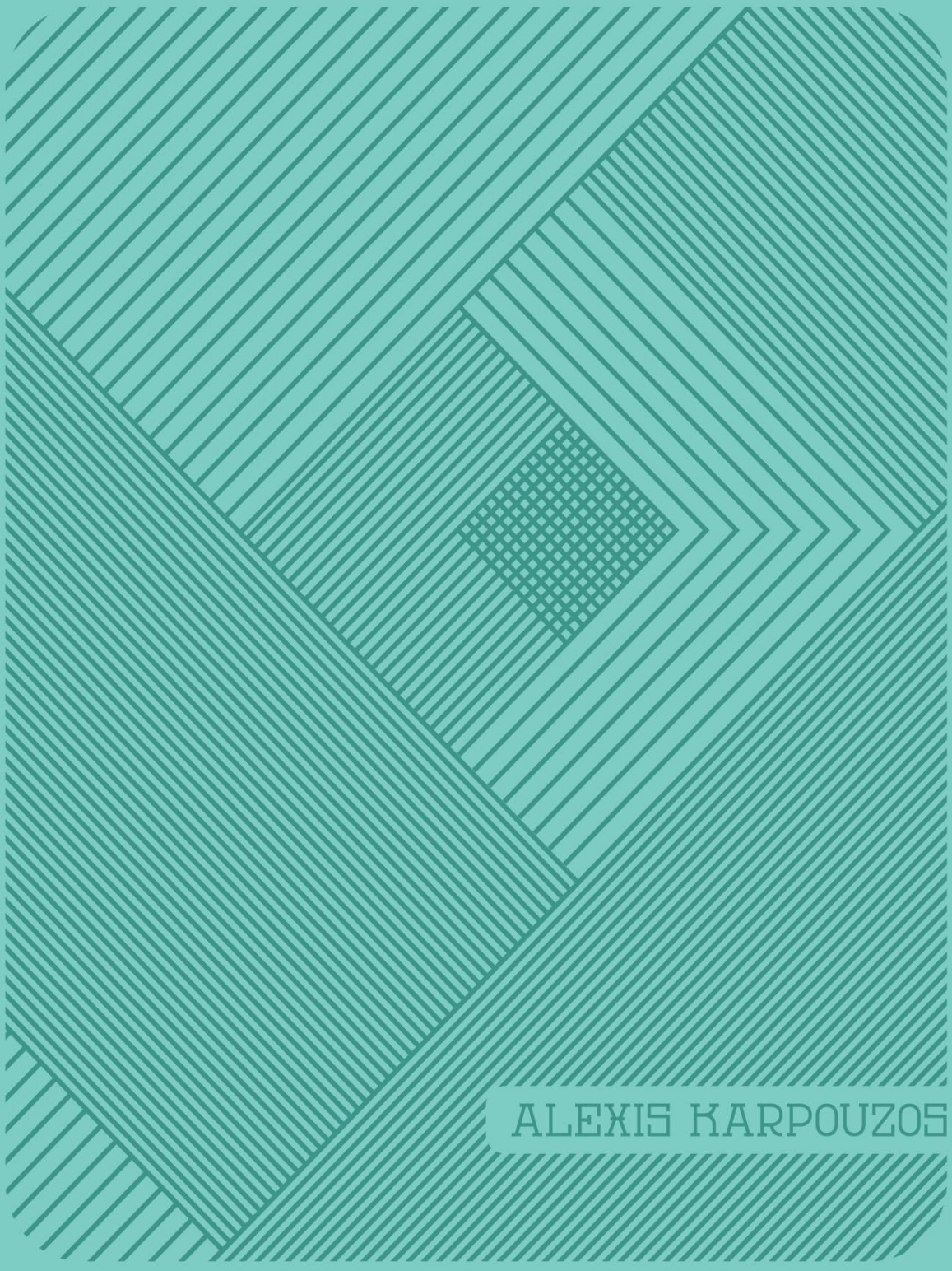
THE END OF CERTAINTY

COMPLEXITY AND SELF-ORGANIZED SYSTEMS
THE PARTICIPATORY UNIVERSE OF QUANTUM THEORY



ALEXIS KARPOUZOS

THINK LAB

''The universe is not a world of separate things and events but is a cosmos that is connected, coherent, and bears a profound resemblance to the visions held in the earliest spiritual traditions in which the physical world and spiritual experience were both aspects of the samereality and man and the universe were one. The findings that justify this new vision of the underlying logic of the universe come from almost all of the empirical sciences: physics, cosmology, the life sciences, and consciousness research. They explain how interactions lead to interconnections that produce instantaneous and multifaceted coherence–what happens to one part also happens to the other parts, and hence to the system as a whole. The sense of sacred oneness experienced by our ancestors that was displaced by the unyielding material presumptions of modern science can be restored, and humanity can once again feel at home in the universe''.

Alexis Karpouzos

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The Newtonian mechanics was the model of classical science. In the classical science all the natural laws had an absolutely deterministic and descriptive character and defined the course and development of every phenomenon. The knowledge of these laws assured the human – observer the ability to understand not only the present but also the past and the future. In a deterministic and timeless universe, the arrow of time is nothing but a human illusion. Only the vision of the universe from the perspective of eternity ensures the truth of physical theories. In the deterministic universe of the classical science, the order always creates disorder and never vice versa! The scientific dream of a united (applying on the microcosm as well as on the macrocosm) and objective (i.e. independent of the observer) description of the natural world, would become the nightmare of the contemporary physics in the beginning of the 20th century. The quantum description and interpretation of the microcosm, which is regarded as the fundamental level in which all the natural phenomena are raised and explained, requires a radical review of not only the classical description but also of the metaphysical preconditions of classical science.

The classical ideal in physics was to be able to predict with certainty the future development of a physical system. Newton's mechanics led to the triumph of the deterministic vision of the natural processes: if we know the initial conditions of a dynamical system, then the solution of the differential motion equations would allow us to know in certainty not only the past but also the future of that system. This, however, is not feasible for two reasons: a) it is not possible to have the initial conditions of the system in absolute accuracy and b) the analytical solution is not feasible for the great majority of the systems. As far as the first reason is concerned, we have to mention that after the discovery of the unstable systems, it became clear that very neighboring orbits (which, namely correspond to initial conditions and whose values may differ slightly) after a certain period of time are removed exponentially. In this notion, the orbit is actually an idealization, since it is never possible to know the initial conditions in "infinite" accuracy. According to Heisenberg's uncertainty principle and Bohr's principle of correspondence, the neutral and deterministic description of the microcosm is impossible: discontinuity and indeterminacy are inherent characteristics of microphysical phenomena and in

order to describe them we have to integrate the observer within his own observations!

Prigozine believed that the laws of nature and those of physics are not given apriori, nor are they entailed logically. They evolve in the same way the various species evolve. Since things are becoming more multiple, bifurcations and aids occur and new laws appear. “How can you be talking about the laws of biology if there are no living systems?” This proves the creativity of life. Each level of organization produces something fundamentally new, something that is not found in the constituents or the "parts" of the previous level. For example, in a mixture of hydrogen and oxygen there is no water. The mixture gets a new identity, which, in practice, sacrifices the "parts", hydrogen and oxygen. The only way to get the parts back is to ruin the water. In other words, it was not obvious in the equations of quantum mechanics that a “quantum arrow of time” emerges. Prigogine notes that in the theory of relativity as well, time is irreversible and space and time are alternating mutually. This theory led to the formulation of the theory of Big-Bang, which in practice gives an irreversible sense to the history of the universe.

Prigogine’s first challenge concerns the phenomenon of irreversibility. The second challenge has to do with the sense of simplicity.

Since Democritus and Aristotle’s era, scientists believed that beneath the complexity of our world there should be simple objects and simple forces. Initially, scientists thought that the atoms are the simple structural stones. Later on, when it was discovered that the atoms consist of smaller parts, simple particles such as the proton and the electron became the structural stones. After that, when the quantum mechanics led to the unexpected discovery of an impressive world of particles at the subatomic level, the physicists invented the grand unified theory and began to look for the unique, simple power - the "superpower" which is supposed to have given birth to that number of interactions of elementary particles. Prigogine points out that: “the idea of simplicity dissolves. Whichever direction we chose, there is complexity.” Complexity is the key idea for the understanding of his theory. According to him, an organism is born, grows to its maturity and passes away, namely, it has a history… Both the classical Newtonian physics and the physics of the 20th century with quantum mechanics and the theory of relativity, are expressed by equations, which

are symmetrical with respect to time, i.e. they are reversible and deterministic. In those theories there is no discrimination between the past and the future.

Thermodynamics, from approximately the half of the 19th century had posed the problem of the irreversible processes and the arrow of time. But the fundamentally nonlinear character of natural processes and the different behavior of natural systems, when they are away from the equilibrium state, were not yet recognized. The discovery, in the 19th century, of the non reversible time – in evolution and entropy - did not change the belief of the physicists that in the most basic levels of matter, time is reversible, while the irreversibility we can see around us is a kind of an illusion, as Einstein once pointed out.

As Prigogine mentions, “the study of systems away from the equilibrium state led me to the belief that this cannot be the right view. Irreversibility plays a constructive role. It creates a form. It creates human beings. How could our simple ignorance of the initial conditions be the reason for this? Our ignorance cannot be the reason we exist."

Prigogine goes on: “If we could raise the knowledge, i.e. create a computer powerful enough, in order to write equations for the motion of all reversible and probabilistic individual molecules that compose a system, then would our ignorance disappear, would the illusion of irreversibility remain vague, and would life, evolution, death and time itself disappear? This is weird.”

This time paradox resulted in the development of physical theories during Newton’s era and thereafter. Particularly the time paradox refers to the fact that while the classical equations are reversible with respect to time, from numerous physical data the arrow of time seems to exist.

So, the question raised by Prigogine is the following: Does the arrow of time arise simply as a result of a phenomenological approach to the natural processes or does it represent a fundamental element which we must incorporate in the descriptions of these processes?

The claim of Prigogine is summarized: “All laws of physics must be compatible to the existence of the arrow of time”. This means that the laws have to be redrafted in order firstly to contain the arrow of time (i.e. not to be symmetrical with respect to

time) and secondly, the various levels of description can lead to the same future state.

The Role Of The Dispersing Structures And Of The Bifurcations.

According to the second law of thermodynamics, in an isolated system (i.e. which does not exchange matter and energy with its environment), the total entropy increases progressively, while the free energy decreases until the system reaches the equilibrium state, when its entropy acquires its maximum value. In thermodynamic equilibrium state, the system is homogeneous and idle. If we also suppose, as Clausius did, that the whole universe is an isolated system of gigantic dimensions, then, according to the second law, the progressive degradation of the energy, i.e. the maximization of entropy inevitably leads to the "heat death" of the universe.

In classical thermodynamics the arrow of time, i.e. the decay, the disorder and the death, is introduced. Classical thermodynamics referred to isolated and closed-linear systems.

However, how can we explain the “weird” behavior of the open systems? These systems are located far from the equilibrium state and continuously exchange matter and energy with their environment. They do not tend to a state of minimum free energy and maximum entropy, but, on the contrary, they use some energy inputs and fluctuations not only in order to maintain their structural stability but also in order to evolve towards new dynamical states.

The open thermodynamic systems are the rules, not the exception. Those systems contain not only the living organisms and the human societies, but also the greatest part of the “simpler” physicochemical systems. Prigogine proved that on conditions away from thermodynamic equilibrium state, the matter acquires new unexpected properties, organizes itself and produces complex structures from random fluctuations.

He will name these structures dissipative structures. Basically, we are talking about systems which consume energy. The dissipative structures are states which reflect their interaction with the environment, with which they interchange energy, sustained through an endless dynamic flow.

The simplest forms of dissipative structures are some rather simple physicochemical systems in which minimum disturbances and fluctuations in microscopic scale lead to the emergence of new unexpected macroscopic structures. The living systems are open systems, organization complexes that are far from the equilibrium state and Prigozine, as it is said, classifies them in the “dissipative structures.”

Prigozine mentions that these random (unpredictable) processes show that the open systems and therefore the greatest part of our universe are not mechanistic but random. He uses the idea of randomness in a more different manner than the other scientists do. For example, for Jacques Monod, author of the book “Chance and Necessity”, chance means a world governed blindly and implies a universe, which according to human terms, is meaningless, namely it is very close to the illogical world of existential philosophy.

However, for Prigozine, chance is a synonym for non-determinism, for spontaneity, for innovation and creativity. Prigozine’s universe is not far from being a living organism, just because it has got space for the random behavior. This allows the dissipative structures – which can be anything – from a chemical solution to a cloud, a brain or a human – to recreate themselves according to unpredictable models. These new models are usually caused by small changes or disturbances. These small changes or disturbances create an unpredictable type of behavior which challenges a mechanical interpretation of entropy, as well as a conventional interpretation of the arrow of time.

This way, the dissipative structures introduce continuous creativity in nature. This means that nature is not something stable, inert molecules that are governed only by impulses and attractions, but something energetic and alive. In those open systems, the matter is not isolated, but on the contrary it is rewarding, and correlative self - changing, with respect to the activities of the rest matter. In those “out of balance” systems, the minimum change can "destabilize" the system and bring about a result that has not been foreseen by the logic of linear equations.

Examples of dissipative structures

The key to the answer to the time paradox is located in the study of systems that are far from the equilibrium state. In systems like that self - organizing processes as well as dissipative structures are possible to come out.

In order to understand this meaning, at first we shall refer to a system which is located close to the equilibrium state, e.g. a pendulum with frictions. If we remove it from the equilibrium state, after a certain period of time it will return to the above state. However, in systems which are not far from the equilibrium state, there are bonds which do not allow them to return to the equilibrium state. Prigogine mentions the ecosystem on the surface of the earth as an example of the above phenomenon. As the ecosystem gets the influence of the solar radiation, it is removed from the equilibrium state and it is lead to the creation of complex structures. “The important thing”, Prigogine mentions, “has to do with the fact that away from the equilibrium state, when the system is disturbed, there is no guarantee that it will return again in its former condition. On the contrary, the system starts exploring new structures, new types of organization in space - time, which I named dispersing structure

Bifurcation: Window of divided routes

An important factor in the emergence of new structures is the contribution of fluctuations or disruptions, namely of sudden illusions that allow something new to appear, even there where the existence of entropy would exclude it. This happens because the dispersion structures are non linear systems, the order of which emerges from chaos. If we add only one fluctuation to other fluctuations, then this fluctuation will become so strong that it will manage to organize the whole system under a new model. These points are called by Prigogine Bifurcation points and they are points at which the deterministic description collapses and then the system follows one of the several possible Bifurcations of the road.

As an instant window into the whole, the strengthening of the bifurcations leads to order or chaos. In Prigogine's perception of things, the bifurcation – a word meaning Point of disunity or division – is a basic notion. The bifurcation in a system is a moment of critical importance when something as small as a single photon, a slight variation of the external temperature, a change in the density, or the fluttering of a

butterfly in Hong Kong expands so much by repetition that a fork is created – and the system gets a new direction. As time goes by, the torrents of Bifurcation points makes the system either get fragmented resulting in chaos or stabilize a new behavior through a series of feedback loops (like self – abolition, cross catalysis and self – interception).

If a system that has gone through a Bifurcation gets stabilized by its feedback, it can resist to other changes for millions of years, until some new critical disorder enhances the feedback and creates a new Bifurcation point.

At its Bifurcation points, the option to “choose” between different types of order is actually offered to the system. The inner feedback of some choices is so complicated that there is basically an infinite amount of degrees of freedom. In other words, the order of the choice is so high that we are talking about chaos. Other Bifurcation points offer options where the coupling feedback creates a lower degree of freedom. These choices can make the system seem simple and normal.

This, however, is a fraud because the feedback in obviously simple orders, such as a solitonic wave, is also very complicated. The pure effect of the Bifurcations in the evolution of the living cells was the creation of organic chemical reactions that have been created in a complex and stable manner in the cell environment. Prigogine by the notion “communication” means this exact creation of feedback loops. Towards such communication the system remains unharmed.

The Bifurcation points are landmarks in the evolution of the system and imprint its history. The historical record of the human Bifurcations is engraved on human fetuses. These undergo stages on which initially they look like fish, later like amphibians and finally like reptiles.

Thousands upon thousands of Bifurcation points that compose a vivid recounting of options, through which we evolved as a system from the initiative cell to our current being, can be found imprinted in all forms and processes – in our cell chemical reactions and in the form of our neural networks - that make us unique. In every Bifurcation point during the past of our system, there was a course in which there were several futures. By the repetition and the support that the system got, one future was chosen while the other possibilities disappeared forever. This way our Bifurcation points compose a map of non reversibility of time. The dynamic of the

Bifurcation points reveals that the time is irreversible but it is able to make summaries. It also reveals that the movement of time is not measurable. Every decision made in a Bifurcation point contains a support to something small. Although causality works every time, the Bifurcation occurs unpredictably.

Prigogine points out that: “This mixture of necessity and chance composes the history of the universe.” It also composes the creativity of the universe. The capability of a system to reinforce a small change constitutes a creative lever. Only one bee which enters a beehive and interacts with thousand other bees can pull the beehive across the air by making small movements that indicate the location rich in pollen. The systems are also very sensitive near those parts which consist the crystallized "memory" of Bifurcations of the past. The nations evolved mainly due to Bifurcations which included heavy conflicts. As a result, they are very sensitive towards several types of information which reproduce those Bifurcations. A mere newspaper title can motivate a whole nation to go to war.

The role of the Bifurcations in the evolution of life.

The belief that the secret of the creativity of nature hides in the laws of unpredictability, chaos and time and not in the mechanistic laws of classical dynamics lies beneath Prigogine’s claims. He mentions as an example of the creativity of the chaos and of the non reversibility, their role in the emergence of life.

The dissipative structures arise as a result of processes in systems which are characterized as releasing systems, i.e. systems that show energy losses. In such systems, when they are away of the equilibrium state, interactions (long-range correlations), which have a long range and play a crucial role in creating new structures, take place. The appearance of life in our planet became possible through such natural processes.

Self – Organising And life

An example of self - organising is the appearance of currents and eddies in fluids where we can see billions of particles “cooperate.”

The matter is blind near the equilibrium state. However, far from the equilibrium state we have correlations of great range that are basic for the creation of new structures. Self organizing takes place because when we are far from the equilibrium state, the system has got lots of choices, of which, anthropomorphically talking, it selects one.

Self – organizing is closely connected to the phenomenon of life. The creation of complexity, which is necessary for the creation of life, is connected to the process of storing information in molecules of which the living cell is constituted. All living systems, either unicellular or multicellular organisms, are extremely complex systems compared to all the other species of the non living matter that exist in the Universe. Complexity is the result of effect processes, leading to systems with great organization, containing large information stocks. This organization of the molecules of a living organism, a result of accumulation of information, is what makes them able to produce useful work. The useful work involves both the fulfillment of basic biological processes, such as metabolism and reproduction, and the further increase in the information content that builds up in living systems. This last process is subject to the great chain of evolution of biological systems, this development is governed by the law of natural selection. The capability of reproduction, mutation and metabolism are necessary conditions for the latter.

A system which has got these properties automatically is able to take part in the “game” of natural selection and evolution. The natural selection leads in forms of organizing, which are more effective, leaving the less effective ones at the process of disappearing. This way, a form of organizing which is stabilized dynamically in a system out of the equilibrium state, will disappear, if a an improved form of organizing appears. In this sense, progress means constant amelioration of the operational efficiency of the biological systems.

A yet unsolved problem, associated to biological order is the way in which the transition from the molecular activity to the supermolecular order of the cell takes place. The biological order was usually considered as a natural condition which was created by enzymes playing a similar to the demon of Maxwell role, maintaining

chemical differences in the system. However, today, it becomes understood that this role is ensured by the genetic information contained in the nucleic acids and is expressed by the creation of enzymes which ensure the perpetuation of life. The enzymes thus contribute to the prolongation of life and postpone death. Namely, life is not located out of the natural order, but appears as the ultimate form and expression of the self organizing processes.

Creative Chaos

By focusing on the role of chance and chaos at the creation of structure, Prigogine pictures a universe in which the objects are not defined as well as they are defined in classical or quantum physics.

In Prigogine's universe the future cannot be defined because it is subject to chance, fluctuation, and support. This is characterized by Prigogine as the new "uncertainty principle".

According to the famous uncertainty principle, which was expressed by Heisenberg, it is impossible to know in absolute accuracy the position and the momentum of any subatomic particle. Prigogine's new uncertainty principle teaches us that beyond a boundary point of complexity, the systems are directed to unpredictable directions.

The systems lose their initial conditions and cannot obtain them again or reverse their course. Their inability to look back in time is an "entropy barrier". The discovery of the entropy barrier is similar to Einstein's discovery that the human beings and the messages cannot travel faster than light, namely, beyond the "light barrier".

Prigogine's uncertainty principle, just like Heisenberg's uncertainty principle, is a damage against reductionism (raising all phenomena to simpler ones). But for Prigogine, this way of viewing nature does not reduce its capabilities, but it recognizes its creative possibilities.

Even when we see a system moving to chaos, points – situations, in which order emerges, appear in that system.

Similarly, inside chaos there are traces of a peculiar order. It is also possible that where the system has the shape of a stable system areas called “windows” or “islets” appear. These areas oscillate around a certain number of values. These islets of order, which are interposed into the areas of chaos, are called intennittencies. The importance of these “islets of order” is great because it indicates that there is a close relationship between order and chaos. The relationship between order and chaos must be due to a single process which is subject to the dynamics of nonlinear systems. Namely, there has to be a global chaotic attractor. Generally, the correlation between order and chaos is taken for granted and reflects a holistic concept for the operation of Nature.

Is Time Ahead Of The Being? The Pre – Universe

Two of the biggest questions that preoccupied philosophers and scientists of all time, are the following: a) does the world (the universe) have a beginning or is it infinite? b) does time have a beginning? It is proved that these questions are not independent of one another. The second one refers to the topological characteristics of time. The problem of the nature of time is connected to the above.

For Newton, time is absolute and independent of the history of the Universe. This abstention has now been rejected. Today we accept that the Universe was somehow created, namely it has got a starting point.

In this point Prigogine wonders: “However, how can we realize this starting point (of the time)? It seems more logical to me to suppose that the birth of our Universe is an event in the history of the world and as a result we owe to attribute to it (to the world) a time which comes before the birth of the Universe.”

But how does he mean this birth of the world? “This birth could have been similar to a change of phase which leads from a pre – Universe (that is also called “quantum gap” or “next universe”) to the Universe that is being observed and surrounds us.”

Prigogine goes further explaining the known theory of Big Bang: the Universe begun from a singularity, a point which enclosed all the mass and the energy of the current Universe. But we do not have a theory able to describe this point abnormality.

However, many scientists consider the beginning of the history of the Universe, as the beginning of time.

Subsequently, Prigogine poses the question: “Does actually time have a defined beginning or is it infinite?” and he goes on: “We cannot support that we hold the definite answer, but our phrasing of the laws of Nature, through probabilities and not certainties, can contribute towards this direction. Our research will follow a different way of the one followed by other scientists. We suppose that the Big Bang is an eminently irreversible process. This irreversibility would occur as a result of the instability of the pre – Universe, an instability which is caused by the interactions between gravity and matter. Inside this perspective, the universe would have been created with the characteristic of instability. Meanings, which we have mentioned, as self – organizing, would likewise be applied in the early stages of the Universe”.

It is known that Einstein believed that the discrimination between the past and the future is an illusion because the equations of the, until then, known theories were symmetrical according to time. K.Godel extended this idea to the end, suggesting a cosmological model in which it was possible for someone to travel into his own past. Einstein, who was concerned a lot by this, eventually ended up in expressing his ideas on such an extreme thesis, supporting that it would oblige physicists reconsider their beliefs on the problem of non reversibility.

Hawking, on the other side, introducing the notion of the imaginary time, reached the point of expressing the belief that at the first stages of Big Bang, space and time could not be discriminated from one another and time obtained the characteristics of space. Prigogine, however supports that “time is eternal. We all have an age, our culture has an age, the Universe has an age, time, however, has neither a beginning nor an end.”

Namely, since the Being, the Existence is meaningful only from the moment the Universe started existing and since, according to Prigogine, time is eternal, then time came before the Being.

Einstein, by the General Theory of Relativity and the field equations, linked the measuring of space-time to the total amount of matter -energy of the universe, namely he showed that the geometry of space – time is affected by the matter – energy, and the moving of the material objects are defined by this geometry. The

solution of the field equations, which was suggested by Einstein, matched to a static Universe, thus a universe without a history, according to the classical ideal, which contained the reversibility of the processes, and therefore, the symmetry towards the time of the past and the future. Later on, Friedmann and Lemaitre showed that such a universe is exceptionally unstable and it may be damaged by the slightest disturbance. Eventually, we have reached the acceptable standard model of the Big Bang, which is firmly supported by critical experimental data, such as the experimental verification of the law of Hubble and the background radiation of 2.7 K.

According to this model, as it is reported, the Big Bang began from a point defect, wherein the density and the curvature of space-time are infinite. The size scales involved in this history of the Universe, are measured according to the fundamental physical constants, i.e. the world gravitational constant G, the speed of light c, and Planck's constant h.

The elementary aggregates calculated by those constants are the following:

(1) Planck's length, which is 10^{-33} cm.

(2) Planck's time, which is 10^{-43} sec.

(3) Planck's energy, which corresponds to a temperature of 1 ~ 2 Kelvin grades.

(4) Planck's mass which is 10^{-5} gr. It is huge compared to the mass of the elementary particles. (e.g. proton mass is 10^{-23} gr)

During the first moments of the Universe's life, what is called Planck epoch (or era), these orders of magnitude dominated. Prigogine, considering that in that epoch the quantum processes, along with gravity, should play an important role, introduces, in that point, the necessity of quantization of gravity, and consequently of space – time. This attempt has not yet delivered the expected results.

Concerning the model of the inflationary universe, Prigogine underlines that "the results are very interesting. They show a possibility of an irreversible process that

transforms gravity into matter. They also focus our attention on the pre – Universe, which would here be Minkowski's vacuum, a starting point of irreversible transformations. We shall stress that this model does not describe a process of creation from the beginning. The quantum gap is already characterized by the universal constants, and hypothetically, we can attribute to these constants the values they have today."

In an other point of his work, he writes: "the substantial point here is the fact that the birth of our Universe is not yet connected to an abnormality, but to an instability, similar to a change of phase or a bificuration." And by stressing on the ratio between geometry and matter, on the one side, and on the equivalence of the mechanical work and the heat on the other, he proves the importance of the second thermodynamic law, which "breaks" this notion of equality: the mechanical work can always be transformed into energy, but not vice versa. The case of space – time and matter is equivalent: the transformation of space – time into matter correlates to an irreversible release process, which produces entropy. The reverse process, which would transform matter into space – time is excluded. Namely, the birth of our universe happened due to the transformation of space – time into matter and is interpreted in an explosion of entropy.

Quantum Shift in the Global Brain: How the New Scientific Reality Can Change Us and Our World

The Newtonian mechanics was the model of classical science. In the classical science all the natural laws had an absolutely deterministic and descriptive character and defined the course and development of every phenomenon. The knowledge of these laws assured the human – observer the ability to understand not only the present but also the past and the future. In a deterministic and timeless universe, the arrow of time is nothing but a human illusion. Only the vision of the universe from the perspective of eternity ensures the truth of physical theories. In the deterministic universe of the classical science, the order always creates disorder and never vice versa! The scientific dream of a united (applying on the microcosm as well as on the macrocosm) and objective (i.e. independent of the observer) description of the natural world, would become the nightmare of the contemporary physics in the beginning of the 20th century. The quantum description and interpretation of the microcosm, which is regarded as the fundamental level in which all the natural phenomena are raised and explained, requires a radical review of not only the classical description but also of the metaphysical preconditions of classical science.

The classical ideal in physics was to be able to predict with certainty the future development of a physical system. Newton's mechanics led to the triumph of the deterministic vision of the natural processes: if we know the initial conditions of a dynamical system, then the solution of the differential motion equations would allow us to know in certainty not only the past but also the future of that system. This, however, is not feasible for two reasons: a) it is not possible to have the initial conditions of the system in absolute accuracy and b) the analytical solution is not feasible for the great majority of the systems. As far as the first reason is concerned, we have to mention that after the discovery of the unstable systems, it became clear that very neighboring orbits (which, namely correspond to initial conditions and whose values may differ slightly) after a certain period of time are removed exponentially. In this notion, the orbit is actually an idealization, since it is never possible to know the initial conditions in "infinite" accuracy.

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microphysical phenomena and in order to describe them we have to integrate the observer within his own observations!

Beyond the separation: the new cosomological paradigm

Science evolves through alternating phases of 'normal' science and radical shifts that create scientific revolutions. We saw this at the turn of the 20th century, when science shifted from a Newtonian worldview to Einstein's relativity paradigm, and again with the shift to the quantum paradigm. Now, as we recognize the non-local interconnection of all things in space and time, we find our scientific worldview shifting once again. The insight now emerging in the physical sciences, especially but not exclusively in quantum physics, highlights the role of interaction and interconnection in the diverse spheres of observation and experiment. He insight now emerging in the physical sciences, especially but not exclusively in quantum physics, highlights the role of interaction and interconnection in the diverse spheres of observation and experiment. The quantum theory holds that we live in a participatory universe - which is what we consider as an independent, external reality is linked to the way we observe. When making observations and measurements, the quanta which are everything in the universe, changing. It makes no sense to talk about the properties of quanta without an observer. The universe is connected by conscious observation instruments from the most elementary particles up to huge galaxies. Moreover, quantum theory gives prominence to the quantum vacuum, the vacuum that is prior to observable phenomena, such as atoms and molecules. Unlike the common sense notion of empty space, the quantum vacuum is full of potential prospects. The quantum vacuum is essential in all aspects of physics, the quantum vacuum is an infinite set of "space-time foam" beyond which time, space - and physical - come to an end itself. Quantum theory has reached the point where the source of all matter and energy is a vacuum, a nothingness that contains all the possibilities of everything that has ever existed or could exist. These possibilities then emerge as probabilities before “collapsing” into localized quanta, manifesting as the particles in space and time that are the building blocks of atoms and molecules. The transcendental field of Cosmos is the total of all the possibilities that can occur in any part of the universal space-time.

The quantum vacuum underlies the level of quanta and is a virtual-energy filled substrate rather than empty space) is the cosmic matrix in which the particles and

systems that constitute the materials of the world arise. The quantum vacuum is an integration of what we used to think of as energy and information. It is a field of informed energy. The particles that appear as the material of the universe are entangled excitations of the ground state of this cosmic matrix. The systems that appear as objects composed of material particles are locally manifest yet intrinsically entangled configurations of excitations in that matrix. The particles and systems we observe emerged in the course of evolution in the cosmos. Following the Big Bang (which appears to have been a Big Bounce, a phase-change in the sequence of local universes in the multiverse) the first entities to emerge were photons, protons, neutrons and electrons, and other, more short-lived exchange particles. In processes of galactic and stellar evolution the higher-order configurations we know as the atoms of the elements had emerged.

The current material of spacetime are superordinate configurations of the excitations of the cosmic matrix. Galaxies are composed of stars and stellar systems, and stars are composed of atoms and particles. All these systems are composed of particles, and particles are entangled excitations of the matrix. Atoms, molecules, cells, organisms—and on the macroscale planets, stars, stellar systems and galaxies—are in the final count superordinate quantum systems: various-level configurations of informed energy. On suitable planetary surfaces higher-order configurations of informed energy made their appearance. We call the self-maintaining and self-reproducing variety of these configurations living organisms. Life is not accidental or extraneous phenomena in the universe: the latest observations in astrophysics show that the basic building elements of life, including glycine (which is an amino acid), and ethylene gycol (a compound associated with the formation of sugars in organisms) are synthesized in the course of the physicochemical evolution of stars. The surface of planets associated with active stars are templates for the further complexification of these elements, building sequentially higher order configurations of informed-energy. Information is a paramount factor in the emergence and persistence of informed-energy configurations. In the absence of information the energies present in the universe would be a random concourse of excitations of its ground state. Information structures the energy-sea of the cosmic matrix, and coordinates interaction among the structures.

The Participatory Universe

Cosmology, which is based on the other successful theory that exists, meaning the theory of general relativity of Einstein, suggests that the universe emerged from the pressure of the quantum foam during the Big Bang and after that it has been developing for at least 13.5 billion years. Everything that we consider to be real, either through our senses or through scientific research, has initially being a state of the so-called Planck era (a tiny, short, and chaotic condition that cannot be penetrated, i.e. a mathematical representation that describes the boundaries of our knowledge). After that began the phase of the universal expansion, which created matter,energy,stars,galaxies,andlife.

Therefore, as there is no fixed limit concerning the space and time, science is confronted with the fact that the human brain works in this specific space and time. This should not discourage us, though. If the universe is indeed participatory, then the human brain should also be involved at a quantum level. Why is this happening? Because the quantum foam, which is the source of any particle that exists and also the source of its corresponding oppositely charged antiparticle, must be at the same time the foundation of the brain. The microcosm and the macrocosm have the same sources for billions of years during the past and the present. The reality is constantly arising from the quantum vacuum.
The quanta are coming out of the quantum foam, while their vast majority falls back again to this foam. Thus, the creation, the maintenance, and the re-absorption of the virtual particles occur at any time and at every point of space. Our senses though oblige us to see a sunrise at a time, a birthday party at a time, a face at a time. Without a doubt, the reality is not limited in a linear experience in time and space. One could argue that beyond our limited perception, the Big Bang is happening everywhere at the same time in an eternal now. The creation is an undivided and single process and we are immersed in it.

Given that everything that exists depends on the quantum vacuum, including all living beings, our belief that we are living outside of this quantum vacuum is probably false. There is no rational way to run away from this phenomenon, so the key is to change the sense of reality. The 'transcendence' that is supposed to belong to the saints and the mystics actually applies to all people (and perhaps the saints and the mystics are those who realized it first) Our participation in the quantum vacuum makes the difference in the way life proceeds. Any strange phenomena can occur depending on

our mental and intellectual involvement. Quantum theory arose from the scientific attempt to describe the behavior of atoms and their components. Therefore, it concerns primarily the microcosm. Physicists have long known that certain procedures, such as radioactivity, seemed random and unpredictable. While a large number of radioactive atoms obey the laws of statistics, it is impossible to predict the exact time at which a specific atomic nucleus will split. This fundamental uncertainty is extended to all individual and subatomic phenomena. The word "quantum" by itself means a small energy package, i.e a very small package (from the Latin word quandum). Thus, quantum mechanics, as quantum theory is called, has to do with the basic keystones of matter. These are the basic elementary particles which build up everything in nature. These particles include atoms, molecules, neutrons, protons, electrons, quark, and also photons (the basic light units). All these objects - if we can really describe them as such - are much-much smaller than anything that can be seen and observed by the human eye.

In the dreamy quantum world: the particles are waves and the waves are particles. That is, a beam light is both an electromagnetic wave propagating in the universe, and a flow of tiny particles directed with speed towards the observer. This arises from the fact that some quantum experiments or phenomena reveal the wave nature of light, whereas others reveal the particulate nature the same light. Note though that never both aspects of light are revealed simultaneously. Nevertheless, we suggest that before we observe a beam of light it is both a wave and a particle flow at the same time. In the realm of quantum physics everything is ambiguous: a feature of uncertainty dominates on all its entities, whether it is light, electrons, atoms or quarks. This uncertainty is known as the uncertainty principle and it states that we can only predict the most probable position of a particle and not the exact location. Moreover, we are never able to determine with exact precision nor the position or the momentum of a particle. Therefore, the scientific predictions on the results have a statistical and probabilistic nature. Moreover, there are no "hidden variables" (as Einstein would like), which, if were made known, would dispel the fog that surrounds the quantum world. Therefore, the magical, the obscure, and the hidden, are the integral features of the quantum structure of the universe. For the interpretation of quantum mechanics there is a need for an ontological investigation and reflection: Because what explanation can be given for the mysterious superposition of the states of the quantum systems?

A photon (a quantum of light) or an electron (a negatively charged elementary particle) can be found in a superposition of two or more states. We can no longer talk about "here" OR "there". In the strange quantum world we can talk about "here" AND "there." A photon, a part of a flow of light, that falls on a film screen with two holes, instead of choosing one or the other hole as normally expected, can pass through both of the two holes at the same time. An electron that follows a curved path around a nucleus can be possibly located in multiple positions simultaneously. The phenomenon that creates the greatest wonder in the dreamy world of quanta is the phenomenon called Quantum Entanglement. Two particles that may be too far away from each other, even millions or billions of kilometers away, are strangely linked. The slightest variation that may occur in one of them immediately causes a change in the other.

The Science Behind The Statement "Consciousness Creates Reality"

The quantum double slit experiment is a very popular experiment used to examine how consciousness and our physical material world are intertwined. It is a great example that documents how factors associated with consciousness and our physical material world are connected in some way. One potential revelation of this experience is that "the observer creates the reality." A paper published in the peer-reviewed journal Physics Essays by Dean Radin,, explains how this experiment has been used multiple times to explore the role of consciousness in shaping the nature of physical reality. In this experiment, a double-slit optical system was used to test the possible role of consciousness in the collapse of the quantum wave-function. The ratio of the interference pattern's double slit spectral power to its single slit spectral power was predicted to decrease when attention was focused toward the double slit as compared to away from it. The study found that factors associated with consciousness "significantly" correlated in predicted ways with perturbations in the double slit interference pattern. "Observation not only disturbs what has to be measured, they produce it. We compel the electron to assume a definite position. We ourselves produce the results of the measurement." Although this is one of the most popular experiments used to posit the connection between consciousness and physical reality, there are several other studies that clearly show that consciousness, or factors that are associated with consciousness are directly correlated with our reality in some way. A number of experiments in the field of parapsychology have also demonstrated this. Sure, we might not understand the extent of this connection,

and in most cases scientists can't even explain it. However they are, and have been observed time and time again.

Non material universe

What we perceive as our physical material world, is really not physical or material at all, in fact, it is far from it. "If quantum mechanics hasn't profoundly shocked you, you haven't understood it yet. Everything we call real is made of things that cannot be regarded as real." – Niels Bohr At the turn of the nineteenth century, physicists started to explore the relationship between energy and the structure of matter. In doing so, the belief that a physical, Newtonian material universe that was at the very heart of scientific knowing was dropped, and the realization that matter is nothing but an illusion replaced it. Scientists began to recognize that everything in the Universe is made out of energy. "Despite the unrivaled empirical success of quantum theory, the very suggestion that it may be literally true as a description of nature is still greeted with cynicism, incomprehension and even anger." (T. Folger, "Quantum Shmantum"). Quantum physicists discovered that physical atoms are made up of vortices of energy that are constantly spinning and vibrating, each one radiating its own unique energy signature. Therefore, if we really want to observe ourselves and find out what we are, we are really beings of energy and vibration, radiating our own unique energy signature -this is fact and is what quantum physics has shown us time and time again. We are much more than what we perceive ourselves to be, and it's time we begin to see ourselves in that light. If you observed the composition of an atom with a microscope you would see a small, invisible tornado-like vortex, with a number of infinitely small energy vortices called quarks and photons. These are what make up the structure of the atom. As you focused in closer and closer on the structure of the atom, you would see nothing, you would observe a physical void. The atom has no physical structure, we have no physical structure, physical things really don't have any physical structure! Atoms are made out of invisible energy, not tangible matter.

"Get over it, and accept the inarguable conclusion. The universe is immaterial-mental and spiritual" – Richard Conn Henry, (quote taken from "the mental universe) It's quite the conundrum, isn't it? Our experience tells us that our reality is made up of physical material things, and that our world is an independently existing objective one. The revelation that the universe is not an assembly of physical parts, suggested by Newtonian physics, and instead comes from a holistic entanglement of immaterial

energy waves stems from the work of Albert Einstein, Max Planck and Werner Heisenberg, among others.

The Role of Consciousness in Quantum Mechanics

What does it mean that our physical material reality isn't really physical at all? It could mean a number of things, and concepts such as this cannot be explored if scientists remain within the boundaries of the only perceived world existing, the world we see. As Nikola Tesla supposedly said: "The day science begins to study non-physical phenomena, it will make more progress in one decade than in all the previous centuries of its existence." Fortunately, many scientists have already taken the leap, and have already questioned the meaning and implications of what we've discovered with quantum physics. One of these potential revelations is that "the observer creates the reality." A fundamental conclusion of the new physics also acknowledges that the observer creates the reality. As observers, we are personally involved with the creation of our own reality. Physicists are being forced to admit that the universe is a "mental" construction. Pioneering physicist Sir James Jeans wrote: "The stream of knowledge is heading toward a non-mechanical reality; the universe begins to look more like a great thought than like a great machine. Mind no longer appears to be an accidental intruder into the realm of matter, we ought rather hail it as the creator and governor of the realm of matter. (R. C. Henry, "The Mental Universe").

One great example that illustrates the role of consciousness within the physical material world (which we know not to be so physical) is the double slit experiment. This experiment has been used multiple times to explore the role of consciousness in shaping the nature of physical reality. A double-slit optical system was used to test the possible role of consciousness in the collapse of the quantum wave-function. The ratio of the interference pattern's double-slit spectral power to its single-slit spectral power was predicted to decrease when attention was focused toward the double-slit as compared to away from it. The study found that factors associated with consciousness, such as meditation, experience, electrocortical markers of focused attention and psychological factors such as openness and absorption, significantly correlated in predicted ways with perturbations in the double-slit interference pattern.
This is just the beginning. I wrote another article earlier this year that has much more, sourced information with regards to the role of consciousness and our physical material world:

What's The Significance?

The significance of this information is for us to wake up, and realize that we are all energy, radiating our own unique energy signature. Feelings, thoughts and emotions play a vital role, quantum physics helps us see the significance of how we all feel. "If you want to know the secrets of the universe, think in terms of energy, frequency and vibration." – Nikola Tesla. Studies have shown that positive emotions and operating from a place of serenity within oneself can lead to a very different experience for the person emitting those emotions and for those around them. At our subatomic level, does the vibrational frequency change the manifestation of physical reality? If so, in what way? We know that when an atom changes its state, it absorbs or emits electromagnetic frequencies, which are responsible for changing its state. Do different states of emotion, perception and feelings result in different electromagnetic frequencies? Yes! This has been proven. "Space is just a construct that gives the illusion that there are separate objects".

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Other Resources

Books

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- Questioning the Scientific Worldview by Thomas J. McFarlane
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