System 3. There is no compelling reason to assume they are fundamental any more than smashing dinner plates will tell how they are manufactured. There is no need to explain why the electrons and protons are created separately in identical equal numbers in a big bang because they are intimately bound by System 3 in the primary projection of atomic matter.
13. There is a degenerate involutory variant of System 3 that accounts for antimatter. The universal set links up the triad of the particular set in reverse direction such that the two sets are not in mutual accord. Electronic charge is reversed making it short lived and degenerate. The evolutionary variant that we see around us thus prevails.³⁰
14. Space and time as we normally know them derive from the synchronous universal projection of atomic matter. They are not things independent from creation. They derive from it. There are no other universal measuring rods or clocks out there that could determine a spacetime continuum. The creative process is eternal allowing the birth, death and evolution of stars, planets and galaxies without beginning or end.
15. A synchronous creation explains why inertial velocity is distinct from gravitational mass as demonstrated by Foucault's Pendulum and the gyro compass. The arc of the pendulum's swings is fixed with respect to the fixed stars thousands of light years distant.³¹ General relativity cannot account for this phenomenon.
16. Relative motions introduce relative space frame skipping and associated quantum frame accumulation accounting for relativity effects with direct cosmological implications. A new Quantum Relativity necessarily emerges as illustrated in the article at <http://www.cosmic-mindreach.com/Gravity.html>.
17. System 3 has a regenerative mode in nuclear fusion processes that create heavier elements in the centres of stars. The neutron is the regenerative mode of the primary hydrogen atom. It contracts the spherical space of the atom to that of a proton by nearly 16 orders of magnitude or about 8.62×10^{15} times. Both the strong and weak force have a

²⁹ Mehra J, Rechenberg H, The Formulation of Matrix Mechanics and its Modifications, *The Historical Decelopement of QuantumTheory*, Vol 3, NY, Springer Verlag. 1982.

³⁰ Campbell R. http://www.cosmic-mindreach.com/Atomic_structure.html

³¹ Baker GP. Seven Tales of the Pendulum. New York: Oxford University Press, 2011:388.

common source outlined at http://www.cosmic-mindreach.com/Atomic_structure.html consistent with the contraction of space by the neutron.

18. A review of star formation and the science of astrophysics is required. The angular velocities of galaxies contract the integrated fabric of external space near the centre with respect to the periphery. This regulates star formation, the internal contraction of space in stars, their migration, evolution, death and the regeneration of primary hydrogen. The lifetimes of stars must be re-evaluated because of the huge contraction of space associated with the neutron in nucleon fusion processes.
19. Correlations of superdense neutron stars with their rotation rates should govern radial migration rates according to a galactic profile of the external fabric of space. This can provide a test if ways to measure these accurately can be determined.
20. A new cosmology necessarily emerges where galaxies are cells actively regenerating their stellar populations. Alternate explanations of the red shift emerge as demonstrated at <http://www.cosmic-mindreach.com/Cosmology.html>.
21. There is no need to invent an expansionary epoch, or dark matter to plug holes in Big Bang theories because there is no *a priori* spacetime continuum. The integrated fabric of discontinuous space and time introduces a new approach to celestial dynamics that can explain many anomalies and lead to predictions of stellar regeneration rates. Since research is generally guided by theory it can be refocused in more meaningful directions. Average star formation rates including starburst periods, periodic ejections from active galactic nuclei, better techniques to detect star formation rates occluded by dust, better understanding of globular clusters, and better detection of accretion rates at black hole centres can ultimately test a sustainable universe.

This covers the most important ground that can confirm the validity of System 3 as it relates to the physical universe. It provides a much better fit with the empirical evidence and it opens new avenues of research to explore. Laboratory tests may also be possible. For example the duration of ultrashort laser pulses should approach a practical limit near the primary interval of time.

Tests of System 4 as it Applies to Biological Evolution

There are only nine possible ways that four active interfaces can mutually relate with respect to a common inside and outside. Each way constitutes a discrete Term and the nine terms mutually interact in sets of transformations. There is a Primary Universal Set and a Secondary Universal Set each with its own transform sequence although they work coherently together in repeating four Step Cycles. There are three Particular Sets that transform through a six Step sequence one Step apart. There are both Expressive and Regenerative modes to particular terms making a total of 12 Steps to complete the whole sequence of transformations. How this works in three consecutive four Step Cycles is detailed in website articles. An introduction is at http://www.cosmic-mindreach.com/System_Intro.html.

System 4 shows how biologically living creatures work and evolve, from the complexity of a single cell to how cells meaningfully relate to organs and host in complex multi-celled creatures. In other words System 4 defines how living intelligent processes work and evolve. The current

paradigm of the biological sciences remains anchored to linear external causal principles that go back to Aristotle and although they have collected a huge fund of knowledge the paradigm is sterile at integrating the pieces into a living whole. The following points demonstrate how System 4 can serve to integrate the empirical evidence.

1. Biological evolution has proceeded in four distinct levels up a ladder of sentient awareness from plants, to invertebrates, to vertebrates, to humans. Plants explore the *Form* of the eukaryotic cell by storing the sun's energy that all higher levels depend upon for food to sustain the *Forms*. The invertebrates explore modes of sensory *Routines* of behaviour in many body formats. The vertebrates with a fixed quadruped limb structure have a capacity to reflect on patterns of behaviour in cerebral *Knowledge*. Humans with language can deal with behaviour in abstraction to create *Ideas*. Each level elaborates within itself in four self-similar³² levels as the evolutionary process proceeds.
2. The hierarchy can be summarized by a four word sequence as follows: *Idea* gives direction to *Knowledge* which gives direction to *Routines* which give direction to *Form*. The evolutionary process has delegated these four levels in reverse order, in a self-similar way to how they are successively delegated in any large business organization.³³ And a business is structured in a self-similar way to how we integrate experience as individuals. The germ of an *Idea* directs our *Knowledge* that directs our muscular *Routines* that directs the behavioural *Form* of our body. The hierarchy must be interpreted in context and this may involve more suitable self-similar language for the hierarchical levels that correspond to active archetypal energy interfaces.
3. If random order prevails as the sole mechanism in biological processes there is no explanation as to how recursive hierarchies that elaborate within themselves could evolve. Hierarchies are an implicit characteristic of the evolutionary process as evidenced in biological processes in general. This is not consistent with random order.
4. Within the eukaryotic cell the *Idea* of the cell is contained in the DNA of its genetic material. The *Knowledge* of the cell is implicit in its infrastructure, its membranes and other organelles that are essential to its function. The chemical *Routines* of the cell are regulated by protein enzymes that do not themselves react but are essential to chemical synthesis including themselves. The physical *Form* of the cell is given by the chemicals synthesized as catalyzed by teams of protein enzymes that create the physical cell.
5. There are thousands of protein enzymes essential to living cells. They accelerate reaction rates by a million times or more and they work in teams essential to a series of chemical reactions. They are complex structures that fold in specific shapes with active sites at specific places where the substrates of each chemical reaction are attracted and fit with precision to chemically react in just the right way. The protein enzyme itself does not chemically react. Energy needs are provided by the exchange of phosphate ions which are the energy currency of the cell. This is common textbook knowledge.
6. Since enzymes catalyse their own chemical synthesis all the processes of the cell are a highly recursive energy pattern that is distinct from its molecular makeup. In other words

³² Agnati LF, Baluska F, Barlow, PW, Guidolin D. Mosaic, self-similarity logic, and biological attraction principles: three explanatory principles in biology. *Commun Integr Biol* 2009; 2:552-3.

³³ Campbell R. http://www.cosmic-mindreach.com/Organize_structure.html

there is an archetypal energy pattern common to each kind of cell that is universal with respect to each particular cell of that species or kind. They all work the same way in relation to their universal archetype. The archetype determines the form the cells take. The energy archetypal pattern is a highly complex reality but it is not a physical thing.

7. Organs in a complex multi-celled creature are made of a variety of cells that must work coherently together. They are usually grouped into tissues made of cells of the same kind, then different tissue kinds cooperate in a complex organ, such as the eye. Tissues are subordinate parts of the organ. So each Organ consists of a variety of Cell types working in concert to perform specific functions in the Host body. The archetypal energy patterns of the Cells that make up a functioning Organ thus constitute an archetypal energy pattern for the organ that has evolved in stages over great period of time. All particular organs of a species work the same way in relation to the universal archetypes. For example the eyes of all domestic cats work the same way although there may be minor epigenetic variations such as eye colour.
8. The coherent function of all archetypal Organ energy patterns that integrate the body chemistry of all Host creatures of each species is likewise a highly organized universal archetype. Each host species has an archetype. Each particular member of each species has a specific living relationship to the same universal archetype of the species. The universal archetype determines the archetypal Form of its particular members.
9. Each particular member of a species is also a self-similar subsumed archetypal pattern that hosts a wide variety of behavioural Forms. There are heritable genetic and epigenetic variations such as colour, relative size, behavioural talents, and other variations³⁴ in the particular archetype of the individual within an otherwise fixed physical form that we recognize as characteristic of the universal archetype of each species. The archetypes are real energy patterns that determine the physical molecular chemistry of each individual but they are not themselves physical collections of atoms and molecules because of the highly recursive nature of protein enzymes that catalyse body chemistry.
10. There is thus an intimate interdependent relationship between Host, Organs and Cells that works behind the synchronous projection of the physical universe to generate the body's physical Form.³⁵ The physical Form of the universe is specified by System 3. System 4 elaborates within this subsuming context to animate biologically living creatures. The *Idea* implicit in the *Host* directs the *Knowledge* implicit in the *Organs* that direct *Cells* to generate the chemistry that animates the physical *Form* of each individual. The universal hierarchy of System 4 is thus clearly implicit in all living creatures.
11. In the transform sequence of the Secondary Universal Set there is a Term that shows how the *Corporeal Body* of the each particular human being is structured to function. The intimate triad of the three mutually closed active interfaces (Host, Organs, Cells) operates behind the open interface of the universe of physical Form at large. This corporeal body Term of the Secondary Universal Set coheres with the Primary Universal Set to distribute resources according to a priority of needs in any given circumstance.³⁶ Chemical

³⁴ Carey N. *The Epigenetics Revolution*. London: Icon Books. 2012.

³⁵ Campbell R. http://www.cosmic-mindreach.com/Cell_Primary_Cilia.html

³⁶ Campbell R. http://www.cosmic-mindreach.com/Human_Integration_Cell_article.html

- signalling alone cannot accomplish a balanced distribution of energy resources throughout the whole body at once.
12. Our body has a regenerative capacity to simulate anticipated future needs such that we can intelligently span and integrate space and time in selecting appropriate behavioural responses to circumstance. The distributed anticipated energy needs must be available on demand whereas chemical signalling of energy needs is driven by past events alone.
 13. Recent research is accumulating evidence that primary cilia play a central role in signalling. One primary cilium protrudes from the surface of nearly every cell in the body, like an antenna that is in touch with other cells much like a radio antenna, and they are known to regulate chemical signalling. Chemical receptors tend to migrate toward them. They are shown to play a central role in proper development and maintenance of the whole body. This requires that a proper creative balance is maintained in the intimate triad of Cells, Organs and Host. Primary cilia are structured in a self-similar way to Systems 4 and 5.
 14. A primary cilium grows from the mother centriole that acts as the basal body in each new cell. The two centrioles in mid phase of each cell are at right angles to one another. The daughter centriole is oriented inside the cell and the mother centriole is oriented toward the outside of the cell. They each have nine sets of three microtubules arranged in a circle consistent with the nine Terms and three Cycles of System 4. Together with compelling evidence of archetypal energy patterns this strongly indicates that centrioles act to regulate and balance active energy interfaces in each *Cell* as it relates to *Organs* and *Host* to generate and maintain the molecular *Form* of the body.³⁷
 15. The primary cilium protrudes outside the cell membrane from the basal body provided by the mother centriole. The primary cilium has nine sets of two microtubules arranged in a circle, with one member of each pair a partial microtubule attached to the other complete microtubule suggesting it is partially internally oriented with respect to the other. Motile cilia, such as flagella, have a central pair of microtubules making a total of 20. As it happens System 5 has 20 Terms. It functions as two reciprocating System 4s, one oriented internally and one oriented externally. For example this is self-similar with the internally oriented autonomic nervous system as it relates to the externally oriented somatic nervous system. They work together in a synchronous reciprocating fashion. Motile cilia such as on cells that line the windpipe beat synchronously in a whip-like wave pattern to remove debris and mucous from the lungs.³⁸ While successive cilia are mechanically linked to generate the wave each cilium nevertheless follows an identical whip-like pattern that is inherent in the role it has to play and not in itself determined by a chemical or external mechanical signal.
 16. Primary cilia lack the two central microtubules that motile cilia have. They can bend when external pressure is applied such as in renal fluid flow, but they cannot bend themselves as motile cilia do. Because they play a central role in signalling associated with the development and maintenance of the Host body and Organs this indicates that the absence of the two central tubules means the Cell is not autonomous as motile cilia

³⁷ Campbell R. http://www.cosmic-mindreach.com/Gene_Expression.html

³⁸ Alberts B, Bray D, Lewis J, et al. *Molecular Biology of the Cell*. 3rd ed. NY: Garland Science; 1994.

are. Each *Cell* must be in intimate communication with *Organs* and *Host* as a spontaneously balanced integrated triad. In other words the *Organ* and *Host* are not delegated at the level of the *Cell*. They are represented by the two missing microtubules in the centre of the primary cilium such that all three members of the triad must work in concert. This is supported by the fact that most cancer cells that autonomously replicate without regard for the Host or Organs lack or lose primary cilia in most cancers.³⁹

17. Vestibular hair cells each have one kinocilium that is a true motile cilium, along with a bundle of actin fibre stereocilia. When the stereocilia move toward the kinocilium due to fluid movement in the semi-circular canals the hair cell becomes depolarized and the afferent nerve fibre ending that surrounds the type I hair cell body like a cup becomes excited sending an expressive signal to the vestibular nuclei. When the stereocilia move away from the kinocilium the signal slows or stops.
18. Type 2 hair cells differ in that they are not cupped by the afferent nerve ending and receive efferent nerve stimulation directly on their cell body with a collateral branch that synapses on the afferent nerve ending that cups type I. This can provide the structural requirements for alternate expressive and regenerative firing modes between the two types of hair cells. For example it is known that gentamicin injections can reduce vertigo in Meniere's disease by eliminating some type I cells while leaving type II cells relatively unaffected.⁴⁰ This suggests that type II cells have a regenerative role relative to the expressive role of type I cells which display excessive activity in the disease.
19. The efferent signal that arises in the reticular system and that projects directly to the type 2 hair cells can stimulate the kinocilium to move independently of fluid motion in the semicircular canals to simulate a corrective action. Specifically focused laboratory tests should be possible to further confirm the operation of these alternate modes. For example stimulating the efferent nerve has been shown to increase the quantum firing rate of type I hair cells as might be expected but it has fast and slow components which may correlate to expressive and regenerative modes of type I and type II hair cells respectively.⁴¹ Focused research may prove valuable as well as a test of the theory that regenerative simulations in type II hair cells as they relate to type I hair cells are essential to proper vestibular function and learning,
20. Some forms of autism display either vestibular hypersensitivity or hyposensitivity. Hypersensitive children avoid twirling motions, merry-go-rounds, swings, escalators, and are prone to motion sickness. Hyposensitive children seek out twirling without getting dizzy, may love amusement park rides and generally seek out movements which will give them the vestibular stimulation they need. These symptoms indicate an imbalance between the expressive and regenerative modes of System 4 which is probably traceable

³⁹ Hassounah NB, Nagle R, Saboda K, Roe DJ, Dalkin BL, McDermott KM.. Primary cilia are lost in preinvasive and invasive prostate cancer; PLoS One. 2013 Jul 2;8(7):e68521. doi: 10.1371/journal.pone.0068521. Print 2013.

⁴⁰ Lyford-Pike S, Vogelheim C, Chu E, Charles C, Santina D, Carey JP; Gentamicin is Primarily Localized in Vestibular Type I Hair Cells after Intratympanic Administration; J Assoc Res Otolaryngol. 2007 December; 8(4): 497–508.

⁴¹<http://www.ucdenver.edu/academics/colleges/medicalschoo/departments/Otolaryngology/research/Pages/HairCellLab.aspx> .

to an imbalance between type I and type II hair cell activity. If the neurotransmitters are known in each case, a pharmacological intervention may restore a balance. Related transmission pathways to the vestibular, fastigial and cerebellar nuclei as well as directly to granule cells in the cerebellum may also be implicated.⁴²

21. Many mammals have long tactile whiskers called vibrissae that vibrate rapidly and can allow some animals such as rats to navigate in the dark. In rats, the macrovibrissae form a two-dimensional grid of five rows on each side of the snout. Their large follicles contain blood-filled sinus tissues that are innervated by a variety of nerve fibers. The "whisking" movements generally occur in bouts of variable duration, and at rates between 3 to about 25 "whisks" per second that allow the animal to locate and investigate objects using both the macrovibrissae and an array of shorter, non-actuated microvibrissae on the chin and lips. Rats can be trained to reliably discriminate multiple textures using only their macrovibrissae, and can make fine distinctions. Movement of an individual whisker across a texture has been shown to give rise to a characteristic whisker vibration or "kinetic signature" which is thought to form the basis on which sensory discriminations are made.⁴³ The whiskers themselves are dead so it is the innervated follicle that initiates signals transmitted and that are represented in the somatic sensory cortex of the brain. There is a proprioceptive and cerebellar involvement. Because learning requires a regenerative mode that anticipates ahead, comparable to vision, the evidence shows that the rapid whisking movements can simulate the spatial shape and texture of objects in the dark allowing navigation in the absence of visual input.⁴⁴ Research specifically focused on the alternating modes of System 4 could thus provide another test and advance an understanding of the process in many mammals, including rats, mice, seals, manatees, naked mole rats and others.
22. Our physical ability to move freely in space is largely dependent on proprioceptive simulations of the body's relative position in space. We can touch the tip of our nose with our finger with our eyes shut because we can simulate their relative position through the agency of muscle spindles and related proprioceptive organs in the joints. A person who loses their proprioceptive ability must use direct vision of the arms and legs to learn to walk and move again.⁴⁵ Vision simulates the external environment in our mind. This adds compelling evidence that goal directed simulations are an essential part of animal behaviour.
23. System 4 demonstrates how the human nervous system meaningfully integrates phenomenal experience synapse by synapse in two website articles. The article on Spinal Integration shows how small muscle spindles throughout the parent muscles of the body are structured to simulate an action before it is enacted as well as provide feedback from

⁴² Campbell R. http://www.cosmic-mindreach.com/System4_Sequence_Part_2.html

⁴³ Prescott TJ, et al. Vibrissal behavior and function; Scholarpedia, 6(10):6642. (2011), http://www.scholarpedia.org/article/Vibrissal_behavior_and_function

⁴⁴ Leung B, Pan Y, Schroeder C, Memik SO, Memik G, et al. Towards an early neural circuit simulator: a FPGA implementation of processing in the rat whisker system: http://hartmann.mech.northwestern.edu/pubs/pdf/leung_fpga_2008.pdf

⁴⁵ Sacks O. http://en.wikipedia.org/wiki/The_Man_Who_Mistook_His_Wife_for_a_Hat

current body position and actual movement.⁴⁶ The spindle simulation thus accommodates the regenerative mode of System 4 and facilitates goal directed activity. One can sense an action before actually taking it. For example one can feel a simulated patterned urge to dance to certain music. We can feel the rhythm. We can anticipate a pattern of running in playing football or basketball. We know this directly.

24. Alpha motor neurons activate the parent muscles. There are two types of gamma motor neurons, dynamic and static, that activate muscle spindles. There are also two types of beta motor neurons, dynamic and static that can likewise activate muscle spindles and they have collateral branches to the parent muscles. There are also two types of afferent sensory nerves from both the nuclear bag and nuclear chain fibres within each muscle spindle sheath that typically includes two nuclear bag fibres and several nuclear chain fibres.⁴⁷ Each spindle thus has a complex structure that is typically up to about a centimetre long attached to fibres of the parent muscle. It is clear from this arrangement of multiple innervation that these organs are capable of more than simply monitoring stretch reflexes and tonus of parent muscles. Specifically focused research in this area should clearly show that muscle spindles are also employed to simulate proprioception in anticipation of goal directed actions, such as learning to play the piano. They perform this regenerative function as well as an expressive function.
25. The second website article on the nervous system shows how the cerebellum integrates vestibular expressive and regenerative modes with other sensory inputs, including those from the spinal level, with cerebral function and motor outputs, synapse by synapse.⁴⁸ At present there is no other theory or paradigm available that can suggest a pragmatic methodology as to how the human nervous system accomplishes this miracle of coherently representing the external features of the physical world in a way that allows us to internally assess and generate meaningful responses according to our situation. Targeted research with System 4 in mind can confirm the role of the cerebellum synapse by synapse. There are already many general indications of its role.
26. An infant's movements are jerky and lack coherent movement apart from inherent reflexes such as sucking and grasping. Only gradually do we learn to sit up, crawl, walk and run. These are goal directed activities that the child wants to achieve. They anticipate the future, inspired by others. ("Come to mamma!") They also require the synchronous patterned activity of the body's muscles in concert with simulated proprioceptive sensory input from muscle spindles.
27. Inhibitory Renshaw cells in the spinal cord act as one of the integrating mechanisms, since they provide negative inhibitory feedback to the alpha motor nerves that synapse with them via collateral branches when discharging to parent muscles^{49,50}. Renshaw cells thus activated project back to inhibit alpha motor neurons and can also inhibit Ia

⁴⁶ Campbell R. http://www.cosmic-mindreach.com/System4_Sequence_Steps.html

⁴⁷ Williams, Warwick, eds. Gray's Anatomy. 37th edition. NY:Churchill Livingstone. 1989

⁴⁸ Campbell R. http://www.cosmic-mindreach.com/System4_Sequence_Part_2.html

⁴⁹ Renshaw B. Central effects of centripetal impulses in axons of spinal ventral roots. J Neurophysiol 1946 9:191-204

⁵⁰ Mentis GZ, Siembab VC, Zerda R, O'Donovan MJ, Alvarez FJ. Primary Afferent Synapses on Developing and Adult Renshaw Cells. The J.of Neuroscience, 2006, 26(51):13297-13310

inhibitory interneurons as well as gamma motor neurons that project to muscle spindles. This temporarily interrupts alpha motor projections to muscles and to spindles, however if simulated gamma projections are synchronous with alpha projections to muscles then simulated spindle sensory feedback will be synchronous with the inhibited alpha motor step. This can allow simulated sensory feedback from spindles to target a modified pattern of alpha motor neuron projections to muscles in alternate steps to facilitate smooth transitions and coherent actions. Renshaw cells are also regulated by descending projections. Specifically targeted research with System 4 in mind can advance our detailed understanding of how the expressive and regenerative modes of System 4 work to generate synchronous neural activity.

28. In addition to the cerebellum, centres in the brain stem are also involved in synchronizing motor functions albeit on a subsumed level. For example the two parts of the substantia nigra have a role in regulating body movement. The striatum provides the main inputs to the pars reticulata by two routes, one direct and one indirect. The direct route is inhibitory. The indirect route is excitatory, indicating they are out of step and may be involved in expressive and regenerative modes of System 4. The pars reticulata fires spontaneously at a rate of 25 Hz in rats to inhibit and regulate basal ganglia targets, although the rate can be modulated by excitatory input from the subthalamic nucleus. The pars compacta plays an indirect role in motor control and is involved in learned responses to new stimuli. It is also important in spatial learning about one's environment and location in space. The pars reticulata inhibits dopaminergic activity in the pars compacta via axon collaterals.⁵¹ These and various other factors indicate that System 4 can be a valuable tool in mapping central nervous system functions and how they are mutually integrated consistent with synaptic interconnections. This is relevant in dopamine related diseases such as Parkinsons and schizophrenia.

Tests of System 4 in Human Social Development

There is compelling neurological evidence that we have three cerebral brains that function independently and seek a mutual balance. The work of James Papez⁵² and Paul MacLean⁵³ showed that the ancient reptilian and lower mammalian brains together with related brain structures form a functionally integrated apparatus with intimate connections to our emotional apparatus, the autonomic nervous system. Overriding this is the neo cortex or new brain to which we owe our intellectual functions and it lacks neurological controls over the old brain.⁵⁴ MacLean wrote extensively on this built-in schizo-physiology⁵⁵ as he called it that has

⁵¹ http://en.wikipedia.org/wiki/Substantia_nigra

⁵² Papez JW. A proposed mechanism of emotion. *J Neuropsychiatry Clin Neurosci*. 1937.

⁵³ MacLean PD. *The triune brain in evolution: role in paleocerebral functions*. NY: Plenum Press, 1990.

⁵⁴ MacLean PD. Contrasting functions of limbic and neocortical systems of the brain and their relevance to psychophysiological aspects of medicine. *Am J Med* 1958; 25:611-26.

⁵⁵ MacLean PD. Man's reptilian and limbic inheritance, In *A Triune Concept of the Brain and Behavior*, Boag TJ, Campbell D eds, U of Toronto Press, 1973

historically plagued the human condition. The new and old brains are required to live in the same house together and often they don't get along.

The work of Roger Sperry on split brain patients⁵⁶ who had the hemispheres of their neo cortex surgically separated showed that the left and right hemispheres perform different functions. The explicit left hemisphere in right handed people is linguistic and concerned with techniques of behaviour in linear space and time outside. Our sciences depend on it. The mute right hemisphere entertains holistic frameworks of understanding that are intuitively experienced inside. Whatever holistic framework of understanding we intuitively accept we tend to believe it is true for all people for all time. Our religious and spiritual convictions (or lack of them) as well as science theories like the big bang attest to this. There are true believers in all schools of thought. Together with the primitive emotional limbic brain we thus have three brains that function separately yet seek a sustainable balance.⁵⁷

The development of our three brains has been played out in the global theatre. Sub-Saharan African languages are universally tonal and also have tenses to verbs. In the migration out of Africa the eastward stream dropped tenses and elaborated on tonal aspects and universal classifiers. The westward stream dropped the tonal aspects and universal classifiers and elaborated on tenses and conjunctions that link events up in a linear causal flow through space and time, more consistent with left brain thinking. The Sino-Tibetan languages integrate meaning holistically and are more intuitively focused toward right brain thinking inside.

Eastern cultures are spirit cultures similar to the Native Americans who migrated from East Asia. Buddhist and Taoist beliefs are a thin veneer added later. East Asia still retains animist traditions intuitively entertained inside. Western cultures are technologically oriented toward explicit performance outside that has given rise to modern science.⁵⁸ The linear western languages are well suited to the development of modern science. Polyrhythmic music developed only with our ancient emotional African roots. Music is in their bones and their powerful spiritual inclinations lack the cosmic overtones of East Asia's spiritual traditions. There are thus three human races, with mixes between them, that must find a mutual sustainable balance in the biosphere.⁵⁹ All languages and races have three brains, of course, however they focus more on one of these three aspects. This is implicit in the history of human development.⁶⁰

Our social organizations have self-similar characteristics to how our three brains meaningfully integrate experience as individuals. As a one man organization grows delegation proceeds in four hierarchical levels that generate six distinct domains of activity that work in three polar pairs.

⁵⁶ Sperry RW. Hemisphere deconnection and unity in conscious awareness. *Amer. Psych.* 23:10, 1968.

⁵⁷ Campbell R. Inside Our Three Brains <http://www.cosmic-mindreach.com/Three-Brains.html>

⁵⁸ Campbell R. Intuition & logic in human evolution *Com & Integ Biol* 5:5, 422-433; Sept/Oct 2012
<http://www.landesbioscience.com/journals/cib/2012CIB0052R.pdf?nocache=1378181213>

⁵⁹ Campbell R. http://www.cosmic-mindreach.com/Language_3Races.html

⁶⁰ Campbell R. http://www.cosmic-mindreach.com/Human_History.html

These six domains correspond to the six particular Terms of System 4 and creatively achieving a universal balance between them is the job of the Managing Director.⁶¹

The product development, engineering or research function has a polar relationship to finance, that is to the resource capacity to develop the product. This is the *Potential Dimension* of the organization. Insight into this polar relationship is the only way to intuitively see the company's potential.

The production department has a polar relationship to the organization and human resources function. If there are problems with production it is either due to the organization structure or to the competence of the people involved. This polar relationship is the *Commitment Dimension* of the organization.

Marketing is a function distinct from sales. It provides long term vision to the organization by assessing long term market conditions and trends. Sales performance can only be meaningfully assessed in polar contrast to this long term vision. This is the *Performance Dimension* of the organization.⁶²

Large organizations tend to build bureaucratic controls to overcome or prevent structural or incompetency problems, however they generally complicate the organization sometimes beyond repair. Bureaucracies cannot address the problem because insight into the three dimensions is lost. The 2008 financial meltdown that impoverished the world for short term executive bonuses is a typical example. They see the marketing function as a sales function that created sub-prime market packages for sale to maximize a short term profit. Everyone should have known it was not sustainable. Marketing properly provides long term vision. In a properly structured organization the creative dynamics are transparent via insight into the three dimensions. Everyone knows their own role and that of everyone else in a creative relationship to the whole organization. Our personal failures and that of our organizations in general result from an imbalanced insight into the three dimensions. If our organizations begin to structure correctly then people begin to mutually resonate, liberating creative potential that is otherwise lost in meaningless strife and political infighting. It destroys people's lives and erodes company performance.

We have evolved up the ladder of sentient awareness to a unique position at the top of the four level evolutionary hierarchy as evidenced by the profound effect that we are having on our natural environment through our creative capacities. We ought not to pride ourselves in this regard. We are also profoundly indebted to our evolutionary history going back a few billion years. We have arrived where we are at enormous evolutionary suffering and cost. And our limbic brain remains anchored to our primitive animal brothers. The unsettling reality is that we

⁶¹ Campbell R. http://www.cosmic-mindreach.com/Organize_structure.html

⁶² Campbell R. http://www.cosmic-mindreach.com/Organize_structure.html

have assumed responsibility for managing the planet in a sustainable balanced way. Our archetypal survival as a species depends upon it.⁶³

Although we have reached the top of the evolutionary hierarchy there are four self-similar levels within the hierarchy. The Functional or *Form* level developed our cultural foundations concerned with spiritual religious and ethnic forms of behaviour. The Supervisory or *Routine* level developed our technological and scientific *Routines* that commit available resources to creating a seemingly endless array of products. The problem we face now is that the resources of the planet are limited. Our burgeoning population is threatening the stability of the biosphere. We face a painful impending natural correction and it may have already gone beyond the tipping point. Our current scientific theories cannot turn the tide since they have created it, albeit bringing us a vast fund of empirical knowledge and many conveniences in the process that is now raping the planet. That is our collective global dilemma.

We need to advance to the administrative *Knowledge* level that concerns the planet's infrastructure. This requires direct right-brain intuitive insight into the cosmic order in such a way that it can find pragmatic translation in our physical, biological and social sciences, consistent with our evolutionary roots in the biosphere.⁶⁴ This is the only avenue open to bring our three brains to balance with our natural environment.

Our Potential Dimension needs to be opened to intuitively see this. Our Commitment Dimension needs to find ways to apply the universal methodology of the System to our left brain sciences in more practical creative ways. The Performance Dimension that reflects emotional feedback from our Limbic brain into cerebral awareness can then hopefully begin to find a better balance with our other two brains. This is essential to both our individual and our collective wellbeing.

Given a chance this will prove to be the ultimate test of the System. There are no other viable options on the horizon.

Cerebral Sensory and Motor Integration

In simplified general terms we can think of the neo-cortex of the brain as divided into four quadrants. We have seen above that the left hemisphere in about 95% of people (right handed) deals with language and processing learned techniques of behaviour accordingly. It deals with reason and linear logic in a social context. Language is also essential to fine tuning many skills, such as socially proper behaviour, improving one's golf swing, perfecting the practice of mathematics, or improving Eliza Doolittle's speech. The situation is generally reversed in left handed people.

⁶³ Campbell R. A Cosmic Insight. Scientific GOD Journal, Oct. 2012, Vol. 3 Issue 9, pp. 858-876
<http://scigod.com/index.php/sgj/article/view/225/260>

⁶⁴ Campbell R. Evolution as Manifestation of Cosmic Order. DNA Decipher J. Vol 2 No3. 2012. .
<http://dnadecipher.com/index.php/ddj/issue/view/6/showToc>

By contrast the intuitive right hemisphere has a timeless holistic quality. It seeks out integrating patterns, has a better appreciation of aesthetics, the arts and spiritual concerns. It fills us with awe at a majestic view of a mountain or the natural splendour of a sunset. It opens us to wonder about the timeless meaning of life. It does not indulge in language based linear logic. It intuitively entertains integrating frameworks of understanding.

There is also a divide across the central sulcus between the front and rear halves of the brain. The rear part concerns the integration of sensory experience which implicitly includes the integration of meaningful ideas. We each reconstruct our version of reality in our minds eye using both rear halves of our neocortex. The front half concerns the integration of explicit behaviour including the motor execution of any behavioural ideas assimilated in the rear part of the hemispheres.

The sensory integration of idea is integrated in the primary sensory area of the post central gyrus. The body is topologically represented with variations according to each individual's personal history. Called a homunculus each point elicits an element of sensory experience in a specific area of the body when electrically stimulated prior to brain operations, as pioneered by Wilder Penfield.^{65,66} Each point exhibits a sensory core in relation to a motor context.⁶⁷

Primary motor integration occurs in the pre central gyrus ahead of the central sulcus where another set of homunculi are topologically represented in both hemispheres. Each point likewise exhibits a motor core in relation to a sensory context.⁶⁸

Two of the three polar relationships of System 4 are thus apparent in the functional organization of the neocortex when both hemispheres work in concert. This is apparent because sensory integration of idea has a polar relationship to memory resources and a history of learning constituting the *Potential Dimension*. Likewise motor integration has a learned polar relationship to social organization constituting the *Commitment Dimension*. Both are anchored to a common emotional polarity across the Limbic System which constitutes the *Performance Dimension*.

There are also secondary sensory and motor areas in each neocortical hemisphere. The secondary sensory areas are on the outside lateral surfaces of the cortex near the primary sensory area. The secondary motor areas face one another on the medial surfaces of the fissure between the two hemispheres just forward of the Primary Motor areas. This is typical of the way the System structurally elaborates within itself this allowing each hemisphere to subsume self-similar *Potential* and *Commitment Dimensions* independently of the other hemisphere, yet both anchored to the same Limbic *Performance Dimension*. This allows each hemisphere to function completely independently of the other as confirmed by Roger Sperry's experimental work on split brain patients.

⁶⁵ Jasper H, Penfield W. *Epilepsy and the Functional Anatomy of the Human Brain*. 2nd ed. NY: Little, Brown and Co., 1954.

⁶⁶ Penfield W, Roberts L. *Speech and Brain Mechanisms*. Princeton U Press. 1959.

⁶⁷ Harlow HF, Woolsey CN, eds. *Organization of somatic sensory and motor areas of the cerebral cortex*. In *Biological and Biochemical Bases of Behavior*, pp. 63-81. Madison: U of Wisc Press. 1958.

⁶⁸ *ibid*

Additional Tests Using fMRI Analysis of Specific Conscious Tasks

Since researchers use fMRI scanners to study brain regions activated when a person is subjected to different kinds of input or when performing specific conscious tasks, a number of tests suggest themselves that may show the role of the secondary sensory and motor areas in relation to the primary areas in one hemisphere versus the other. This can be facilitated by projecting images onto a screen fitted inside the scanner while minimizing background input from other sources.

The test apparatus used by Roger Sperry in testing split brain patients consisted of a split screen with the patient asked to focus on the centreline of the screen. If a picture is flashed for less than a tenth of a second on the left screen it registers only on the right hemisphere of the brain and vice versa. One half of each eye projects to the opposite hemisphere via the optic chiasma such that half of the visual field registers on each hemisphere. A similar split screen apparatus can be useful in demonstrating the role of the secondary sensory and motor areas during the independent function of the hemispheres.

Some people are more right brain oriented than others. They may excel at art, design, and abstract puzzle solving not involving language. These people may be better subjects for right brain testing than someone lacking interest or ability in these areas. A variety of images can be flashed on the left half of the screen that invoke the right brain sense of wonder. This can include images from Gestalt Psychology that can be taken in either of two mutually exclusive ways. It may be necessary to flash the same image quickly a number of times after a pause each time, to invoke the right brain sense of wonder in trying to make integrated sense of the images. There are many such images that can be used without verbal communication with the test person. The results can be compared with later leaving each of the series of images on the screen for both eyes to see and ask them if they can distinguish the two mutually exclusive figures in each image. This should introduce increased left hemisphere activity. The test people selected should be given no prior cues as to what the test entails apart from the importance of looking at the centreline of the screen. In the first part of the test if the person is curious both the primary and secondary areas should be activated preferentially to the same areas in the left hemisphere.

A similar test can involve alternately quickly flashing the objective and subjective orientation pictures (unlabeled) of System 2 on the left half of the screen a number of times in succession. The subject will see the two active interfaces, in series first with one behind or inside the other, then alternately facing each other, several times in a row. This should invoke a right brain sense of wonder as to what this means. It is not necessary for them to understand it so long as they are intuitively curious enough to wonder. A variety of tests are possible.

Tests of the left brain should involve language. A short misspelled word that lacks meaning can be flashed on the screen alternating with the correct spelling such as TU and TWO, or TEH and THE, or OTH and HOT to invoke a subsumed sense of left brain wonder. The results can be compared with long term visual input to both hemispheres involving sentences. Simple sentences such as "my name is Beth", can be compared to a cryptic sentence such as "Bethlehem is the song of a soul." Many variations are possible.

In summary tests should confirm that the secondary sensory and motor areas are essential to the subsumed independent yet related function of the two neocortical hemispheres. Together with the primary areas they constitute two of the polar relationships in each hemisphere that are anchored to the third polarity across the limbic system. This adds further evidence that the hierarchically nested self-similar organization of the nervous system and biological processes in general are not consistent with the strict Darwinian interpretation of random mutation and natural selection as the sole determining factors of the evolutionary process. The cosmic order as structurally delineated by System 4 is implicitly operative in all biological processes from the single cell to the human nervous system.