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CYBERNETICS & MUTUAL CAUSALITY IN LIVING SYSTEMS -THE SELF-ORGANIZING LOOP-

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ABSTRACT

Mutual causality is the hidden wisdom that maintains synergy and harmony within a living system and hence potentially in all human activities. It is a quality that enhances the ability for bonding and reconciliation, as needed. Humans possess this natural attribute which perceives the essence of goodness, beauty, love, grace as well as pain, compassion and empathy with others. It is a self-organizing loop; a natural ability provided by the mutual causality inherent in all healthy living organisms.

Mal-functioning of this loop leads to numerous types of human sufferings and deterioration of the human ecology. In order to remedy to this malady or repair of any damage to its smooth functioning caused basically by a lack of or the interruption of the naturally existing mutual causality owing to short-sightedness of human agency, a solution should be sought within the intangible aesthetic and spiritual components hidden within human empathy, passion, propitious relational living and deep contacts with Nature -itself, and fine-arts, along with music and architecture; these are the most effective and affective healers and agents to equalise conflicting stands prevailing within around humans.

In his 2015 Edward W. Said London lecture at the Southbank Centre, the famous musician Daniel Barenboim appeals for 'music once more to be taught in schools on a par with literature, mathematics or biology'. Music forces us to listen to contrapuntal voices – a practice Barenboim places on a par with the democratic right to vote.

Jacques Herzog - a well-known Swiss Architect - once said: "Technology is very important as a tool, but it in itself cannot do anything and cannot create anything without the assistance of the human mind. When you go into old cathedrals, they are extremely physical, and they follow the laws of craftsmanship, but they transport

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something we cannot explain, which is what makes great buildings human friendly, and that has never changed at all."

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Each new observation, be it viewing, studying, listening, learning, understanding and many other experiences which both enhances my ability and gradually raises my level of wisdom, assisting me to better understand Mutual Causality's specific role in human behaviour and growth. In brief, my research in this fields, is opening up more avenues in my mind, leading to a series of new questions. It is a continuing process. Simultaneously, a deep personal transformation is occurring, also as a continuing process. More energy is flowing from various avenues to satisfy the needs for new efforts to be made towards a distant objective; in practice, an objective very difficult to reach but still remaining to be ever attractive. I needed to take a deep breath to stop the process for a while and synthesize all the thoughts accumulated to date; and still additional thoughts continue to flow in my mind for making a contribution to this conference. In doing this, I also sought help illustrated below, from the thoughts of others, both ancient and contemporary.

SEARCH FOR THE HIDDEN WISDOM

According to Bertrand Russell, philosophy is a "No Man's Land" between theology, to which all dogma, non-questionable knowledge, belongs, and science, to which all definite knowledge belongs. Almost all the questions of interest to speculative minds are such that mechanical-reductionistic science cannot answer, and the self-confident answers of theologians no longer seem so convincing as they did in former centuries.

Russell then poses a number of questions. Is the world divided into mind and matter, and if so, what is mind and what is matter? Is mind subject to matter, or is it possessed of independent powers? Has the universe any unity or purpose? Is it evolving towards some goal? Are there really laws of nature or do we believe in them only because of our innate love of order? Must the good be eternal in order to deserve to be valued, or is it worth seeking even if the universe is inexorably moving towards death? Is there such a

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thing as Wisdom, or is what seems such merely the ultimate refinement of folly? He concluded by saying: to such questions no answer can be found in the laboratory. Though they are still valid questions.

It is, then, left to philosophy to study these questions, if not to find a ready answer to them. Here, we can safely say that only philosophy cannot cope with it alone. It has to work in a closely-knit manner with science, where feasible also by benefiting from the sound ideas coming from the cosmic and human history. Ancient wisdom offered a philosophy whereby the justice and the love together guide the evolution of the world.

It was also helping to comprehend the meaning of living and its ultimate objective. What progress has been made in this field since the birth of the philosophy? Science, is now taking the lead in tackling these questions in a trans-disciplinary manner. Thus, philosophy and science, as well as other disciplines dealing with subliminal and aesthetic imbedding matters, which remain beyond the threshold of sensations and consciousness, now work hand in hand.

Western philosophy, as distinct from theology, began in Greece in the sixth century B.C. in effect in Miletus, in Asia Minor, when Greeks invented mathematics, science and philosophy; and they freely speculated about the nature of the world and the end of life, without being bound by the fetters of any inherited orthodoxy. Miletus was a rich commercial city, in which primitive prejudices and superstitions were softened through contacts with many nations. Culturally, it became the most important city in the Hellenic world. This School was created by contact of the Greek minds with those of Babylonia and of Egypt, which were, in turn, deeply-influenced by Eastern thought.

The above originated by Thales, a thinker and scientist of the Milesian School, who said that everything is made of water. It is the original substance, out of which all others are formed. This had, then, become a scientific hypothesis. Everything is made of hydrogen (2/3 of water) was the next scientific hypothesis in this regard and made only during the 20th Century.

The second philosopher of the Milesian School, Anaximander held that all things come from a single primal substance, that is not water, or any other substance that we know. It is infinite, eternal and ageless. It encompasses many worlds as he thought our world is

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one of those many. We may note that these ideas are not very far from newly developed ideas either.

The idea of justice, both cosmic and human, played a role in the Greek spiritual sphere and philosophy. This may imply that there should be a certain proportion of fire, of earth, and of water in the world, but each element (conceived as God) is perpetually attempting to enlarge its empire. But there is a kind of necessity or natural law, which perpetually redresses the balance. Where there has been Fire, Water extinguishes it and turns the burning matter into ashes, Earth.

It was believed that through such a process of change and transformation the worlds evolved. This thought is also very close to today's understanding of the origin of the cosmos and its evolution as a transformation from radiation to matter and from matter to life, as the movement of energy. Anaximenes, the last philosopher of the Milesian triad launched the idea that the fundamental substance is Air. The soul is air, fire is rarefied air; when air is condensed it first becomes water, if further condensed it becomes earth and finally stone. Thus, the degree of condensation defines all different substances. Breath and air encompass the whole world, which we can now call as the mind of everything.

Another Greek Philosopher of the 5th century B.C., Heraclitus of Ephesus, thought that everything is in a state of flux. He regarded fire as the fundamental substance; everything as flame, is born by the death of something else. There is unity in the world, but it is a unity formed by the combination of opposites. All things come out of the one, and the one out of all things; but the many of all have less reality than the one, which is God (the mind of the universe: guiding human beings to their ultimate objective of Goodness and Love - my interpretation).

Now almost all the hypothesis that have dominated modern philosophy were first thought of by the ancient Greek; their imaginative inventiveness in abstract matters can hardly be over-praised. They gave birth to theories that have proved capable of surviving and developing throughout more than two thousand years. Especially, Heraclitus' thought is sufficiently dynamic to satisfy the most hustling of moderns. He believed that: This world, which is the same for all, no one of gods or men have made; but it was ever, is now, and ever shall be an ever-living fire, with measures kindling and measures going out. The transformation of fire is first of all the sea.

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The half of the sea is earth and the other half whirlwind. In such a world, **Heraclitus** believed the occurrence of a perpetual change. His belief in universal change is commonly expressed in the phrase: "All things are flowing *'pànta rhêi'*". His doctrine of 'mingling of opposites' and his belief in 'strife' is also a very up-to-date thought: there is a unity in the world, but it is a unity resulting from diversity. In strife, opposites combine to produce a motion, which is a harmony. Heraclitus takes strife as justice and a balancing act in a world where war is common to all and at all times.

Aristotle also believed that the world is continually evolving towards a greater degree of form, and thus becoming progressively more like God (divine spirit-free energy). But the process cannot be completed, because 'matter' cannot be wholly eliminated. He believed that while men appear rational and mortal, they also partake of the 'divine', which is immortal. It is open to men to increase the element of divine in his nature. The process of doing so aims at ultimately reaching the highest virtue. But if man succeeded completely, he would have ceased to exist as a separate entity and reached to oneness.

There is also a great similarity between the ancient Greek thought and those of Hindu and mainly Buddha as all spring from the same source. The most important similarity is the identity of the One and Oneness doctrine of Upanishad and of the Greek Eleatic School. The famous saying *"pànta rhêi"* that expresses also the concept that characterizes "***Sankhyano***" that all things are in continuous change under the incessant activity of three ***Guna***. One can also find similarity between Christianity and ***Hindu*** (Vedic/Brahman) and the gnostic systems in its triple logos i.e:

The Trinity: 1* the source of every life (***the Father),*** 2* the dual nature of human being (***the son and the God);*** and 3* the creative mind (***Holy Spirit***).

Since those ancient times, humanity has undergone many transformations both in thought and action. While gaining in some ways it has lost on others. The pattern of thoughts had not always been supporting human evolution towards a harmony both within and without. In effect, human is now facing a number of problems, which endanger its very survival, in addition to harming its environment at large.

The sublime-conscious may be needed now more than any other time in human history in order to repair the wounds of the natural process. At this juncture it may be

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opportune to quote a saying of Albert Einstein: "Without changing our pattern of thought, we will not be able to solve the problems we created with our current patterns of thought." That is, we need a context to belong to.

Now turning to our present situation, we can survey some of the relevant hard facts and findings regarding the emergence of wisdom as a universal virtue, an intangible property. It manifests itself, as a sensation of goodness and happiness, where the balance appears in the process of any human endeavour.

Some individuals have the ability to sense it right from their birth; others have to acquire it through repeated experiences and, at times, as a by-product of a long suffering at times. It may also be acquired with a deliberate action through continuing observations and contact with the essence of goodness, beauty and grace & love surrounding us and by reflecting on their opposites. Here the role of art and aesthetic and feeling a part of Nature are of paramount significance. MORE RECENTLY

Astrophysicist, **Eric J. Chaisson,** in one of his books (2001), 'Cosmic Evolution - The Rise of Complexity in Nature', outlines the essence of an ongoing research program of a multi-disciplinary work though coloured by the modern scientific method's unavoidable mix of short-term subjectivity and long-term objectivity. It is a subject that seeks to synthesize reductionist posture of specialized natural science with a holistic view that goes well beyond dealing with many of the philosophical questions raised by **Bertrand Russell,** hence reporting as well a considerable progress in this field. Its essence stipulates that a price is paid each time energy changes from one form to another.

In an isolated system, energy states always tend to even out, that is, achieve equilibrium. Nature harbours an inherent tendency to eliminate inequalities and realize uniformity in the distribution of matter and energy to achieve a maximum entropy configuration for any unconstrained system. *Chaisson* brings us to a point where we are well informed and educated to sense clearly the need for acquiring the ability, in effect very rapidly, for using all available knowledge as creatively as possible. This will happen by digging out and bringing up all human forces so long imprisoned in us in order to even up with the presently over-dominant logic based rationality in human activities.

Similarly another Astrophysicist and Cosmologist Sir Martin Rees in one of his recent books entitled "Our Final Hour"(2003) says: "In 21st Century humanity is more at risk

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than ever before from misapplication of science. The environmental pressures induced by collective human actions could trigger catastrophes more threatening than any natural hazards".

He continues to say that: "science is advancing faster than ever. But there is a dark side, namely new science can have unintended consequences; it empowers individuals to penetrate acts of mega-terror, even innocent errors, could be catastrophic. Within a few decades bio-terror or bio-error might kill a million people. Humanity is now at risk as never before from mis-interpretation and application of science. Environmental pressures induced by collective human actions could trigger catastrophes more threatening than any natural hazard. Here comes the role of metaphors - analoging which can tell the truth more touchingly."

A most recent work of Ulisse Di Corpo & Antonella Vannini (2014 Kindle Version) on the Balancing Role of Entropy and Syntropy in Self-organizing Systems (Quantum Paradigm) reflects also on the ideas presented in the Fantappiè's (1941) book on "Unitary Theory" which deals in the main with the mutual-causality in terms of Causality and Retro-causality. That is: physical energy is determined by the past, converging energy is determined by the future. They thus revive the concept of Entropy versus Syntropy as was discovered also by mathematician Fantappiè (1941, coined from the union of the Greek words *Syn*=converging and *Tropos*=tendency).

This concept is based on the fact that everything starts from the grass-root level that is at the level of the individual living being. It, then, inter-connectedly expands and gains breadth and depth in its growth. This approach already indicates the absolute need for peoples' deep empathy with and the sense of awe for their ecology and in a larger sense for their environment including the people and the community around them as well as all other living things as well as non-living matters. A sketchy presentation of the idea is presented at the end of this paper.

Isaac Asimov, more known as a science-fiction writer than scientist likened science's frontier to a fractal - a pattern with layer upon layer of structure, so that a tiny bit of it, when magnified, is a simulacrum of the whole. No matter how much we learn in the course of evolution is just an infinitely complex as a whole. In its course, the greatest paradigm shift which took place in the last century was the quantum theory, namely in the atomic scale nature is "fuzzy". Nonetheless, atoms behave in precise mathematical

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ways when they emit and absorb light, or link together to make molecules. His ever-green question had always been what is going to happen after the fast growing computerization of human life as a whole and now gradually invading the same with a culture of robotics in future?

We have to live with this question now and thereafter I guess. That is: what is going to happen as robots take over and people are put out of jobs? Asimov's considered view or prediction was that: "I am hoping that it is only a transition period and that we are going to end up with a new generation that will be educated in a different way and that will be ready for a computerized world with considerable more leisure and with new kinds of jobs. But there will be different kind of jobs that are going to be created in a computerized world requiring a great deal more sophistication than jobs they destroy.

While it may not be easy, a great many people spend their whole lives doing jobs that are repetitive and stultifying and thus ruin their brains and invalidate their minds. Society will however have to be extremely wise and extremely humane to make sure that there is no unnecessary suffering during this interval."

A DIGEST

Classical, strictly deterministic physics has now fallen. Gone with it also are the deterministic and mechanistic paradigm and the ideas that the future is implicit in the past. In quantum physics there is no single final state but only several possible alternative states. Probabilities can be assigned to each of the possible outcomes if we are given the initial conditions, but the outcome is not fixed or predetermined. Chance is surely a factor in all aspects of cosmic evolution, but it cannot be the sole instrument of change.

Ample evidence here on Earth exists to show that, the natural phenomena can constrain chance which produces oddities in structure for which a priori chances are slim. Life itself may have arisen on Earth (or elsewhere) by means of such an unlikely concentration of chemicals, yet it is also unlikely to have occurred by chance alone. Some factors, in addition to chance are clearly involved in the pre-biotic chemistry of life's origin, though one needs not resort to supernatural phenomena.

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The uniformity and ubiquity of life's essential biochemistry, despite the rich diversity of resulting biological types, speaks volumes about the likelihood of an underlying factor principle, or process – if we could only find it – that derives change. The single, unifying principle encompassing all aspects of natural change is the concept of energy flow as guided by the second law of thermodynamics -energy movement. It may be one of the candidates responsible for change. Necessity and Chance interplay in the process of evolution.

Thus, it is a synthesis of determinism and chance. This synthesis makes it a creative process. Any creative process involves, however, a risk of failure, which in biological evolution means extinction. On the other hand, creativity makes possible striking successes and discoveries. As nothing designed or purposeful governs the process of crystal growth, there is no reason to suspect that ontogeny and phylogeny among life's diverse forms have any design or purpose expressed or implied.

With the onset of human induced problems of a global nature such as atmospheric pollution, ozone depletion, overpopulation, scarce food and natural resources and species' extinction, etc. the biosphere not merely remains the environment for society but has also now become an integral part of society. By any evolution standard, such technologically driven changes are extraordinarily rapid, so much so that the biosphere no longer seems able to respond well to the assaults of humankind.

The hard realities of occupational complexity in an industrial society are upon us. Humankind is moving towards a time, possibly as soon as within a generation or two, when we will no longer be able to expect Nature spontaneously to provide for us the environmental conditions needed for survival. From the two, society and the biosphere will likely emerge a socially controlled bio-culture: here the components become ideas, artifacts, technology, and humans among all other living organism on Earth- the epitome of complexity writ large in Nature. We have become the agents of change, the human drivers of cultural evolution.

Ironically the use of energy and natural resources so vital to our technological civilization is also a root cause of many socio-political problems now facing humankind at the dawn of the new millennium. Humankind is now entering an age of synthesis such as occurs only once in several generations, perhaps only once every few centuries. The scenario of cosmic evolution provides an opportunity to inquire systematically and synergistically

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into the nature of our existence. This may act as an effective intellectual vehicle to invite all citizens to become participants, not just spectators, in building of a whole new legacy.

In order to understand living systems as a holistic ecology (benefitting from **R.E. Ulanowicz - A Third Window),** the emphasis in thinking should be towards understanding the process approach. The important concept is then the recognition the development is the outcome of mutual causation of dual and opposing tendencies. While these tendencies oppose one another in the near field, they are seen to be mutually obligatory under a wider vision. The integrity of the system thus is anchored in its controlling cybernetics quality. In the process approach nothing is context-free.

A system must however exceed a certain threshold in complexity before it can exhibit self-organizing behaviours. It is understandable why reductionistic science developed as it did because systems of unchanging and non-interacting entities are certainly simpler to treat than are co-dependent ones. Process ecology, which has a timeless-history suggests that the agency that creates living entities is to be sought among configurations of ongoing processes. **Peirce, Popper, and Prigogine** all argued against the belief that universe is closed because this closure effectively trivializes, and creativity that arises out of the arts and the humanities is blocked. In this connection Gödel's treatise on logic very much supports this idea.

The practical message of this presentation is that both matter and life have likely proceeded from a common dynamic, and one can follow these developments in terms of a non-linear process with its related variables which share a common dynamical legacy operating within the dynamic quantum field. With the process vision, we now come full circle and invite science to step down off its pedestal to mix as equal with other human endeavours.

"We should chiefly depend not upon that department of the soul which is most superficial and fallible (our reason), but upon that department that is deep and sure, which is instinct." by Charles Sanders Peirce; "Truth is best left to emerge by its own natural strength." by Thomas More (a 16th Century thinker). I only add to those wise-words above the following: be it an individual thought or public opinion generated from internal strengths, which sense also what is beyond the threshold of sensations and integrates them into the essence of thought.

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Higher synergy and freer energy then result in the process and cherish the world with a continuous flow of the sublime-wisdom possibly emanating from many universes. To reach such a subliminal equilibrium we need more and more to see, observe, listen, reflect and digest the world around us and the world within us to become a real human with highly humane qualities. World, then becomes a wonderful place to live in and to relate to others as well as eventually to leave her to the generations to come with pride. The science needs to be broadened to include both objective and subjective, epistemology and ontology, rational-tangible and irrational-intangible enquiries linearly or non-linearly dominating the life and living on the Earth.

Between order and disorder with us or without us the universe will continue its journey per-force towards its destination betwixt of chaos (material-tangible energy depletion) and order (immaterially-intangible energy collection) as described in the sketch below.

Inspired with these considered and conscious words we should now be positively encouraged to present schematically the Life-Tree of Living Systems below as a desirable path for an anthropogenically living: The following diagram sketches how much equilibrium needs to be attaining between: those activities non-linear and subjective in nature which are highly indeterministic and uncertain and being unpredictable in nature they are thus open to creativity and allow changes as needed; best expressed by the beauty and power of Fractal geometry, and those linear and objective in nature that maintain reliability, security, certainty, predictability, deterministic and rational.

Giuseppe Arcidiacono (1927-1998): in his book "Spazio, Iperspazio e Frattali" – "Il magico mondo della Geometria", Di Renzo Editore, Rome, Italy (1993): "After an in-depth examination of plane and spatial geometry, that is, of polygons, circles, polyhedra, and spheres, we move on to the study of hyper-spatial geometry and of 'fractals', with a non-integer number of dimensions, highlighting how hyper-spaces are of fundamental importance in modern physics, as they allow to study the phenomena of micro-physics and cosmology".

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Carlo Levi – *Lungomare,* 1928

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"Art is a mix of the hard and the soft.
When the perfect balance is achieved between them
one will then have the classical beauty."
Salvador Dalí

"A geometry able to include
mountains and clouds exist:
***Fractals Geometry**.*
Like everything in science, this newly revived
powerful geometry has very,
very deep and long roots."
Benoit Mandelbrot