The balancing role of Entropy and Syntropy

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ENTROPY AND SYNTROPY

Energy exists in many different forms: heat; kinetic, potential, nuclear, chemical, mass, and electromagnetic. However, modern science has not yet explained what energy is:

> "*It is important to realize that in physics today, we have no knowledge of what energy is… There is a fact, or if you wish, a law, governing all natural phenomena that are known to date. There is no known exception to this law – it is exact so far as we know. The law is called the conservation of energy. It states that there*

is a certain quantity, which we call energy, that does not change in the manifold changes which nature undergoes. That is an abstract idea, because it is a mathematical principle; it says there is a numerical quantity which does not change when something happens. It is not a description of a mechanism, or anything concrete; it is just a strange fact that we can calculate some number and when we finish watching nature go through her tricks and calculate the number again, it is the same..."[1] (Richard Feynman)

The energy-mass relation $E = mc^2$ was published in:

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[1] Feynman R.P., et al. (2006), *The Feynman Lectures on Physics*, Addison Wesley. 4-1.

– 1890 by Oliver Heaviside[2] in his *Electromagnetic Theory* vol. 3;
– in 1900 by Henri Poincaré[3];
– in 1903 by Olinto De Pretto in the scientific journal "*Atte*" and registered at the "*Regio Istituto di Scienze*"[4].

In deriving this equation, Einstein's predecessors made assumptions that led to problems when dealing with different frames of reference, since the quantity of motion was not present in the equation. Einstein

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[2] Auffray J.P., *Dual origin of $E=mc^2$*, arxiv.org/pdf/physics/0608289.pdf
[3] Poincaré H, Arch. néerland. sci. 2, 5, 252-278 (1900).
[4] De Pretto O., Lettere ed Arti, LXIII, II, 439-500 (1904), Reale Istituto Veneto di Scienze.

succeeded where others had failed by deriving the formula in a way that was consistent in all frames of reference. He did so in 1905 with his equation for Special Relativity, which adds momentum to the $E = mc^2$ equation:

$$E^2 = m^2c^4 + p^2c^2$$

*where **E** is energy, **m** is mass, **p** momentum and*
***c** the constant of the speed of light*

This equation is known as energy-momentum-mass. However, since it is quadratic, it has two solutions for energy: a positive-time and a negative-time solution.

The positive-time solution describes energy that diverges from a cause, for example light diverging from a light bulb or heat spreading out from a heater. The negative-time solution describes energy that diverges backward-in-time from a future cause; imagine beginning with diffuse light energy that concentrates into a light bulb. This, quite understandably, was considered an unacceptable solution since it implies retrocausality, which means that an effect occurs before its cause.

Einstein solved this problem by assuming that the momentum (p) is always equal to zero; he could do this because the speed of physical bodies is extremely small when compared to the speed of light. And so, in this way, Einstein's complex energy/momentum/mass equation simplified into the now famous $E=mc^2$ equation, which always has positive solution.

But in 1924 Wolfgang Pauli discovered that electrons have a spin which nears the speed of light. Soon after the Swedish physicists Oskar Klein and the German physicist Walter Gordon formulated the Klein-Gordon equation, to describe quantum particles in the framework of Einstein's special relativity. This equation uses the full energy/momentum/mass equation of special relativity and yields two solutions: a forward-in-time wave solution (delayed waves) and a backward-in-time wave solution (advanced waves).

The backward-in-time solution was considered unacceptable, and it was rejected. Werner Heisenberg wrote to Wolfgang Pauli: "*I regard the backward-in-time solution ... as learned trash which no one can take seriously*"[5] and in 1926 Erwin Schrödinger removed Einstein's equation from the Klein-Gordon equation and suggested that time be treated in essentially the classical way, as only flowing forward.

Whereas the Klein-Gordon equation could explain the dual nature of matter (particle/wave), because of the dual causality (forward and backward-

[5] Heisenberg W. (1928), *Letter to W. Pauli*, PC, May 3, 1928.

in-time causality), Schrödinger's equation was not able to explain the wave/particle nature of matter.

Consequently, in 1927 Niels Bohr and Werner Heisenberg met in Copenhagen and suggested an interpretation of quantum mechanics in which matter propagates as waves that collapse into particles when observed. This interpretation, in which the act of observation creates reality, implied the idea that men are endowed with God-like powers of creation and that consciousness precedes the formation of reality. But when Schrödinger discovered how Heisenberg and Bohr had used his equation, with ideological and political implications, he commented: "*I do not like it, and I am sorry I ever had anything to do with it.*"

In 1928 Paul Dirac used the energy/momentum/mass equation to describe relativistic electrons. He was faced again with a dual solution: electrons (e^-) and neg-electrons (e^+, the backward-in-time anti-particle of the electron).

Heisenberg's reaction was of outrage, since he perceived the backward-in-time solution as an abomination and in 1934 he replaced those parts of the equation which refer to the backward-in-time energy, with an operator which creates unlimited numbers of "virtual" electron-positron pairs, without any energy input.

In 1934 Heisenberg took this escape window and, since then, physicists ignore the backward-in-time energy solutions of the two most used and respected equations in modern physics: the energy/momentum/mass equation of special relativity and Dirac's relativistic equation.

In 1941, while working on the d'Alembert operator, which combines special relativity and quantum mechanics, the mathematician Luigi Fantappiè[6] realized that the forward-

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[6] Luigi Fantappiè (1901-1956) was considered one of the foremost mathematicians of the last century. He graduated at the age of 21 from the most exclusive Italian university, "La Normale Di Pisa,"

in-time solution (i.e., delayed waves) describes energy and matter that diverge and tend towards homogeneous and random distributions. For example, when heat radiates from a heater, it tends to spread out homogeneously in the environment; this is the law of entropy, which is also known as heat death.

Fantappiè showed that the forward-in-time solution is governed by the law of *entropy,* whereas the backward-in-time solution (i.e., advanced waves)

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with a dissertation on pure mathematics and became a full professor at the age of 27. During the university years he was roommate with Enrico Fermi. He worked with Heisenberg, exchanged correspondence with Feynman, and in April 1950 he was invited by Oppenheimer to become a member of the exclusive Institute for Advanced Study in Princeton and work with Einstein.

is governed by a symmetric law that Fantappiè named *syntropy* (combining the Greek words *syn* = converging and *tropos* = tendency).

The forward-in-time solution describes energy that diverges from a cause, and requires that causes be in the past; the backward-in-time solution describes energy that converges towards future causes (i.e. attractors).

The mathematical properties of the law of syntropy are energy concentration, an increase in differentiation and complexity, a reduction of entropy, the formation of structures, and an increase in order. These are also the main properties that biologists observe in life, and which cannot be explained in the classical (time forward) way.

This realization led Fantappiè to write "*The Unitary Theory of the Physical and Biological World,*" first published in 1942, where he suggests that we live in a supercausal universe, governed by causality and retrocausality, and that life is caused by the future.[7]

The energy/momentum/mass equations tells that the total amount of energy is the sum of energy in the syntropic state (concentrated) and energy in the entropic state

[7] Fantappiè L. (1942), *Sull'interpretazione dei potenziali anticipati della meccanica ondulatoria e su un principio di finalità che ne discende*, Rend. Acc. D'Italia, 1942, 4(7).

(dispersed):

$$\textit{Total Energy} = \textit{Syntropic Energy} + \textit{Entropic Energy}$$

Since the first law of thermodynamics, the law of conservation of energy, states that energy is a fixed quantity which cannot be created or destroyed, but only transformed, Energy can be replaced with the number 1 and the equation changes into:

$$1 = \textit{Syntropy} + \textit{Entropy}$$

which shows that entropy and syntropy are complementary polarities of the same unity:

$$Syntropy = 1 - Entropy$$

$$Entropy = 1 - Syntropy$$

In "*Syntropy: definition and use*" Mario Ludovico[8] writes:

> "*I deem it impossible to grasp the concept of syntropy without having assimilated the concept of entropy, since not only are the two concepts in a strict mutual connection but entropy and syntropy are also complementary concepts. In other words, where it is possible to measure a level of entropy there is a complementary level of syntropy.*"

[8] Ludovico M. (2008), *Syntropy: Definition and Use*, Syntropy Journal, 1: 139-201.

Moreover, since we cannot see the future, syntropic backward-in-time causality is invisible whereas entropic forward-in-time causality is visible. Therefore, the previous equation can be written as follows:

$$Visible = 1 - Invisible$$

Gandhi described the invisible in the following way:

> *"There is an indefinable mysterious power that pervades everything. I feel it, although I do not see it. This invisible force makes itself felt and yet challenges any demonstration, because it is so different*

from everything that I perceive with the senses. It transcends the senses. (...) In order to see this universal power, of all-pervading truth, we must be able to love the meanest creature as ourselves. He who aspires to this universal power, cannot stay away from any area of life. (...) instruments are as simple as difficult. It may appear quite impossible to an arrogant person and perfectly possible to an innocent child. He who seeks this invisible power should be more humble than the dust. (...) No one will find it if he does not have a great sense of humility."[9]

We continuously experience forces and entities that we cannot observe

[9] Gandhi MK (1968), *The Voice of Truth*, Nvajivan Trust, Ahmedabad.

directly but which exist objectively, independently of any human perception. One such force is gravity.

Suppose we hold a small object like a pencil between our thumb and forefinger and then release it. We observe that it falls to the floor and we say that the force of gravity causes it to fall.

But do we actually see any downward force acting upon the pencil, something pulling or pushing it? Clearly not.

We do not observe the force of gravity at all. Rather we deduce the existence of some unseen force (called gravity) acting upon unsupported objects to explain their otherwise inexplicable downward movement.

According to the energy momentum mass equation half of the forces acting in the universe are entropic (visible), half are syntropic (invisible) and nothing takes place without the interplay of both these forces. We constantly experience observable effects that have unobservable causes, behaviors that cannot be explained observably and phenomena in the visible reality that arise from the invisible reality.

MICRO AND MACRO

We are accustomed to the fact that causes always precede their effects. But the energy/momentum/mass equation predicts three types of time:

– *Causal time* is expected when the forward-in-time energy solution prevails. That is when systems diverge, such as our expanding universe. In diverging systems entropy prevails, causes always precede effects and time flows forwards, from the past to the future. Since entropy prevails, no advanced effects are possible, such as light waves moving backwards-in-time or radio signals being received before they are broadcasted.

- *Retrocausal time* is expected when the backward-in-time energy solution prevails. That is when systems converge, such as black holes. In converging systems retrocausality prevails, effects always precede causes and time flows backwards, from the future to the past. In these systems no delayed effects are possible and this is the reason why no light is emitted by black holes.
- *Supercausal time* would characterize systems in which diverging and

converging forces are balanced. An example is offered by atoms and quantum mechanics. In these systems causality and retrocausality coexist and time is unitary: past, present and future coexist.

This classification of time recalls the ancient Greek division in: Kronos, Kairos and Aion.

– *Kronos* describes the sequential causal time, which is familiar to us, made of absolute moments which flow from the past to the future.
– *Kairos* describes the retrocausal time. According to Pythagoras kairos is at the basis of intuitions,

the ability to feel the future and to choose the most advantageous options.
- *Aion* describes the supercausal time, in which past, present and future coexist. The time of quantum mechanics, of the sub-atomic world.

This classification of time suggests that syntropy and entropy coexist at the quantum level, i.e., the Aion level, and that at this level life originates. This statement is now supported by the fact that the functioning of living systems is widely influenced by quantum events: the length and strength of hydrogen bonds, the transmission of electrical signals in the microtubules, the action of DNA, the folding of proteins.

A question naturally arises: how do the properties of life ascend from the quantum level of matter, the Aion level, to the macroscopic level, the Kronos level, transforming inorganic matter into organic matter?

In 1925 the physicist Wolfgang Pauli discovered in water molecules the hydrogen bond. Hydrogen atoms in water molecules share an intermediate position between the sub-atomic level (Aion) and the molecular level (Kronos), and provide a bridge that allows the properties of syntropy to flow from the quantum to the macro level.

Hydrogen bonds make water different from all other liquids, increasing its attractive forces (syntropy), which are ten times more powerful than the van der Waals forces that hold together other liquids, with behaviors that are in fact symmetrical to those of other liquid molecules.

Consequently, we can suggest that life originates at the quantum level, since at this level syntropy is available, and that thanks to water and the hydrogen bond, life rapidly grow into the macroscopic level which is governed by the opposite law of entropy.

To survive the destructive effects of entropy, life needs to acquire syntropy from the quantum level and water provides the mechanism, becoming in this way vital.

Among the anomalous properties of water which recall the cohesive qualities of syntropy:[10]

– When water freezes it expands and becomes less dense. Other liquid's molecules when they are cooled concentrate, solidify, become denser and heavier and sink. With water exactly the opposite is observed.
– In liquids the process of

[10] Ball P. (1999), *H_2O A Biography of Water*, Phoenix Book, London.

solidification starts from the bottom, since hot molecules move towards the top, whereas cold molecules move towards the bottom. The liquid in the lower part is therefore the first which reaches the solidification temperature; for this reason, liquids solidify starting from the bottom. In the case of water exactly the opposite happens: water solidifies starting from the top.

– Water shows a heat capacity by far greater than other liquids. Water can absorb large quantities of heat, which is then released slowly. The quantity of heat which is necessary to change the temperature of water is by far greater than what it is needed for other liquids.

– When compressed cold water becomes more fluid; in other liquids, viscosity increases with pressure.
– Friction among surfaces of solids is usually high, whereas with ice friction is low and ice surfaces result to be slippery.
– At near to freezing temperatures the surfaces of ice adhere when they come into contact. This mechanism allows snow to compact in snowballs, whereas it is impossible to produce balls of flour, sugar, or other solid materials, if no water is used.

– Compared to other liquids, in water the distance between melting and boiling temperatures is very high. Water molecules have high cohesive properties which increase the temperature which is needed to change water from liquid to gas.

Water is not the only molecule with hydrogen bonds. Also, ammonia and fluoride acid form hydrogen bonds and these molecules show anomalous properties like water. However, water produces a higher number of hydrogen bonds, and this determines the high cohesive properties of water which link molecules in wide dynamic labyrinths.[11] Other molecules that form hydrogen bonds do not reach the point of being able to build networks and broad structures in space. Hydrogen bonds impose structural constraints extremely unusual for a liquid. One example of these structural constraints is provided by crystals of snow. However, when water freezes hydrogen bonds stop working and the flow of syntropy from micro to macro stops, bringing life to death.

Hydrogen bonds make water essential for life: water is ultimately the lymph of life which provides

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[11] Bennun A. (2013), *Hydration shell dynamics of proteins and ions couple with the dissipative potential of H-bonds within water*, Syntropy 2013 (2): 328-333.

living systems with syntropy. Water is the most important molecule for life, which is necessary for the origin and evolution of any biological structure. Consequently, if life would ever be discovered beyond Earth water would necessarily be present.[12]

[12] Vannini A. (2011) and Di Corpo U., *Extraterrestrial Life*, Syntropy and Water, Journal of Cosmology, journalofcosmology.com/Life101.html#18

THERMODYNAMICS

During the nineteenth century, the study and description of heat lead to a new discipline: thermodynamics. This discipline, which can be traced back to the works of Boyle, Boltzmann, Clausius and Carnot, studies the behavior of energy, of which heat is a form. The study of the transformations of heat into work led to the discovery of three laws:

– *The law of conservation of energy*, which states that energy cannot be created or destroyed, but only transformed.

- *The law of entropy*, which states that energy always moves from a state of availability to a state of unavailability. Transforming energy (for example from heat to work) part is lost to the environment. Entropy is a measure of the quantity of energy which is lost to the environment. When energy lost to the environment is distributed in a uniform way, a state of equilibrium is reached, and it is no longer possible to transform energy into work. Entropy measures how close a system is to this state of equilibrium.
- *The law of heat death*, which states that dissipated energy cannot be

recaptured and used again, and that the entropy of an isolated system (which cannot receive energy or information from outside) can only increase until a state of equilibrium is reached (heat death).

Entropy is of great importance as it introduces in physics the idea of irreversible processes, such as that energy always moves from a state of high potential to a state of low potential, tending to a state of equilibrium.

In this regard, the eminent physicist Sir Arthur Eddington (1882-1944) stated that "*entropy is the arrow of time*" in the sense that it forces physical events to move in a particular time direction: from the past to the future.[13] Our experience continually informs us about entropy variations, and about the irreversible process that leads to the dissipation of energy and heat death: we see our friends becoming old and die; we see a fire losing intensity and turning into cold ashes; we see the world increasing in entropy: pollution, depleted energy, desertification. The term irreversibility entails a tendency from order to disorder. For example, if we mix together hot and cold water we get tepid water, but we will never see the two liquids separate

[13] Eddington A. (1935) *New Pathways in Science*. Cambridge Univ.

spontaneously.

The term "entropy" was first used in the middle of the eighteenth century by Rudolf Clausius, who was searching for a mathematical equation to describe the increase of entropy. Entropy is a quantity which is used to measure the level of evolution of a physical system, but in the meantime, it can be used to measure the "disorder" of a system. Entropy is always associated with an increasing level of disorder. Nevertheless, life defies entropy. Life becomes more complex over time, through growth and reproduction, turning more of the physical universe from disordered atoms into very highly ordered molecules. Living systems evolve towards order, towards higher forms of organization, diversification, and complexity, and can keep away from heat death.

Biologists and physicists have been debating this paradox. Schrödinger, answering the question of what allows life to counter entropy, wrote:

> "*It feeds on negative entropy. It is by avoiding the rapid decay into the inert state of 'equilibrium' that an organism appears so enigmatic; so much so, that from the earliest times of human thought some special non-physical or supernatural force (vis viva, entelechy) was claimed to be operative in the organism, and in some*

quarters is still claimed."[14]

The same conclusion was reached by Albert Szent-Györgyi (1937 Nobel Prize in Physiology and discoverer of vitamin C):

"*It is impossible to explain the qualities of organization and order of living systems starting from the entropic laws of the macrocosm. This is one of the paradoxes of modern biology: the properties of living systems are opposed to the law of entropy that governs the macrocosm.*"[15]

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[14] Schrödinger E. (1944), *What is life?* whatislife.stanford.edu/LoCo_files/What-is-Life.pdf

[15] Szent-Györgyi A. (1977), *Drive in Living Matter to Perfect Itself*, Synthesis 1, Vol. 1, No. 1, 14-26.

Györgyi continues suggesting the existence of a law symmetric to entropy:

> "*A major difference between amoebas and humans is the increase of complexity that requires the existence of a mechanism that is able to counteract the law of entropy. In other words, there must be a force that is able to counter the universal tendency of matter towards chaos and energy towards dissipation. Life always shows a decrease in entropy and an increase in complexity, in direct conflict with the law of entropy.*"

While entropy is a universal law that leads to the dissolution of any form of organization, life demonstrates the existence of another law. The main problem, according to Györgyi, is that:

> "*We see a profound difference between organic and inorganic systems ... as a scientist I cannot believe that the laws of physics become invalid as soon as you enter the living systems. The law of entropy does not govern living systems.*"

Similar considerations were reached by the paleontologist Teilhard de Chardin who pointed out the need for a law symmetrical to entropy:

> "*Reduced to its essence, the problem of life can be expressed as follows: once we admit*

the two major Laws of Energy Conservation and of Entropy (to which physics is limited), how can we add, without contradictions, a third universal law (which is expressed by biology) ... The situation is clarified when we consider at the basis of cosmology the existence of a second kind of entropy (or anti-entropy)."[16]

The energy/momentum/mass equation requires the following extension to thermodynamics:

– *Principle of Energy Conservation*: energy can neither be created nor

[16] Teilhard de Chardin P. (2008), *The Phenomenon of Man*, www.amazon.it/dp/0061632651/

destroyed but can only be transformed.

- *Law of Entropy*: in an expanding universe energy is constantly released in the environment. Entropy is the magnitude by which we measure the amount of energy that is released into the environment.
    - The increase of entropy is irreversible.
    - Time flows forward.
    - The system tends towards a state of thermodynamic death.
- *Law of Syntropy*: in a converging universe energy is constantly absorbed from the environment. Syntropy is the magnitude by

which we measure the concentration of energy.

  - The increase of syntropy is irreversible.
  - Time flows backward.
  - The system tends towards a state of thermodynamic potentiality.

– *Law of Supercausality*: in a system were diverging and converging forces interact:

  - Differentiation and complexity increase.
  - Time is unitary.
  - Processes can be reversed.

LIFE

The first question about life, which has always puzzled scientists and philosophers, is this: *How can life develop from molecules that are not living*? To this question the ancient Greeks responded by saying that life spontaneously generates from inorganic matter because of the action of the goddess Gaia. This hypothesis was reformulated by the Latins as *generatio spontaneous* and in contemporary science as abiogenesis.

Some important dates in the debate between biogenesis and abiogenesis are the following:

- In 1668 the Italian physician Francesco Redi (1626-1697) proved that no maggots appeared in meat when flies were prevented from laying eggs, providing in this way the first solid evidence against the hypothesis of the spontaneous generation of life. Redi gradually showed that, at least in the case of all the higher and readily visible organisms, the abiogenetic hypothesis was false.
- Spontaneous generation for small organisms gained favor in 1745 when John Needham (1713-1781) showed that if a broth was boiled

and then placed in a sterile container it became cloudy, supporting in this way the theory of abiogenesis.

– In 1768 Lazzaro Spallanzani (1729-1799) repeated Needham's experiments, removing air from the sterile container. Spallanzani wanted to avoid contamination by boiling a meat broth in a sealed container. The problem with this approach was that air could shatter the container upon heating. Therefore, he removed the air from the container after sealing it. The broth did not subsequently cloud with bacterial growth, supporting in this way the theory of biogenesis.

– It was not until mid-nineteenth century, almost 100 years later, that the great French chemist Louis Pasteur put the debate to rest. By passing air through cotton filters, he first showed that the air is full of microorganisms. Inspection of this material revealed numerous microbes. Pasteur realized that if these bacteria were present in the air then they would likely land on and contaminate any material exposed to it. The debate brought the French Academy of Sciences to allocate a prize for whoever was able to provide a convincing and accurate experimental answer to the question. Pasteur entered the contest with experiments similar to those performed by Spallanzani, which used heat to kill the microbes. In a simple, but brilliant modification, the neck of a flask, used in the experiments, was heated to melting point and drawn out into a long S-shaped curve, preventing dust particles and their load of microbes from reaching the contents of the flask. After prolonged incubation the flasks remained free of life and this ended the debate for most scientists. Results were published in 1862 and explained the errors and artifacts of other competitors. Pasteur summarized his findings in the

Latin phrase: *Omnevivum ex vivo*, indicating that life can only be generated from organic matter, from life. These findings further restricted the abiogenetic hypothesis to special conditions which would have characterized the early stages of our planet.

– In 1924, Alexander Oparin (1894-1980) published in Russian a work entitled *The Origins of Life*[17] in which he describes that the findings on the characteristics of colloids suggest that the ability of colloids to bind substances to the surface indicates a beginning of

[17] Oparin A. (1924), *The Origin of life*, http://www.uv.es/orilife/textos/The%20Origin%20of%20Life.pdf

metabolism. His book ends with the phrase: "*Work is already in a very advanced stage, and soon the last barriers between organic and inorganic will fall under the attack of a patient work and powerful scientific theories.*" The English version of Oparin's book was published in 1938 and has had a wide impact on researchers and public opinion.

– In 1952 Harold Urey (1893-1981) coined the term cosmochemistry, or chemical cosmology, in order to indicate the origin and development of the substances of the universe. The main focuses are the elements and their isotopes, primarily (but not always) within the solar system. Closely related fields are astrochemistry, a branch of astronomy concerned with measuring chemical elements in other parts of our galaxy and in other galaxies. Cosmochemistry focused on the study of the chemical elements on Earth and planets during their evolution. In 1952, in the book *The Planets: Their Origin and Development*[18], Urey assumed that the composition of primordial Earth was similar to that of the cosmos: 90% hydrogen atoms, 9% of helium atoms, 1% atoms of other elements. From this assumption he deduced that the

[18] Urey H. (1952), *The Planets: Their Origin and Development*. Yale Univ. Press, 1952.

composition of the primordial atmosphere should be made of methane (CH_4), ammonia (NH_3), nitrogen (N_2), water (H_2O) and hydrogen (H_2).

– In 1953 a student of Urey, Stanley Miller (1930-2007), published the article *A Production of Amino Acids Under Possible Primitive Earth Conditions*.[19] Miller demonstrated that, in a primordial atmosphere and in the presence of water, the action of electrical discharges (simulating the action of lightning) could generate amino acids, that is the fundamental building blocks of

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[19] Miller S.L. (1953), *A Production of Amino Acids Under Possible Primitive Earth Conditions*, Science, May 15, 1953.

proteins. In his experiments, which used sterile equipment, Miller inserted gases such as methane (CH_4), ammonia (NH_3) and water (H_2O). The system consisted of liquid water, gas and two electrodes. The experiment was divided into cycles in which water was heated to induce the formation of water vapor, the electrodes were used to produce electrical shocks similar to lightning and the whole was then cooled to allow water to condense. Then a new cycle began. After about a week of uninterrupted cycles, where the conditions were kept constant, Miller noted that about 15% of the carbon had formed organic compounds, including some amino acids. The idea was that this synthesis of amino acids would provide the building blocks for proteins. Miller's experiments produced an aqueous mixture containing various products which were then isolated using a process of extraction. These products contained amino acids, including some of those found in living systems. This aqueous mixture was called primordial soup. Miller gave a decisive impetus to the experimental research of the abiotic origins of life.

The second question about life is this: *How did molecules, that are essential for life, form from amino acids*? Amino acids are the building blocks of life but are not considered to be living forms. Miller's experiments gave rise to a host of other experiments, which are still being conducted to demonstrate the feasibility of constructing complex organic molecules from amino acids. These experiments are aimed at attempting to describe how proteins can form spontaneously starting from amino acids. Results have been very problematic, for several reasons:

– Proteins involved in the

metabolism of cells are composed of chains which include more than 90 amino acids. Simple combinatory calculations show that more than 10^{600} (one followed by 600 zeroes) permutations are required to combine amino acids by chance in a "spontaneous" formation of just one protein of 90 amino acids. Elsasser[20], in a work published in the American Scientist, shows that in the 13-15 billion years of our Universe a maximum of 10^{106} simple events (at the nanosecond level) have taken place. Consequently, any event which requires a combinatory value

[20] Elsasser W.M., *A causal phenomena in physics and biology: A case for reconstruction.* American Scientist 1969, 57: 502-16.

greater than 10^{106} simply cannot apply to our physical Universe. This number is greater than all the combinations which have taken place in its entire history, since the Big Bang. In other words, the possibility of the spontaneous formation of just one protein is nil. Elsasser's results show that "*the notion of mechanical causation in biology is devoid of logical underpinning*" and that *"the use of mechanical causation in life and ecology is metaphorical at best, and a very real danger exists that the use of this metaphor can too easily divert one's attention in the wrong direction.*"

– In addition, primordial soups are made up mostly of water, but water leads to the decomposition of macromolecules and makes it impossible for amino acids to chain together in the initial stages of protein formation. In 2004, Luke Leman and collaborators at the Scripps Research Institute and Leslie Orgel of the Salk Institute for Biological Studies[21], obtained peptides (short chains of amino acids) using solutions of amino acids, carbonyl sulfide (COS, a volcanic gas) and catalysts based on metal sulfides. But using this process it is not clear where the amino acids came from, since they

[21] Leman L. (2004), Orgel L and Ghadiri MR, *Carbonyl Sulfide-Mediated Prebiotic Formation of Peptides*, Science 8 October 2004: 306 (5694), 283-286, DOI: 10.1126/science.1102722

require a totally different environment which is not based on water.

– Another proposal is that amino acids, which form in water, are concentrated in lagoons which periodically become dry and condense under the influence of dry heat, which also creates chemical bonds responsible for the union of amino acids (peptide bond).
– The processes of synthesis have allowed to produce 13 of the 20 amino acids involved in the construction of proteins. In addition to these, thousands of other amino acids are generated,

which are not present in living organisms.

– If it were possible to select and combine only the amino acids present in living systems (the probability is equal to zero), the resulting combinations would be three-dimensional and not linear, such as that which is present in life's protein chains. The three-dimensional combinations (known as proteinoids) are inappropriate to the metabolism of cells because they cannot be encoded by a linear genetic code. Proteinoids are therefore given no value in the formation and development of life.

– Life, as we know it, depends totally

on levorotatory amino acids whereas the synthesis of amino acids leads to the formation of an equal number of dextrorotatory and levorotatory chains. The production of proteins in laboratories is therefore unsuitable for the formation of living organisms.

– The synthetic processes for the construction of protein chains leads to the formation of monofunctional molecules that block the ends of the chains, making them inaccessible for further extensions. The presence of monofunctional molecules is therefore a crucial impediment to

the development of longer chains, i.e., proteins.
– In all the experimental approaches, in addition to the desired amino acid, many other substances, which prevent the next steps, are formed.

The third question about life is: *What differentiates the organic from the inorganic*? Miller's experiments constitute an important first step towards the synthesis of the molecules which are necessary for life but have also led to an impasse.

The synthetic production of proteins requires complex procedures of isolation and purification that do not occur spontaneously in nature and are based on assumptions, models and projects which derive from the study of living systems. These models involve theoretical assumptions, about the relationship between inanimate matter and life, which are defined by the various and fundamental characteristics of organisms discovered thanks to observation, such as the intake of substances and energy from the environment, metabolism, reproduction, growth, mobility, reaction to stimuli, processing of information.

All these features allow to describe different aspects of life. For example, the description of molecular structures allows the understanding of the physical characteristics of organisms and biochemical processes, but this identifies only some individual aspects of the manifestations of life. The same happens with the definition used in exobiology (search for life beyond Earth), according to which life would be a chemical system capable of evolution and reproduction.

The development of models which describe the transition between inanimate matter and life is a consequence of the definition of life which is given in theoretical models. The vast and fascinating knowledge developed studying the details and the reciprocal interactions of molecules and macromolecules, involved in the creation of living organisms (proteins, DNA), has not yet solved the mystery of life.

We know about life only in relation to material components, but we also know that the DNA macromolecules, for example, can perform their functions only within the highly structured complexity of a cell. This indispensable whole is a prerequisite for life, and this requires an approach that considers complexity, since the individual and isolated feature alone would have no chance of success.

An unambiguous definition of life is still missing.

- *Taxonomy*

Cataloguing and classifying living organisms is one of the oldest and main objectives of biology and is referred to as "taxonomy." The term comes from the Greek word taxis (ordering) and nomos (rule). In biology, a taxon (the plural is taxa) is a taxonomic unit, a group of real organisms, morphologically distinguishable and / or genetically recognizable from others as a unit with a precise location within the hierarchy of the taxonomic classification. Carl Linnaeus (1707-1778), the father of taxonomy, based the classifications mainly on the external features of living things and this procedure is sometimes referred to as Linnaean taxonomy. Only later taxonomy was expanded to anatomy, i.e., the skeleton and soft parts, and molecular and genetic information. Morphological taxonomy attempts to classify living beings according to their similarities, using neutral and objective descriptions.

Taxonomy is an empirical science which uses ranks, including, among others: kingdom, phylum, class, order, family, genus, species. In zoology, the nomenclature for the more important ranks is strictly regulated by the ICZN Code (International Commission on Zoological Nomenclature), whereas taxonomy itself is never regulated, but is always the result of research in the scientific community. How researchers arrive at their taxa varies. It depends on the available data, and resources and methods can vary from simple quantitative or qualitative comparisons of striking features to elaborate computer analyses of large amounts of DNA sequence data.

For this reason, researchers can produce different classifications due to a series of subjective choices. For example:

– Depending on which features we choose to consider, the classifications can change.

– The similarity values used in statistical analyses can be changed, and this can lead to place individuals into taxa that are close to the critical values of similarity.

To overcome the limitations of subjective choices genetic taxonomy was developed. Genetic taxonomy is based on the idea that couples that produce fertile progeny belong to the same taxa. The genetic approach classifies species according to their ability to produce fertile offspring under conditions of natural life. If organisms produce fertile offspring only when artificially crossed, in captivity or breeding, they are counted in different species. For example, a mule is the product of a horse and donkey and is barren. The genetic approach therefore leads to catalogue horses and donkeys as different species.

Biological taxonomy is therefore divided mainly into morphological taxonomy, which considers the external features (morphospecies) and genetic taxonomy which considers fertility (genospecies).

Depending on whether the emphasis is put on the genetic (fertility) or morphological (features) the boundaries between species can vary. In the case of donkeys and horses there are two genospecies and one morphospecies, since they are indistinguishable based on their external features, and therefore belong to the same morphospecies, but do not produce fertile offspring, and therefore do not belong to the same genospecies.

To overcome this discrepancy, the base type of classification was introduced which considers both classifications: the reproductive behaviors and the morphological features. However, even the base type of classification has not managed to produce generally accepted taxa. The geneticist W. Gottschalk says:

"Despite decades of research, the definition

of species as a biological unit presents great difficulties. To date there is still no single definition that meets all the requirements."[22]

The common definition of species, morpho and genospecies, and base type, are imprecise since they do not permit a clear and always valid delineation among taxa. By applying different definitions of species, inevitably the boundaries change. This raises the question whether it is possible to define higher taxonomic units that encompass the concepts of both genetic and morphological species.

[22] Gottschalk W. (1994), *Allegmeine Genetick*, Stoccarda.

- Microevolution

Charles Darwin (1809-1892), in *The Origin of Species*[23], described the variability among species and the fact that in the long-term population size remains constant, despite the overproduction of progeny. Darwin concluded that only the best and fittest individuals survive and become the parents of the next generation. This process of natural selection would be enhanced by genetic drift, i.e., the tendency of alleles, which are responsible for the particular ways in which the hereditary features

[23] Darwin C (1859), *On the Origin of Species by Means of Natural Selection*, London, 2nd edition 1964, Cambridge: Harvard University Press.

manifest, to randomly combine during reproduction. Positive combinations would increase the chances of survival and would be therefore selected, becoming a common feature. Only random variations (mutations) which directly or indirectly benefit the possibilities of survival and contribute to evolutionary progress are selected whereas deleterious mutations are mostly eliminated. This mechanism favors advantageous mutations and plays an important positive role in the evolutionary process. For Darwin, natural selection and genetic drift are the key elements of the evolutionary process. However, it is generally accepted that the mechanism of natural selection and genetic drift operate only within the context of microevolution.

The terms microevolution and macroevolution were introduced in 1927 by Philiptschenko[24], where:

– *Microevolution* indicates the selection of features within the same species, for example: quantitative changes of organs and structures of existing bodies.
– *Macroevolution* indicates the evolution of new features, for example: the development of organs, structures, and forms of

[24] Philiptschenko J. (1927), *Variabilitat und Variation*, Berlin.

organization with qualitatively new genetic material.

The function of microevolution is to optimize existing structures, whereas the function of macroevolution is to develop for the first time, or from scratch, structures with new functions.

An example of microevolution is provided by seeds carried by wind, which fail to germinate in soils polluted by heavy metals.

In landfills in Britain, it was observed that a minority of seeds can germinate, grow and make seeds that can colonize soils polluted by heavy metals. These offspring show the inability to re-cross with their parental plants growing on normal uncontaminated soils. Based on the definition of genospecies, one can therefore say that a new species is born.

Can these processes be used as evidence of the development of a new specie with new information?

Genetic analysis shows that these new plants, that can grow on contaminated soils, have not developed a new character, but the tolerance to the high content of heavy metals derives from the fact that the absorption of minerals from the soil is limited.

The genetic information has been

limited, and it is not an evolutionary progress due to new information.

The example of plants colonizing mine landfills, as well as other examples of this type, proves that the process of microevolution should not be considered a development towards higher forms, but an impoverishment of the genetic information, a specialization with depleted genetic information. These plants are more tolerant to heavy metals but are less adjustable to environmental changes and are more at risk of extinction.

When this process of selection is repeated, it results in massive depletion of the genetic information. These new breeds are more suited to specific environments, more specialized, but also less flexible.

Another example of microevolution is provided by the cheetah, the fastest mammal on the planet. The depletion of the genetic information, due to specialization, is not reversible and tends to bring this species to extinction. Despite its extraordinary abilities as a predator, the cheetah is endangered because of its very low genetic variability and information which makes the species all very similar. This specialization leads to illnesses, a high percentage of abnormal sperm, the fact that after hunting these predators are so tired that they become unable to defend their prey from other competitors, such as lions, leopards and hyenas, and an insufficient capacity for adaptation that increases the risks of extinction.

The formation of new species (*Speciation*) observed to date is limited to microevolution processes of specialization governed by natural selection which selects the genetic potentials of species.

Observations suggest that species start from a condition in which large quantities of genetic information is available; gradually this potential is reduced because of natural selection, guided by events of colonization and isolation. This reduction of the original variability of genetic information allows the colonization of new habitats, but limits future possibilities of adaptability.

Speciation, as it is known today, is based on the loss of genetic information due to environmental conditions and the processes of specialization.

An important role in microevolution is played by genetic drift, i.e., by the recombination of parental genes during sexual reproduction that leads to the formation of a virtually unlimited number of new combinations.

The biological importance of sexual reproduction is explained by the fact that it enhances the possibilities of natural selection. But, since genetic recombination does not produce anything new, natural selection is confined only within microevolution.

No new genetic material is formed, but only pre-existing genes and alleles are recombined, mixed and selected.

- *Macroevolution*

Unlike microevolution, which is based on genetic drift, natural selection and speciation which progressively reduce the genetic information, macroevolution requires mechanisms that can increase and produce new information.

However, so far, only microevolution processes of specialization have been observed. Evolutionary factors such as natural selection, genetic drift and isolation do not seem to provide explanations regarding macroevolution.

Consequently, the term macroevolution has been understood and is understood in very different ways:

– Some authors use it to indicate mechanisms other than Darwin’s gradualism which are insufficient to explain the development of new complex organs (such as the development of wings or legs, etc.).

– Others use it in a descriptive way, without any comment on the mechanisms.
– Some use it to indicate evolution beyond the species level. The difference between micro and macroevolution becomes the border between species.
– Sometimes a distinction is made by discipline: macroevolution is studied by paleontologists whereas microevolution by biologists.
– The boundaries between micro and macroevolution are fluctuating and it is not possible to distinguish between these two terms.

– Others reject the term macroevolution on the grounds that there is only one evolutionary mechanism.

Genetic mutations appear spontaneously in nature (without apparent causes) and can also be artificially induced or favored, for example by treatment with chemicals, radiation, and temperature changes. However, artificial mutations limit evolution to the field of microevolution.

Empirical findings show that these mutations can explain the separation of a parental species into two or more species (speciation), but they do not explain the increase in information. Offspring specialize in different directions but cannot increase their information.

One wonders then:

- if there are known mechanisms that explain macroevolution.
- if there are clues that suggest that macroevolution is possible.
- if the equation *microevolution* + *time* = *macroevolution* is correct.

A first consideration about the action of natural selection is that a series of mutations that should initiate the development of a new organism (macroevolution) would survive only if every single change causes a selective advantage or, at least, not a disadvantage.

This means that the evolution of a new organ or structure cannot go through intermediate stages which are disadvantageous and would not survive natural selection. Living systems must be able to survive in each stage of the evolutionary process. For this reason, it is difficult to explain the development of complex organs, since the intermediate stages would result in a disadvantage which would be eliminated by natural selection.

In the formation of new organs and structures, in general, a selective advantage is given only after their completion.

The early stages of a new body represent a pure waste of material and until the process is completed do not offer any selective advantage. Therefore, incomplete intermediate forms would be eliminated by the mechanism of natural selection.

The biological value of an organ is given only when the various functions can interact. Simulating the evolution of new organs using computer software, advantageous intermediate stages should be achieved in a very limited period of time; but neither the computational or biological models can account for these quick intermediate stages of evolution.

Advantageous intermediate stages require information on mechanisms, rates of mutation and recombination, suitable and appropriate selection criteria, and population size, which in simulations need to be introduced artificially (from outside) showing that the processes of macroevolution require good technology, good programs and software, but there is no known natural source that can provide these resources, programs and information.

From the evolutionary point of view, the unsolved question is not about the existence of advantageous mutations, but the possibility of the development of new genetic material and new structures.

Darwin believed that similar features are hereditary, for example children resemble their parents, and for this reason he argued that similar species, such as chimpanzees and humans, should have common ancestors. This hypothesis requires the existence of numerous intermediate links which should testify the evolution between chimpanzees and humans, but these links are missing and have not been found so far. Occasionally there are fossils that are interpreted as links, but their interpretations have resulted fundamentally controversial.

Phylogenetic theory cannot ignore

the fact that these links are missing. Darwinists try to explain their absence by saying that evolutionary processes took place in marginal populations with a low probability of fossilization.

The theory of macroevolution also maintains that affinities should be interpreted as convergences. But how can an evolutionary process without a tendency converge towards similar results? The convergence is usually explained by saying that evolution has been strongly channeled by similar selective processes. But fossils show that regarding size, morphology, ecology, stages of development and reproduction, old species cannot be distinguished from recent ones, suggesting a substantial constancy of species.

While biology examines living species, paleontology studies the world of plants and animals which existed on our planet in the past, and it is therefore considered to be a science of origins and evolution.

According to the macroevolution doctrines, each type of organization would have developed gradually, and links existed between and among different types, gradually developing in higher forms and organisms. But paleontologists have failed to provide any evidence for the existence of these links.

On the contrary, they have provided

evidence of a substantial constancy of species.

For example: the major groups of plants appear suddenly and not in a gradual way and species often appear in the wrong chronological order (the most complex and evolved appearing first).

Within the same taxa, it is usually impossible to show a trend from simple to complex, for example, under the Psilophyton taxa, the oldest forms are the most complex in the stratigraphic sequence. In most cases, family trees can be reconstructed only if we admit the possibility of convergence and reversions (i.e., the return to original features).

According to generally accepted studies, spores appear before macrofossils (wood, leaves, etc.). No one knows why this could have happened.

- *Converging evolution*

At the beginning of chapter 21 of his second book on the "*Descent of Man*", published 12 years after the "*Origin of Species*", Darin says:[25]

> "*It seemed worthwhile to try how far the principle of evolution would throw light on some of the more complex problems in the*

[25] Darwin C., *Descent of Man*, 1871. infidels.org/library/historical/charles_darwin/descent_of_man/

natural history of man. False facts are highly injurious to the progress of science, for they often endure long; but false views, if supported by some evidence, do little harm, for everyone takes a salutary pleasure in proving their falseness: and when this is done, one path towards error is closed and the road to truth is often at the same time opened."

Darwin's "*road to truth*" suggests the possibility of a hidden converging evolution.

One of the main postulates of the entropy/syntropy hypothesis is that life converges towards attractors, which guide in a retrocausal way the evolution of living systems.

A similar converging evolution hypothesis was formulated by Pierre Teilhard de Chardin. Teilhard was a paleontologist and a well-known evolutionary scientist and became famous after his death with the publication of his books, among which *The Phenomenon of Man* and *Towards Convergence*. His hypothesis broadens science to a new type of causality which retro-acts from the future. The entropy/syntropy hypothesis states that life is subject to dual causality, efficient causality, and final causality. For Teilhard life is guided by final causality which leads to converge towards the Omega point, the source of life.

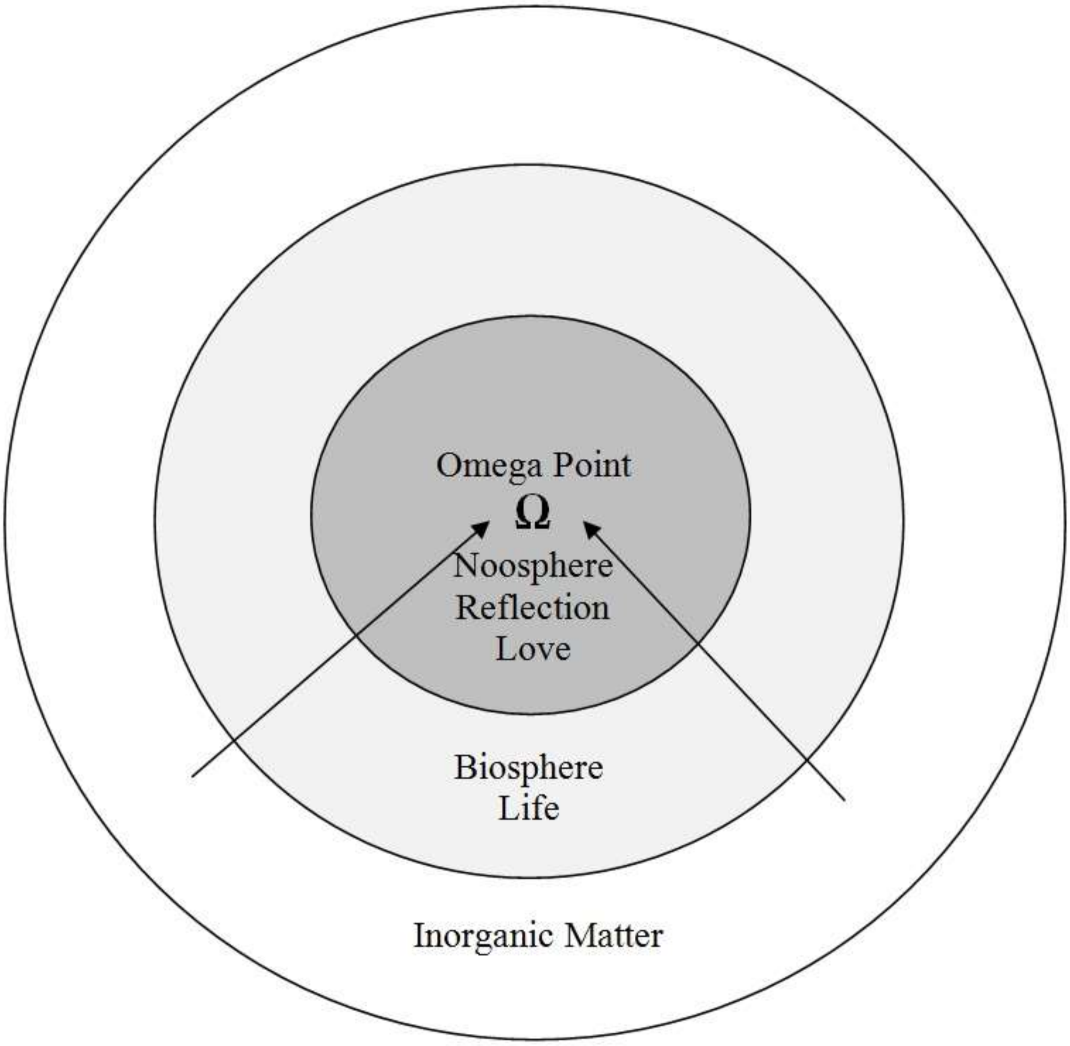
Teilhard considered reality organized on three main concentric spheres:

– The innermost sphere is the final aim of the evolution of the universe, in which all of matter will be transformed into organic and conscious matter, and it is also the closest to the Omega point.
– The outer sphere is the most distant from the Omega point, the realm of inanimate matter.
– The middle sphere is the realm of life which does not yet reflect on itself, the biosphere.

Teilhard adds that:

"Evolution cannot be measured along the line that goes from the infinitely small to the infinitely big, but according to the axis that goes from the infinitely simple to the infinitely complex. We can represent evolution as distributed on concentric spheres, each of which has a radius that diminishes as complexity grows."[26]

[26] Teilhard de Chardin P. (2008), *The Phenomenon of Man*, www.amazon.it/dp/0061632651/



In his childhood Teilhard's idol was represented by solid matter: the *God of Iron*.

He soon reached the conviction that the consistency of solid matter was not given by the substance itself, but by convergence. The theme of convergence became soon fundamental in Teilhard's vision.

Working as a paleontologist Teilhard showed that life evolves converging towards attractors and that during this converging process unity, complexity, and diversity increase.

Teilhard relates the Omega point to consciousness.

The entropy/syntropy hypothesis considers syntropy the attractor of life and the source of the feeling of life, consciousness. Consequently, increasing syntropy increases consciousness.

Teilhard expresses this concept in the following way:

"The universe, taken as a whole, concentrates under the influence of the attraction which arises from the Omega point, which takes the form of love. People can evolve and become more human since they share at the core level the same attractor of love. According to this view we are all immersed in a converging flow of conscious energy, whose quality and quantity is growing at the same rhythm of our complexification."

Concentration and convergence are the key concepts in Teilhard's vision of evolution:

"Viewed at the more essential level we see

that the universe is a system of center-complexification. Evolution does not match a transition from the homogeneous to the heterogeneous, but a transition from the heterogeneously dispersed to the unified and complex, even more clearly, the transition from a minimum to a maximum of center-complexification."[27]

Teilhard sees consciousness as a universal property, a cosmological property of the universe which arises while converging towards unity.

"*Consciousness increases in proportion to the complexity of life. Consciousness is absolutely inaccessible to our means of*

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[27] Teilhard de Chardin P (2004), *Verso la convergenza. L'attivazione dell'energia nell'umanità*, Gabrielli Editori, Verona.

observation at the small level of viruses, but it clearly appears at the maximum level of complexity of the human brain."

Both Fantappiè and Teilhard's explain macroevolution because of intelligent in-formation provided by attractors, and ultimately by the Omega point, which would allow the development of new organs, without any intermediate evolutionary steps that would constitute a disadvantage.

Attractors in-form our body and guide it to specific shapes and structures. Macroevolution would therefore be a converging retrocausal process and this is continuously observed when studying life in laboratories.

The hypothesis that a different type of causality is required, had been postulated by Hans Driesch (1867-1941), a pioneer in experimental research in embryology.

Driesch suggested the existence of final causes, which act in a top-down way (from global to analytical, from the future to the past) and not in a bottom-up way, as it happens with classical causality.

Final causes would lead living matter to develop and evolve, and would coincide with the purpose of nature, the biological potential.

Final causes were named by Driesch

entelechy.[28] Entelechy is a Greek word whose derivation (en-telos) means something that contains its own end or purpose, and that evolves towards this end. So, if the path of normal development is interrupted, the system can achieve the same end in another way.

Driesch believed that the development and behavior of living systems are governed by a hierarchy of entelechies, which all result in an ultimate entelechy.

The experimental demonstration of this phenomenon was provided by Driesch using sea urchin embryos. Dividing cells of the embryo of sea

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[28] Driesch H. (1908), *The Science and Philosophy of the Organism*, www.gutenberg.org/ebooks/44388

urchin after the first cell-division, he expected each cell to develop into the corresponding half of the animal for which it had been designed or preprogramed, but instead he found that each developed into a complete sea urchin. This also happened at the four-cell stage: entire larvae ensued from each of the four cells, albeit smaller than usual. It is possible to remove large pieces from eggs, shuffle the blastomeres and interfere in many ways without affecting the resulting embryo. It appears that any single monad in the original egg cell can form any part of the completed embryo. Conversely, when merging two young embryos, a single sea urchin results and not two sea urchins.

These results show that sea urchins develop towards a single morphological end. The moment we act on an embryo the surviving cell continues to respond to the final cause that leads to the formation of structures. Although smaller, the structure which is reached is like that which would have been obtained by the original embryo.

It follows that the final form is not caused by the past or by a program, a project or a design which act from the past, since any change we introduce in the past leads to the same structure. Even when a part of the system is removed or the normal development is disturbed, the final form is reached, and it is always the same.

Another example is that of the regeneration of tissues. Driesch studied the process by which organisms can replace or repair damaged structures. Plants have an amazing range of regenerative capabilities, and the same happens with animals. For example, if a flatworm is cut into pieces, each piece regenerates a complete worm. Many vertebrates have extraordinary capabilities of regeneration. If the lens of the eye of a newt is surgically removed, a new lens is regenerated from the edge of the iris, whereas in the normal development of the embryo the lens is formed in a very different way, starting from the skin.

Driesch used the concept of entelechy to account for the properties of integrity and directionality in the development and regeneration of bodies and living systems.

Independently in 1926 the Russian scientist Alexander Gurwitsch[29] and the Austrian biologist Paul Alfred Weiss[30] suggested the existence of a new causal factor, different from classical causality, which was named morphogenetic field. Apart from the

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[29] Gurwitsch A.G. (1944), *The Theory of Biological Field*, Moscow: Soviet Science, 1944.

[30] Weiss P.A. (1939), *Principles of Development*, Henry Holt and Co.

claim that morphogenetic fields play an important role in the control of morphogenesis (the development of the shape of the body), neither author showed how causality works in these fields.

The term "field" is currently fashionable: gravitational field, electromagnetic field, individual field of particles and morphogenetic field. However, the word field is used to indicate something that is observed, but not yet understood in terms of classical causality; events that require a new type of explanation based on a new kind of causality.

The entropy/syntropy hypothesis replaces the terms entelechies and fields with the term attractor. An attractor is a cause retroacting from the future which guides and generates a field.

The biologist Rupert Sheldrake[31] refers to the theory of René Thom "*The theory of catastrophes*" which identifies the existence of attractors at the end of any evolutionary process.[32]

Thom introduced the hypothesis that the shape could be due to causes that act from the future and Sheldrake added the hypothesis of formative causation according to which morphogenesis (the development of

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[31] Sheldrake R. (1981), *A New Science of Life: The Hypothesis of Formative Causation*, Blond & Briggs, London, 1981.

[32] Thom R. (1972), *Structural Stability and Morphogenesis*, W. A. Benjam, (1972), ISBN 0-201-40685-3.

the shape) is guided by attractors (i.e., retrocausal processes). The term comes from the Greek root morphe/morphic and is used to emphasize the structural aspect.

Experimental results that can be easily explained in terms of attractors, were provided by Sheldrake. Members of the same group, such as animals of the same species, can share knowledge, without using any physical transmission.

Experiments show that when a mouse learns a task, this same task is learned more easily by each other mouse of the same breed. The greater the number of mice that learn to perform a task, the easier it is for each mouse of the same bread to learn the same task.

For example, if mice are trained to perform a new task in a laboratory in London, similar mice learn to perform the same task more quickly in laboratories all over the world. This effect occurs in the absence of any known connection or communication between the laboratories.

The same effect is observed in the growth of crystals. In general, the ease of crystallization increases with the number of times that the operation is performed, even when there is no way in which these nuclei of crystallization may have been moved from one place to another infecting the different solutions.

Sheldrake explains these strange results introducing the concept of morphogenetic field:

> *"Today, gravitational effects and electromagnetic ones are explained in terms of fields. While Newtonian gravity rose somewhat unexplained by material bodies and spread into space, in modern physics fields are the primary reality and by using fields we try to understand both material bodies and the space between them. The picture is complicated by the fact that there are several different types of fields. First there is the gravitational field (…) then there is the electromagnetic field (…) third, the quantum field theory (QFT), and so*

on.”

Sheldrake’s morphogenetic fields are a combination of the concepts of fields and energy. Energy can be considered the cause of change. Fields can be considered the project, the way in which energy is guided. Fields have physical effects, but are not themselves a type of energy, they guide energy in a geometric or spatial organization.

- *Attractors*

The entropy/syntropy hypothesis translates the word fields into attractors and "morphogenetic fields" into "morphogenetic attractors" or "morphogenetic retrocausality." It agrees with the statement that morphogenetic fields would be at the basis of formative causation, morphogenesis, macroevolution, and the maintenance of the shape of living systems at all levels of complexity, not only on the surface, but also in internal processes.

Attractors provide the project and the design, with properties like those of Driesch's entelechy.

For example, to build a house, we need building materials and a project (an attractor) which determines the shape of the house. If the project is different, the same building material can be used to produce a different house.

When building a house there is a field that corresponds to the project. The project is not present in the building materials, which can therefore be used in many different types of projects. The project gives stability and leads the building material to converge and cooperate, despite individual differences.

The project represents the cohesive force of syntropy that brings parts together and contrasts the diverging tendency of entropy.

This example can be extended to cells, organs, trees, and living systems in general. For each species, for each type of cell and organ there is at least one attractor which coincides with what is normally called a field. Each morphogenetic field would correspond to a project that drives the living system towards a specific form and evolution.

In 1942, Conrad Waddington coined the term *epigenetics* in order to describe the branch of biology that studies the causal interactions between genes and phenotypes, i.e. the physical manifestation of the body. According to epigenetics, phenotypes are the result of inherited genetic mutations. These mutations last for the entire life and can be transmitted to the following generations through cell divisions. However, the hypothesis that the features of life can be added by means of random mutations, such as described by epigenetics, contradicts the law of entropy according to which the spontaneous formation of the smallest protein requires at least 10^{600} mutations. It should also be noted that epigenetics implies that some mysterious mechanism has placed the properties of life in genetic programs and genetic instructions.

Attractors provide programs and instructions and constitute the common denominator of a collectivity of individuals. For example, the attractor humanity is the common denominator of all human beings, the attractor mice is the common denominator of all mice.

Besides providing programs and instructions, attractors act as relays of information. They receive the experiences of individuals, select what is advantageous for the specie and transmit it to all the other individuals. This mechanism explains the results obtained by Sheldrake which show that when mice in a laboratory learn to solve a task, automatically all the mice of the same species (same attractor), around the world solve the same task more easily. Genes might not store information, but act as antennas that connect our cells, our body, to the projects stored in the attractor. When genes are broken the communication malfunctions, the project is not received correctly, cells are no longer finalizes, guided by the project, and tumors arise.

We have seen that Darwin's theory of evolution is valid within microevolution. We now add that macroevolution can be a product of attractors and of the properties of syntropy.

An example taken from our everyday life can help to clarify this concept.

The shape and structure of our body shows that we do not have claws to hunt, we do not have canine teeth typical of carnivores, the digestive tract is so long that meat remains in the intestines producing dangerous toxins. We eat only meat which has been matured (in an advanced state of decomposition), the smell of animal hormones is sickening to us and for this reason we castrate animals before slaughtering them. The shape and structure of our bodies tell that the attractor is not that of a carnivorous animal. We can therefore forecast that mankind will evolve naturally and inevitably into vegetarian habits.

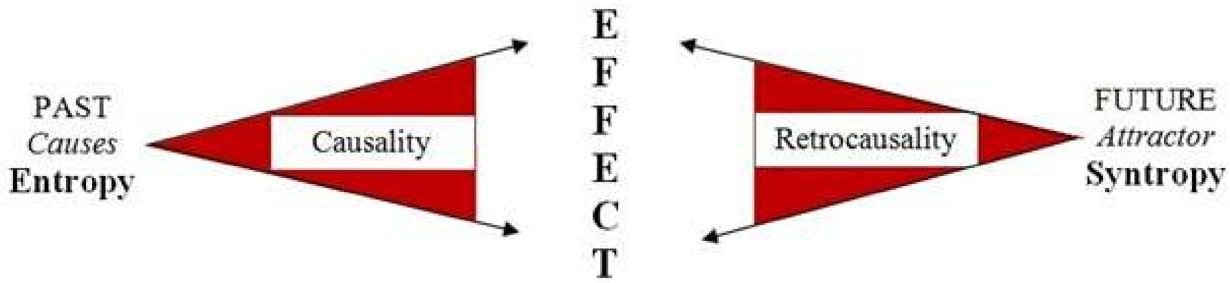
Following classical logic, one would conclude that we lack the features typical of carnivorous animals, since at the beginning of our evolution we were vegetarians and fruit-eating animals, and only recently we have become omnivores. On the contrary, following the retrocausal logic, we say that we lack the features typical of carnivorous animals since our goal, our attractor, is to evolve towards a vegetarian diet.

Our current characteristics do not depend on a hypothetical vegetarian past, but are determined by the future, by the attractor which is guiding us.

The supercausal hypothesis reverses the traditional way of thinking and introduces the idea that intelligent causality retroacts from the future providing projects and guidance.

Whereas causality produces effects

that diverge from the past, retrocausality produces effects that converge towards attractors which act from the future.



Attractors are non-local. They select the information which is "*advantageous*" for life, changing it into in-formation, and share it instantaneously. As explained by Barrow and Tipler[33], in the *Anthropic Principle*, this mechanism has brought the Universe towards physical

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[33] Barrow J.D. and Tipler F.J. (1988), *The Anthropic Cosmological Principle*. Oxford University Press. ISBN 978-0-19-282147-8.

constants that happen to fall within the narrow range which is compatible with life. The Universe seems to be compelled (attracted) towards those conditions which favor life.

Shared in-formation is like what the *Quantum Hologram hypothesis*[34] describes. The idea of a holographic mechanism for conveyance of life designs goes back to the mathematical insights of Dennis Gabor[35] (1940s) and quantum holograms by Dr. Walter Schempp[36] (1992), a mathematician at the University of

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[34] Mitchell E. (2008), *The Way of the Explorer*, www.amazon.com/dp/1564149773

[35] Gabor D. (1946), *Theory of communication*, Journal of the Institute of Electrical Engineers, 93, 429-441

[36] Schempp W. (1993) *Cortical Linking Neural Network Models and Quantum Holographic Neural Technology*. In Pribram, K.H. (ed.) Rethinking Neural Networks

Siegen in Germany. The term "Holographic" implies that processes are holistic and postulates that the whole is more than the sum of its parts since information spreads everywhere to entangle the parts. In this domain, space and time no longer exist and neither does causality in Aristotle's sense of efficient causation, whereas Aristotle's more comprehensive formal or formative causation is appropriate.

In 1963 the meteorologist Edward Lorenz discovered the existence of attractors. Studying, for example, a simple mathematical model of meteorological phenomena, Lorenz found that a small perturbation could generate a chaotic state which would amplify, making weather forecasting impossible. Analyzing these unforeseeable events, Lorenz found the existence of what were named the *chaotic attractors of Lorenz*. These attractors cause microscopic perturbations to be amplified and interfere with the macroscopic behavior of the system. Lorenz described this situation with the words: "*The flap of a butterfly's wings in Brazil can set off a tornado in Texas*." The concept of the butterfly effect flourished in popular culture and became the central tenet of chaos theory. This beautiful image provides a striking analogy for how small actions can have tremendously powerful effects – often independent of the intent of the initial action.

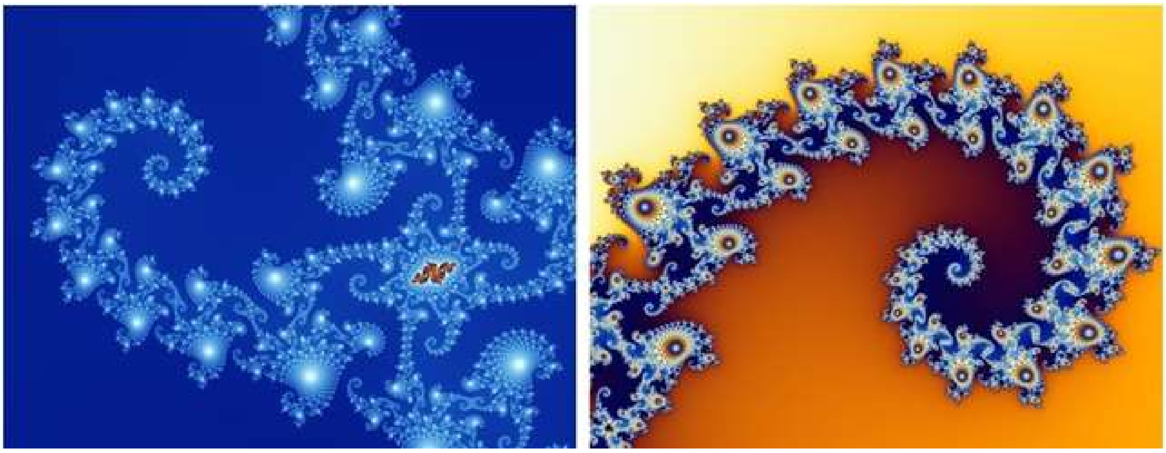
When attractors interact with physical systems, fractal geometry arises. A fractal is a geometric object that is repeated in its structure the same way on different scales, that has an aspect which does not change even if it is seen with a magnifying glass. This feature is often called self-similarity. The term fractal was coined by Benoît Mandelbrot[37] in 1975 and derives from the Latin word *fractus* (broken), similarly to the word fraction, since fractal images are mathematical objects of fractional

[37] Mandelbrot B (1982), *Fractal Geometry of Nature*, www.amazon.it/dp/0716711869/

dimension.

Fractals are often found in complex dynamical systems and are described using simple recursive equations. For example, if we repeat the square root of a number greater than zero (but smaller than one) the result will tend to one (but it will never reach it). Number one is therefore the attractor of the square root. Similarly, if we continue to square a number greater than one, the result will tend to infinity and if we continue to square a number smaller than zero, the result will tend to zero. As shown by Mandelbrot, fractal figures are obtained when inserting in a recursive function, an attractor (an operator which tends to a limit). Complex shapes, and at the same time ordered, are obtained when an attractor is inserted.

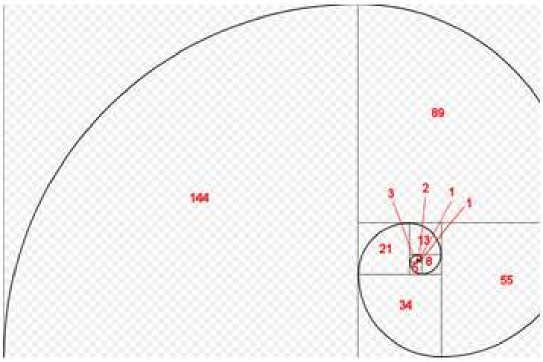
Fractal geometry reproduces some of the most important structures of living systems, and many researchers have concluded that life follows fractal geometry: the outline of a leaf, the growth of corals, the form of the brain and the nervous terminations.

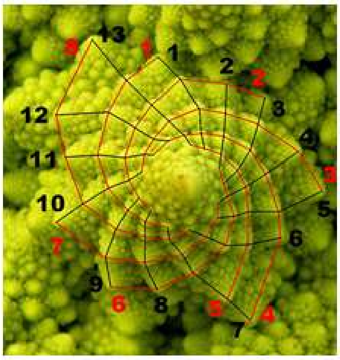


Fractal images

An incredible number of fractal structures has been discovered, for example blood arteries and coronary veins show ramifications which are fractals. Veins divide into smaller veins which divide into smaller ones. It seems that these fractal structures have an important role in the contraction and conduction of electrical stimuli: the spectral analysis of the heart frequency shows that the normal frequency resembles a chaotic structure. Neurons show fractal structures: if neurons are examined at low magnification, ramifications can be observed from which other ramifications depart, and so on. Lungs follow fractal designs which can easily be replicated with a computer. They form a tree with multiple ramifications, and with configurations which are similar at both low and high magnification. These observations have led to the hypothesis that the organization and evolution of living systems (tissues, nervous system, etc.) is guided by attractors, in a similar way to what happens in fractal geometry.

Even before Leonardo da Vinci was exploring the fractal nature of rivers, trees and blood vessels, another Leonardo - named Leonardo of Pisa - was exploring fractal patterns in arithmetic. His book "*Liber Abaci*," published in the year 1202, under the penname ‘Fibonacci’, was significant in the history of mathematics because it introduced the use of Arabic numerals into Europe, which would replace Roman numerals. Fibonacci described a sequence of numbers that would come to be called Fibonacci Numbers.





This sequence, which Fibonacci called *Modus Indorum*, method of the Indians, solved, a problem involving the growth of a population of rabbits based on idealized assumptions. In the Fibonacci sequence of numbers, each number is the sum of the previous two numbers. Fibonacci ratio of consecutive numbers is known as the *golden ratio*.

Michelangelo used to state that the skill of an artist is to bring out from stone the figure that is already in it and does not belong to it. Similarly, the success of living species is to bring out the attractor, which is already present in them, but which does not belong to their body. This explains the incredible stability of species and their convergence towards common forms, and the strange results obtained by Driesch with sea urchins' embryos.

- Evolution

Long before Darwin published *The Origin of Species*, scholars were divided in two main currents of thought. On the one hand, some envisioned a dynamic and constantly changing nature, on the other hand others believed in a substantially unchanging nature. The first group included scientists and philosophers of the Age of Enlightenment, a cultural movement of intellectuals in 18th century Europe and the United States, whose purpose was to reform society and advance knowledge and promote science and intellectual interchange. The second group included scientists and philosophers close to the theory of fixity which the scientist Linnaeus proposed. This second group was rooted in the biblical Genesis and the Aristotelian philosophy, and believed that the various species and entities had been created once and for all and were unable to change if not within certain limits.

The debate between these two groups is still going on: the first group is named *evolutionists* and claims that life and its various forms have emerged gradually as a result of random processes of mutation and natural selection that required millions of years, whereas the second group named *creationists* believes that life in its main forms was originated instantaneously, some thousand years ago, through the act of God.

Strong of the fact that the simplest protein would not form by the effect of chance, creationists argue that evolutionists are wrong. Similarly, evolutionist argue that creationists are wrong since, if life was created by God, the action of entropy would lead this creation to death.

The evolutionist approach is based on the work of Charles Darwin (1809-1882) and assumes that all primates (including humans) descend from a common ancestor. According to Darwin, a gradual and continuous accumulation of successive mutations takes place, which in a period sufficiently long produces significant and advantageous changes in living organisms. This process is based on genetic transfer of information to offspring and on random mutations. Although changes between one generation and the next are generally small, their accumulation over time would result in substantial transformations through the phenomena of natural selection and genetic drift and the emergence of new species. Darwin's theory found support in the laws of Mendelian inheritance of characters, and in the discovery of DNA.

A third group is named Intelligent

Design (ID). The ID assumption is that Darwin's theory of evolution is unable to explain macroevolution, that is the formation of progressively more complex structures, and suggests the introduction in science of intelligent causality. While the creationists refer to sacred texts, ID is based on empirical evidence and assesses whether these can be attributed to chance or require an intelligent cause. The conclusions which are reached cannot, however, justify the existence of a divine being, a creator. Furthermore, ID does not deny the theory of evolution, but it confines it within the boundaries of microevolution, i.e., the evolution by subtraction of features. However, ID does not explain macroevolution, it only states that a different type of causality is required.

Will the entropy/syntropy hypothesis give rise to a fourth group?

- *The additional mass of life*

Syntropy is cohesive. This fact explains the binding properties of living systems, but it also suggests an interaction between life energy and gravitation, since they both follow the same law of attraction.

Given these premises, the hypothesis arises that an additional mass associated to life should be observable.

The mass of a living organism (ML) would be the sum of the mass of the dead organism (MD), plus the mass due to the cohesive force of life energy: syntropy (MS).

$$ML = MD + MS$$

The idea that at the moment of death there is a loss of weight can be traced back to the 1901 experiments of Duncan MacDouglass, which were based on the idea that the "soul" has a mass.

MacDouglass idea was reinforced by the 2003 fictional movie titled "21 grams”. The title refers to Duncan MacDougall results which show a loss of body weight, immediately following death, of approximately three-fourths of an ounce, since then popularized as 21 grams. MacDougall’s results were published in the peer reviewed journal American Medicine.

The syntropy hypothesis considers life energy to be immaterial, whereas MacDouglass believed the soul to have a mass. But since backward-in-time energy is cohesive, a living body can exert a stronger gravitational attraction, and therefore result to have a higher weight.

Duncan results have been replicated

using closed system. Amrit Sorli describes these experiments in the paper "*The Additional Mass of Life*."[38] Preliminary experiments were carried out at the Bio-technical Faculty, Ljubljana, Slovenia, in June 1987 using test-tubes which were filled with three milliliters of water solution mixed with meat and sugar. Funguses were added into half of the test-tubes and all test tubes were welded airtight. The weight difference between test-tubes was measured for ten days. After three days of growth, the weight of test tubes with the fungus increased and in the last seven days remained unchanged. These experiments were

[38] Sorli A (2004), *The Additional Mass of Life*, Journal of Theoretics, 4:2, www.journaloftheoretics.com/articles/4-2/Sorli-final.htm

repeated in 1988 at the Faculty for Natural Science and Technology, Ljubljana, and identical results were obtained.

In another experiment, a test-tube was filled with 70 grams of live Californian worms and a small test-tube was filled with 0.25 ml of 36% water solution of formaldehyde. The control test tube contained 70 ml of distilled water with a small test tube of formaldehyde inside. Both test tubes were welded and one hour was allowed for acclimatization. Test-tubes were then weighted at intervals of five minutes. Then they were turned upside down to spill the solution of formaldehyde and again they were measured at intervals of fifteen minutes. The weight of the test-tubes with the poison was found to have increased in the first 3 minutes after the poisoning, for an average weight of 60 micrograms and it then went down. Fifteen minutes after poisoning, the weight diminished, on average by 93.6 micrograms. This experiment was repeated several times obtaining always similar results. Independent researchers have reproduced similar results. It is interesting to note that after poisoning, but before death occurs, an increase in weight is reported. This can be interpreted as an increase in syntropy, in the attempt of the attractor to keep the system alive. An increase in syntropy results in an increase of cohesive forces and consequently of weight.

In the hypothesis that the interaction between life energy and gravitational forces is true, a wide range of applications can be imagined. For example, vital parameters of an organism (such as heart rate and skin conductance in human beings) could be used to anticipate gravitational changes. Living systems with no or simple cortical systems, which mainly react in an instinctual way directly guided by the attractor, should show stronger anticipatory reactions in their vital parameters.

The belief that animals can predict earthquakes has been around for centuries. Accounts date back to 373 B.C., when animals, including rats, snakes, and weasels, abandoned the Greek city of Helice, just days before a quake devastated the place. Cats and dogs showing signs of nervousness and restlessness, catfish moving violently, chickens that stop laying eggs, bees leaving their hive in a panic, are continuously reported before earthquakes.

Based on the observation of these strange behavior of animals, in 1975 Chinese officials ordered the evacuation of Haicheng, a city with one million people, just days before a

7.3-magnitude quake. Only a small portion of the population was hurt or killed. If the city had not been evacuated, it is estimated that the number of fatalities could have exceeded 150,000.

But mainstream science still rejects the idea that anticipatory reactions can exist.

The macroscopic level is governed by the law of entropy, which destroys life and triggers the fight for survival.

The biologist Jacques Monod describes entropy with the following words:

"*Man must at last finally awake from his millenary dream; and in doing so, awake to his total solitude, to his fundamental isolation. Now does he at last realize that, like a gypsy, he lives on the boundary of an alien world deaf to his music, indifferent to* *his hopes, his sufferings, his crimes.*"[39]

Entropy has turned life into a highly unlikely episode, which does not stem from the laws of the universe. Syntropy, instead, reintroduces life in the laws of the universe.

Entropy destroys life, syntropy constructs life. Consequently, the fundamental law of life is to:

reduce entropy and increase syntropy

Vital needs which reduce entropy and increase syntropy can be grouped in three main categories: material

[39] Monod J. (1971), *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, New York, Alfred A. Knopf, 1971, ISBN 0-394-46615-2.

needs, needs for cohesion and love and needs for meaning.

- *Combating the dissipative effects of entropy:* ***material needs***

To combat the dissipative effects of entropy, living systems must acquire energy from the outside world, protect themselves from the dissipative effects of entropy and eliminate the remnants of the destruction of structures by entropy. These conditions are generally referred to as material needs, or basic needs, and include:

– Combating the dissipative effects of entropy, for example, acquiring energy from the outside world through food and reducing the dissipation of energy with a shelter (a house), and clothing.
– Disposing of the production of wastes caused by entropic degradation, therefore hygiene and sanitation.

The total satisfaction of these needs leads to a state characterized by the absence of suffering. The partial satisfaction is experienced as hunger, thirst, and diseases. The total dissatisfaction leads to death.

- *Acquiring syntropy:* ***the need for love and cohesion***

The satisfaction of material needs does not stop entropy from destroying the structures of living systems. For example, cells die and must be replaced. To repair the damages caused by entropy, living systems must draw on the regenerative properties of syntropy that allow to create order, regenerate structures, and increase the level of organization. They must, therefore, acquire syntropy. In human beings this function is performed by the autonomic nervous system that supports vital functions.

Since syntropy acts as an absorber and concentrator of energy:

- the acquisition of syntropy is felt as feelings of warmth, in the area where the autonomic nervous system is located (heart, lungs and thorax), associated with wellbeing. These feelings coincide with what people usually name love.
- the lack of syntropy is felt as feelings of void (entropy) and emptiness in the thorax area associated to pain and suffering. These feelings coincide with what people usually name anxiety and anguish and come with symptoms

of the autonomic nervous system such as nausea, dizziness, and sensations of suffocation.

The satisfaction of the need for syntropy is experienced as love, the partial satisfaction is experienced as anxiety and anguish, the total dissatisfaction leads to death, since living systems are not capable of sustaining the regenerative processes and entropy takes over.

- *Solving the conflict between entropy and syntropy: the need for meaning*

To meet material needs we produce

maps of the environment. These representations give rise to a paradox. Entropy has expanded the material world towards infinite (diverging forces), whereas syntropy concentrates our feeling of life, the Self, in extremely limited spaces. Consequently, when we compare ourselves with the infinity of the universe, we realize to be equal to zero. On one side we feel we exist; on the other side we are aware to be equal to zero. These two opposite considerations generate the identity conflict: "*to be, or not to be: that is the question*."

The identity conflict can be expressed in the following way:

$$\frac{I}{Universe} = 0$$

When I confront myself with the universe, I am equal to zero

The universe corresponds to entropy whereas I corresponds to syntropy. To be equal to zero is equivalent to death, which is incompatible with our feelings of existence.

We must therefore solve the conflict between "*to be or not to be*" and this is felt as the need to give a meaning to our life.

The strategies implemented to meet this need may differ. For example, we might try to increase our value through wealth, power, achievement, judgment of others or we might try to find a meaning in life, a purpose, through ideologies and religions.

The identity conflict is felt as being meaninglessness, lack of energy, existential crises, and depression. These feelings arise in the form of tensions in the head and generally come together with anxiety and anguish.

The total satisfaction of this need is experienced as having a purpose in life. The partial satisfaction is experienced as depression and existential crises. The total dissatisfaction leads to death.

- *The theorem of love*

The identity conflict can be written as follows:

$$\frac{Syntropy}{Entropy} = 0$$

Where Syntropy is our feeling of life, our Self, which is in a small space, whereas Entropy is the outside Universe which has inflated towards infinite.

The aim is to solve the identity conflict, and this can be done only if we find a way to state that I am equal to I. This can also be written as:

$$Syntropy = Syntropy$$

From a mathematical point of view this is possible only when we multiply the numerator of the identity conflict by Entropy.

$$\frac{Syntropy\ x\ \cancel{Entropy}}{\cancel{Entropy}} = Syntropy$$

This expression tells that when we unite Syntropy and Entropy, when we shift from duality to non-duality, the identity conflict vanishes, and we experience the meaning of our life. For this reason, this equation is named the theorem of love.

The theorem of love can be written also in the following way:

$$\frac{I \times \cancel{Universe}}{\cancel{Universe}} = I$$

Only when I unite myself to the Universe, through love, I experience my identity.

The theorem of love:

– requires the multiplication "x" between I and the Universe. Since the multiplication has the cohesive properties of love, we can state that only through love we can experience the meaning of our life.
– shows that Shakespeare's dilemma: "*to be, or not to be*" is solved only

when I am united with the Universe.

– posits that the union of entropy and syntropy, which are complementary polarities, is achieved through love and that love accomplishes the transition from duality (I=0) to non-duality (I=I).
– explains why anxiety (the lack of love) and depression (the lack of meaning) are perfectly correlated, although they have different etiologies.
– suggests that love is the aim, the attractor of life.

- Depression

We always implement strategies to solve the identity conflict, but they usually provide only a temporary relief from depression.

Within these strategies, one which is commonly used is to expand our Ego through the judgment of other people, wealth, popularity, power, and so on:

$$\frac{I+judgment+wealth+popularity+power\ldots}{Universe} = 0$$

These strategies become vital since they respond to the vital need for meaning. We are not able to backup also when they become harmful and damaging.

In a famous experiment, Stanley Milgram[40] shows how vital and strong these strategies can become.

The aim of the experiment was to study the extent to which people are willing to obey orders which are clearly wrong.

Milgram used an experimental design in which volunteers were divided in pairs, the first volunteer was asked to play the role of a teacher, while the second the role of a student. The student was taken to a nearby room and seated on a sort of electric chair, then he was entrusted with the task of memorizing a series of words.

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40 Milgram S. (1974), *Obedience to Authority: An Experimental View*, Harpercollins, New York, 1974.

The teacher was given the task of listening to the recitation and send electric shocks to the student when he was wrong. The teacher used a power switch. At the first mistake he was asked to send an electric shock of 15 volts, 30 volts for the second mistake, 45 volts for the third and so on, with regular successions up to 450 volts. Every six clicks of the switch the current intensity was notified by a recorded voice that warned: weak shock, medium shock, strong shock, dangerous shock.

Milgram explained to the teacher that shock intensity had to be increased at each mistake. When the list was long and difficult, the answers were often wrong, and the teacher was required to send stronger and stronger shocks. At 75 volts the student began to complain, at 150 he asked to stop the experiment, but Milgram ordered to continue. At 180 volts the student began to scream because he could no longer bear the pain. If the teacher showed he was doubtful, Milgram ordered to continue, even when the student, at a shock of 300 volts, shouted desperately to be freed.

The aim of the experiment was to study up to what point the teacher was willing to follow the orders. He did not know that the student was a collaborator of Milgram and that he did not receive any electric shocks. The student was in another room, his prayers and screams were not real but were recorded.

A group of psychiatrists calculated in advance that most teachers would have stopped at 150 volts, when the student began to yell for help.

The results of the experiment, however, were strikingly different: more than 80% of the teachers continued the experiment even after 150 volts, and 62% of these continued up to 450 volts.

However, Milgram pointed out that for teachers it was not easy to obey. Many started sweating, but they were ordered to continue increasing the intensity of the shocks. Disobedience was easier, however, when Milgram was not present and when the orders were given by phone, from a room nearby. Many teachers said they executed the order, but the students received weaker shocks than they should have. On the other hand, teachers obeyed more readily if victims were far away. Only 30% agreed to compel students with force to keep their hands on a metal plate that was supposed to transmit very strong shocks, but if the victim was in another room, and the protest was limited to kicking the wall, the percentage of obedience exceeded 60%.

This experiment shows that teachers obeyed orders that are commonly rejected by ethics and moral, and that they were unable to disobey!

According to the vital needs theory, any strategy that responds to the need for meaning becomes vital. People turn into robots with no sensibility for life and the suffering of other humans and develop destructive behavior.

Ayten Aydin in a keynote speech, for the IIAS 2007 forum, notes that:

> "*The most important underlying factor of this anti-survival behavior of human beings is a combination of (among other things) greed, hatred and ideologies. All these vices, separately or combined, fuel*

ever-spreading acts of societal disintegration and the creation of two major camps in terms of controllers and the controlled. These vices are speedily gaining increased power fueled by increasing hatred, which kills the ability to reason as well as inherent human wisdom, and thus strengthens and deepens further their belief systems."[41]

The need to increase our Ego has another negative effect: it isolates people. Since we want to meet the expectations of others, we behave in ways that others judge positively. But, by doing so we lose our spontaneity,

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[41] Aydin A. (2007), *A culture of optimization and reconciliation: a concept of equitable, ethical and creative living*, Keynote speech: IIAS forum 2007 on "Survival in an Orwellian world."

and we use masks. Others interact with our mask and not with our true self. This separation from the outside world is accompanied by strong feelings of loneliness which increase the identity conflict.

Furthermore, without a group, without other people, it would be impossible to receive a positive judgment. Others are the source of value and meaning, and this generates a deep need to be accepted and a fear of being rejected. This fear leads to accept all the conditions that the group or the community imposes.

Without a community, without the presence of other people, it would be impossible to be judged and receive a value from the outside. To be judged we need to ensure social contacts. Being marginalized means losing our source of value and identity, and the fear of being marginalized, of being rejected, often leads to accept, without hesitation, all the conditions that the group imposes. The phenomenon of social pressure, which stems from this fear, is so strong that at times it leads people to forget key ethical values.

Having more money, popularity and power gives us the illusion to be more. But, in whichever way we expand our Ego, when compared with the infinity of the universe, the result is always equal to zero.

We can become emperors of the planet and feel depressed, lonely, and meaningless. We can reach the highest forms of power, where we decide the life or death of people, but we still feel to be equal to zero. Nevertheless, we substitute the need for meaning with the need for money, for popularity, for power and feel them to be vital.

These secondary needs create a distance between us and others and trigger the fear of being deprived of what we possess. Many psychologists and sociologists have suggested specific needs of power, for example, the nPow, Need of Power, model developed by McClelland in 1975. However, the vital needs theory suggests that the need for power is nothing else than a secondary need, a strategy that we use in order to give a meaning to our life expanding our Ego. There is no "biological" need for power, for popularity or money, but there is only a need for meaning.

The judgment of other people, money, power, and popularity don't solve our need for meaning, we continue to feel meaningless and our loneliness increases. Consequently, we start searching for value and meanings in other ways and at this stage most people encounter religion. We substitute our vital need for meaning with a vital need for religion, providing in this way power to religions. But our unconscious mind soon becomes aware of the fact that also religion is unable to provide a meaning to life. This deep awareness explains the fear and hate that religious people can manifest towards those who belong to other religions. We don't want to become aware of the contradictions of our religion, since religion has become vital to us. The strength and power of religion can be found throughout all the history of humanity and in all the cultures and nations. History is filled with wars which have been conducted in the name of God. This fact provides an indication of how strong the need for meaning is.

Also, ideologies, cultural systems and sets of values provide meanings and become vital to us.

We feel the need to defend our sources of value, and this is probably one of our chief obstacles. People stay entrapped in their ideologies. Also, the culture in which we grow communicates values, such as the concepts of good and bad, social roles and duties. When we come into close contact with different cultures, we naturally lose these references, with a consequent sense of loss of identity and depression. Unprepared visitor can experience a cultural shock when immersed in an alien culture. Immigrants frequently suffer of cultural shocks, depression, and identity crises.

Cultural shock is what happens when a traveler finds himself suddenly in a place where yes means no, where fixed prices are replaced by bargaining, in which being made to wait is not an offense, where laughter may signify anger and when the familiar psychological cues that provide us with meaning are at once removed and replaced with new cues, unknown and incomprehensible.[42]

Another strategy commonly used to try to solve the identity conflict is to decrease the value of the denominator of the equation, for example:

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[42] Toffler A., *Future Shock*, http://www.amazon.com/dp/0553277375

$$\frac{I \times \cancel{Community}}{\cancel{Community}} = I$$

In this strategy, people seek to resolve their identity conflict limiting the outside world to a community, without contacts with the outside world. Rather than comparing ourselves with the universe, we reduce the denominator by limiting our universe. This strategy changes the need for meaning, into the need to belong to a group, to a community. It becomes vital to be part of a community.

The group may be the family, a group of friends, a religious community, a political party, an association, a scientific community, the workplace, or any other type of group with a limited number of people who belong to it. To secure this sense of belonging, from which we receive a meaning, we are willing to do whatever the influential members of the community want. Group violence in which ordinary people become momentarily blind, in a state of altered consciousness, and commit acts of violence and hooliganism, which would otherwise be unthinkable, show how powerful the need to belonging to a group can become. To respond to the need for belonging, people can become actors of the most atrocious sufferings, intentionally inflicting pain.

Another strategy is to cancel the external world. In this case the formula is transformed into:

$$\frac{I\ x\ \cancel{I}}{\cancel{I}} = I$$

This strategy explains 3 main types of psychiatric disorders:

– when the IxI multiplication prevails people can develop a *narcissistic* personality disorder.
– When the I/I fraction prevails there may be a *paranoid* personality disorder.

– When the I/I fraction and the IxI multiplication have similar weights, the person may be faced with a spectrum of *psychotic* disorders.

A trait common to these disorders is the closure in oneself, and the perception of the outside world as threatening or inappropriate in relation to one's expectations.

In the *narcissistic* personality disorder love for ourselves IxI dominates. Individuals who develop a narcissistic personality disorder believe that they are special and unique. They expect to receive approval and praise for their superior qualities and are likely to have proud and arrogant attitudes. By virtue of the personal values that they believe to have, they only want to be with prestigious people of high social or intellectual level. Finally, they are often occupied with fantasies of unlimited success, power, brilliance, beauty, or ideal love. Since the denominator of the equation has been replaced with their ego, these individuals show a lack of awareness of the needs and feelings of others, they lack empathy and can easily abuse others without any regard for the consequences. In addition, others are idealized if they meet the need for admiration and gratification. Relations tend to be cold and detached, without regard for the pain that they generate. They are in effect the joy-killers of the society; they tend to break rather than strengthen the bonds which make a healthy and harmonious living.

In the *paranoid* personality disorder, the I/I fraction dominates and the "universe" is replaced with ourselves. But since we are in an identity conflict, we feel the "universe" to be threatening and dangerous. In this case it is difficult to distinguish between objective reality and the inner world of depression and destructive ideas. The pervasive sense of threat is never regarded as a subjective experience, a fantasy, or a hypothesis, but as an objective matter of fact, absolutely certain. Sometimes our feelings are of derision, and other times they are derogatory or provocative and we start believing to be, unjustly, victims of a hostile and humiliating world. We start experiencing anger, resentment and irritation, and the tendency is to react to this aggression by attacking. When, instead, the feelings that prevail are those of being excluded, not wanted, or ostracized by the group, the prevailing experiences are those of anxiety, sadness, loneliness and fatigue, with the consequent tendency to become even more isolated and to withdraw from the world. Individuals with this disorder may also be insanely jealous and may suspect, without any real reason, that their spouse or partner is unfaithful. These individuals have also the inability to put themselves in the perspective of others and to distinguish their views from those of other people.

In the *psychotic* spectrum disorders the fraction I/I and the multiplication IxI are both emphasized. People replace external reality with their inner world which becomes the reality to which they compare themselves. Consequently, they project their own suffering outside themselves in the form of hallucinations, associated with the typical considerations that characterize the identity conflict:

being a nullity, being unworthy, incapable, and unfit, being destined to death and destruction. These considerations may take the form of actual hallucinations, delirium, illogical thinking supported by convictions and absurdities which seem obvious to the person concerned, but which cannot be shared or accepted by other people. Reality takes the form of false perceptions in the absence of real external stimuli, such as threatening and persecutory voices that are a constant reminder of the utter lack of meaning of their existence. Hallucinations are often characterized by paranoid beliefs according to which the whole world is part of a conspiracy. These paranoid beliefs, combined with hallucinations typical of schizophrenia and psychosis, may result in unbearable levels of suffering, so high as to lead the person towards suicide, which is felt as the only way out. Since at the numerator of the identity conflict we find IxI, people who suffer from hallucinations and delirium are also characterized by extreme social withdrawal, in contact only with themselves and with their own imaginary world. Social withdrawal, in turn, leads to become more introvert and these people start worrying only about the symptoms of their illness. It follows that an additional trait that characterizes psychosis and schizophrenia is selfishness, insensitivity, and lack of concern for the feelings of others.

- *Anxiety*

The autonomic nervous system (ANS) regulates and controls the vital functions of the body automatically and unconsciously, without the need for any voluntary control. Nearly all visceral functions are under the control of the autonomic nervous system which is divided into the sympathetic and parasympathetic systems. The nerve fibers of these systems do not reach directly the organs which they govern but stop before and form synapses with other neurons in structures called ganglia, from which other nerve fibers form systems, called plexus, which reach the organs. The sympathetic part of the system is close to the spinal ganglia, and forms synapses together with longitudinal fibers, in a tree called the paravertebral chain. The parasympathetic system forms synapses far away from the spinal column and closer to the organs it controls.

The ganglia of the sympathetic system are distributed as follows: 3

pairs of intracranial ganglia, placed along the path of the trigeminal, 3 pairs of cervical ganglia connected to the heart; 12 pairs of dorsal ganglia connected to the lungs and solar plexus, 4 pairs of lumbar ganglia that are connected through the solar plexus to the stomach, small intestine, liver, pancreas, and kidneys, 4 pairs of sacral ganglia in connection with the rectum, bladder, and genital organs.

For a long time, it was believed that there was no relationship between the brain and the sympathetic system, but today we know that this relationship exists, it is strong, and the brain can act directly on organs through the mediation of the solar plexus. There is thus a link between mental and physical states. For example, sadness acts on the solar plexus through the sympathetic system, generating vasoconstriction due to the contraction of the arterial system. This contraction caused by sadness hinders blood circulation, thereby also influencing the digestion and breathing.

People commonly refer to the heart and not to the solar plexus. However, from a physiological point of view, the organ that allows us to perceive feelings is the solar plexus. When we experience anxiety or love, they are not a product of the brain or of the heart, but of the solar plexus. The brain is not separate from the solar plexus and the solar plexus is itself a brain, but with a reversed anatomy. Whereas the brain is made of grey matter on the outside and white matter in the inside, in the solar plexus just the opposite is observed. The grey matter consists of nerve cells which allow us to think, the white matter is made up of nerve fibers, extensions of the cells, which allow us to feel.

The solar plexus and the brain are one the opposite of the other and represent two polarities: the emission pole and the receptive pole. The same duality of entropy and syntropy that is found throughout all of nature. The solar plexus and the brain are closely linked and from a phylogenetic point of view the brain develops from the solar plexus. Between brain and solar plexus there is a specialization of powers and functions which are totally different, and which may manifest completely only when these two polarities are integrated and work in harmony, producing results which are quite extraordinary.

Experiments show that syntropy acts mainly on the autonomic nervous system and is felt as warmth associated to wellbeing. On the contrary the lack of syntropy is felt as void associated to suffering.

Since syntropy points to the

attractor, feelings of warmth and wellbeing help to orient our choices towards advantageous aims and show anticipatory properties.

The following examples provide some indications of the backwards-in-time properties of feelings:

- The article "*In Battle, Hunches Prove to be Valuable*," published on the main page of the New York Times on July 28, 2009, describes that gut feelings associated with hunches and premonitions have helped soldiers to foil attacks: "*My body suddenly got cooler; you know, that danger feeling, and I said no – no!*" According to the entropy syntropy hypothesis the attack happens, the soldier experiences fear and death and these feelings travel backwards-in-time. The person in the past, experiences these feelings of death and fear as a hunch, a gut feeling, and he is pushed to make a different choice avoiding in this way the danger. According to the New York Times' article these hunch feelings have proved more effective than the technology and billions of dollars spent on intelligence.

- William Cox conducted a study on the number of tickets sold in the United State for commuter trains between 1950 and 1955 and found that in the 28 cases in which commuter trains had accidents a lower number of tickets was sold.[43] Data analysis was repeated checking possible intervening variables which could explain the accidents and the lower number of passengers, such as bad weather conditions, departing time, day of the week, etc. In these analyses the reduction of tickets associated with the accidents continued to emerge and to be significant. The reduction of passengers the day of the accident is strong, not only from a statistical point of view, but also from a quantitative point of view.

[43] Cox WE (1956), *Precognition: An analysis*. Journal of the American Society for Psychical Research, 1956(50): 99-109.

According to the entropy syntropy hypothesis, Cox's findings can be explained in this way: when involved in an accident, feelings of pain and distress are sent backward-in-time and can be felt in the past in the form of premonitions and hunch feelings, which may lead to a decision not to travel. This backward-in-time flow of feelings can therefore change the future. In other words, a negative event happens in the future and informs us in the past, through feelings. Consequently, listening to our feelings can help us to decide differently and to avoid pain and distress in our future. If we listen to our feelings the future can change advantageously.

- Among many other similar accounts: on 22 May 2010 a Boeing 737-800 of Air India Express flying between Dubai and Mangalore crashed during landing, killing 158 passengers, only eight occupants survived the accident. Nine passengers, after check-in, felt ill and refused to board the plane.

Feelings of warmth and wellbeing work as the needle of a compass that points to what is beneficial for our future, whereas feelings of void and distress tell that we are on a wrong or dangerous territory. Learning to recognize and understand feelings can therefore be of great help.

When we diverge from our path the intake of syntropy decreases, the regenerative processes become difficult and slow and instead of wellbeing we experience pain, usually unbearable, which is described with the terms anxiety and anguish.

We live in a time that disregards the body language. For example, when we feel anxiety or anguish, we search for a substance (a cigarette, a glass of wine, a drug) or anything that can free us from this painful experience. However, anxiety provides important information. When we feel thirsty, we do not try to suppress this feeling since we know that dehydration would continue and lead towards serious damages. Similarly, anxiety and anguish tell that we are in a shortage of syntropy, and that we need to change our course.

We here make a distinction between anguish and anxiety. Anguish indicates a lack of syntropy, whereas anxiety anticipates future states of anguish. Anxiety is an anticipation, whereas anguish is an indicator.

However, anxiety, anguish, fear and panic, use the same somatic markers, and this can be confusing. It is important to learn to distinguish between these feelings to respond effectively to our needs:

– *Anxiety*. We constantly use feelings to sense the future and choose advantageously. Anxiety alerts us about future situations that can cause anguish.
– *Anguish*. Syntropy concentrates energy and when we acquire syntropy we feel warmth in the thorax area associated with feelings of wellbeing. On the contrary, when the intake of syntropy is insufficient we experience anguish, feelings of void accompanied with pain and suffering. Anguish is usually coupled with symptoms of the autonomic nervous system such as nausea, dizziness, and

feelings of suffocation.

Instead of using the feelings of anxiety and anguish to respond more effectively to their needs, most people try to avoid these feelings.

Several stratagems are used, among which:

- Substances that produce feelings of warmth in the solar plexus are, for example, alcohol, tobacco, and heroin. When we use these substances in order to escape anxiety and anguish, they become vital, and addiction starts. Any substance that produces feelings of warmth similar to love reduces anguish but produces also addiction. A typical example is provided by heroin. Heroin is described as "*the cold lover*" and consumers speak about their "*honeymoon with heroin.*" Heroin replaces the need for love and turns into a vital need which leads to a strong addiction. Even alcohol causes feelings of warmth, like love, and can replace the need for love, causing a strong addiction.

– We fill our lives with activities and commitments, we spend all our time working, volunteering, busy with sports, political, religious, or ideological groups. We do not allow ourselves a moment of relaxation and in the rare moments of relaxation immediately we light a cigarette, drink alcohol, turn on the TV, or feel the need to eat compulsively, in order not to feel our inner sensations of anguish and suffering.

– When the suffering becomes unbearable, we try to avoid any moment of silence. During silence we perceive our inner state and to avoid silence, we become addicted to TV, radio, loud music, games, and violence.

These strategies do not satisfy the need for love and cohesion. As a result, the acquisition of syntropy continues to be insufficient and anguish persists.

Eliminating feelings of anxiety, anguish, and depression without resolving the cause, inevitably leads to several side effects, such as:

- It becomes difficult to meet the needs for love and meaning and the body enters in a state of chronic undernourishment of syntropy.
- When we artificially reduce anxiety and anguish, we also reduce our ability to feel the future and choose advantageously. Consequently, the use of substances, severely impairs our decision-making abilities and leads us away from advantageous

strategies and from wellbeing and happiness.

– When we artificially reduce the painful feelings of anguish and anxiety, we also reduce our ability to feel other people's heart, triggering loneliness and hindering cohesiveness, further increasing all those conditions which cause anxiety, depression and anguish.

Anxiety, depression, and anguish, although painful, are necessary guides towards wellbeing. The use of substances precludes the perception of these feelings and reduces the possibility to reach wellbeing and happiness.

Anguish and anxiety are important signals that we must learn to understand and listen to.

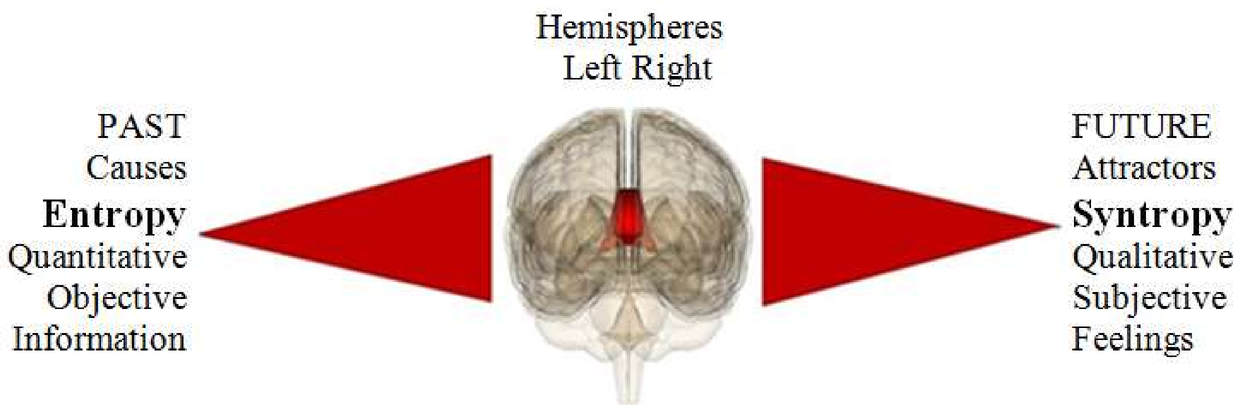
Starting from the dual solution of the energy momentum mass equation of special relativity, the mathematician Chris King[44] speculates that free will arises from the constant interaction between objective and quantitative information arriving from the past and subjective and qualitative feelings arriving from the future. King suggests that living systems are constantly faced with bifurcations, which force to make choices. From this constant process of choice arises

[44] King C.C. (1989), *Dual-Time Supercausality*, Physics Essays, Vol. 2(2): 128-151.

free-will.

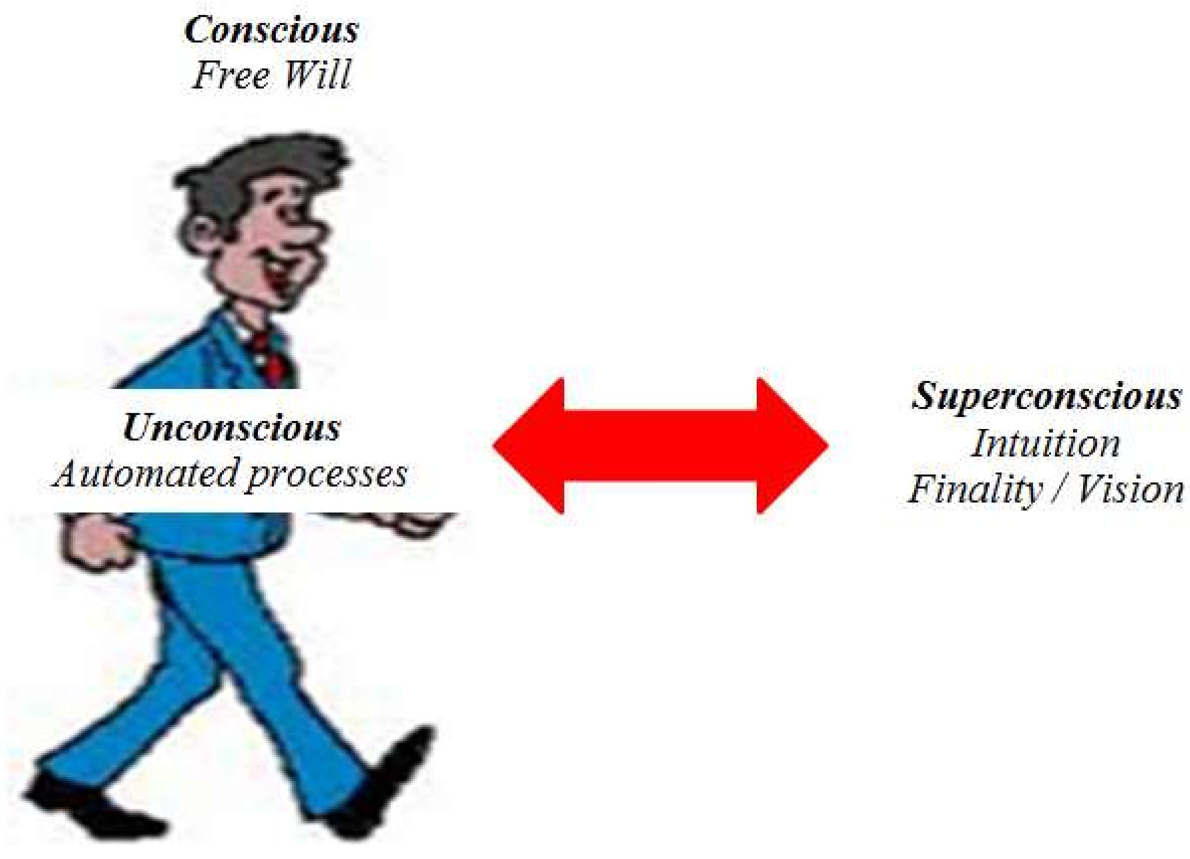
The forward-in-time flow of information follows linear time and is processed by rationality, whereas the backward-in-time flow takes the form of intuitions and guides towards the attractor.

Since the forward and the backward-in-time solutions are perfectly balanced, past and future have similar weights. This is probably the reason of the perfect division of the brain into two hemispheres, where the left hemisphere is the seat of logical reasoning, rationality, linear time and language (upward causation), and the right hemisphere processes intuitions and feelings (downward causation).



Since rational-logical thinking is characterized by objective and quantitative information which is perceived as certain, whereas intuitive thinking is characterized by subjective and qualitative experiences which are perceived as uncertain, the tendency is to choose according to the logical-rational thinking penalizing intuitions and all what is related to syntropy.

The experiments on the anticipatory reactions suggest that the autonomic nervous system, must be included in the model of the Mind:



According to the entropy syntropy

hypothesis, the autonomic nervous system connects individuals to the attractor, the source of our vital energy (syntropy), and it is therefore the seat of the feeling of life: the Self.

The brain, on the other hand, is the seat of the conscious mind and of free will.

Consequently, the mind should be organized on three levels:

- the *conscious mind*, associated with the head and free will.
- the *unconscious mind*, associated with the autonomic nervous system and characterized by highly automated processes.
- the *superconscious mind*, associated to

the attractor, which provides the purpose, the mission, and the meaning to our existence.

More precisely:

– The conscious mind on which we are tuned during the time we are awake, connects us to the physical reality of existence. The conscious mind mediates feelings that come from the autonomic nervous system, i.e., the unconscious mind, with information that comes from the physical plane of reality. The conscious mind is characterized by free will.

– The unconscious mind governs the vital functions of the body, therefore called involuntary, such as heartbeat, digestion, regenerative functions, growth, development, and reproduction. In addition, it implements highly automated programs, which allow us to perform many complex tasks, without having to think continuously about them, such as walking, riding a bicycle, driving, etc. The autonomic nervous system supplies the body with the properties of syntropy and it is therefore the seat of the Self that connects us to the attractor. The unconscious mind can be accessed during dreams or using techniques of relaxation and altered states of consciousness such as hypnotic trance.

- The superconscious mind is that part of our being that is directly associated to the attractor. The attractor is the source of syntropy (life energy) and receives all the experiences of the individuals who are connected to it (for example the individuals of the same species), selects that information which are advantageous and relays them to all the individuals. The superconscious mind shows the way and provides solutions. It is the source of inspiration and insight of knowledge and intelligence which allow to solve problems. It sends messages through dreams, or in the form of feelings of anticipation, presentiments, insights, and inspirations.

- *The conscious mind*

The conscious mind constantly chooses between past and future, and it is characterized by processes of evaluation, which are at the basis of free will and decision making. Feelings which attract towards future aims act as pull factors, and provide motivations and direction, whereas information, typically based on experiences and knowledge (past), act as push factors.

Studying neurological patients affected by decision making deficits the neurologist Antonio Damasio[45] noted that the pull factor is not present in patients with specific lesions of the prefrontal cortex. The prefrontal cortex integrates signals arriving from the body. These patients show an absence or imperfect perception of feelings and a behavior which can be described as "*short-sighted toward the future.*" Damasio suggested

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[45] Damasio AR (1994), *Descarte's Error. Emotion, Reason, and the Human Brain*, Putnam Publishing, 1994.

that feelings constitute an important part of the decision-making process, instead of opposing it, and help to operate advantageous choices, without having to produce advantageous assessments.

The duality between past and future, cohabits in our mind in the form of rational and intuitive thinking and it is seen in the specialization of the two cerebral hemispheres. The cortex is not a single block but is split in the left hemisphere which is the seat of logical reasoning and the right hemisphere which is associated with intuitions, global processing, analogies, symbols, and colors.

The left hemisphere deals with the

external and material world, it is objective and uses analytical reasoning; the right hemisphere deals with our inner world, it is intuitive and uses feelings, symbols, and images.

In the last century the attention was increasingly focused on objects. We can describe objects scientifically, use standardized symbols to represent them, attempt to reconstruct retrospectively the parts of a whole by the analytical process of rationality, however we are not able to look at objects and ourselves from the inside and reach the essence of reality.

We tend to overlook intuitions, since it is widely believed that life must be based on facts. This attitude has gradually led to abandon insights, inspirations, and dreams, with the result that choices are now made only following push factors, which are governed by the law of entropy, and not pull factors, which are governed by the law of syntropy.

- *The unconscious mind and the autonomic nervous system*

The autonomic nervous system oversees acquiring syntropy and distribute it, in the form of life energy, nourishing regenerative and healing processes and connecting the individual with the attractor which guides the shape, organization and structure of the physical body.

When we try to explain the complexity and order of genetic information solely as a result of past causes, we face a series of logical contradictions and paradoxes such as the fact that random genetic mutation are governed by the law of entropy and can only lead to a gradual increase of the structural differences between individuals, thereby averting the formation of species.

However, in the real world we witness just the opposite, namely an incredible convergence of biological structures towards common designs, despite individual differences.

For example, we can indicate different races of human beings, such as Europeans, Asians, Africans, but there is something that unites all of these individuals, and that makes them all part of humanity.

Considering only the past it is impossible to explain the convergence of different individuals towards the same species and the stability of species in time. The retrocausal hypothesis suggests that the design of species is held in specific attractors which retroact from the future.

Attractors unite individuals of the same species. When a common attractor is shared, the discoveries of one individual are disseminated to all the other individuals. Members of the same attractor, such as individuals belonging to the same species, can share knowledge without any physical contact or any other way that may allow the transition of information. Attractors transforms information into in-formation which is relayed back to all the other individuals.

The verb to inform means to model according to a form. It derives from the Latin term in-formare, that means to give a form. Aristotle wrote: "*Information is a primitive fundamental activity of energy and matter.*" Information does not have an immediate meaning, such as the word knowledge, but rather it encompasses a modality that develops forms and solutions. Once there is a form, the potential information can become manifest.

The autonomic nervous system connects the individual to the attractor and receives in-formation and syntropy. This happens at the unconscious level, despite the incredible amount of intelligence that it implies.

The autonomic nervous system, i.e. the unconscious mind:

- Is guided by feelings of anticipation that lead towards specific forms and solutions.

- It provides syntropic vital energy, to the various organs of the body and performs healing actions based on the designs received from the attractor.
- It behaves like a mechanic who consults the book of the manufacturer to perform repairs and maintain the system as close as possible to the project. The project is not mechanical, and instructions are written with the ink of love.
- It underlies all the involuntary functions of the body, and it is responsible for controlling the motion of muscles and limbs.
- It governs all the functions of the

body that are not subject to choose and which do not require the conscious level. For example, it is responsible for digestion, heart rate, assimilation of food, cell regeneration. These are processes which are completely unknown to our conscious mind. We do not know how they are carried out and, often, we do not even know that they exist. It is not necessary to be a doctor or a biologist to digest food or regenerate a tissue. The body knows everything independently and shows an extraordinary level of intelligence.

– It directs and regulates these processes, thereby expressing the capabilities and potentialities of an intelligence which is incredibly higher than our conscious mind.

- It memorizes patterns of behavior which it then executes automatically, and which are maintained over time, giving rise to habits. This memory is then stored, at least in part, in the muscles of the body in the form of patterns of behavior.
- It repeats behavioral patterns, until they become habits that are activated regardless of our will. These patterns are then placed firmly in the memory of the unconscious mind. The conscious mind often does not remember

what was included in the memory of the unconscious mind. Consequently, the unconscious mind can open incredible sceneries in the processes of knowing ourselves.

– The unconscious mind also acts as a guardian of any information that the conscious mind cannot handle.

- *The superconscious mind and the attractor*

The superconscious mind is the attractor, the source of syntropy. It resides outside our physical body and is connected to it via the solar plexus.

Since syntropy concentrates energy, the good functioning of the superconscious mind is felt as warmth and wellbeing located in the heart area. In contrast, a weak functioning of the superconscious mind is associated to feelings of void and pain usually named anxiety and anguish, accompanied by symptoms of the autonomic nervous system, such as nausea, dizziness, and feelings of suffocation.

The superconscious mind allows to experience visions of the future, intuitions, inspirations, and higher levels of awareness, which are inaccessible to the ordinary states of the conscious mind.

We constantly interact with the superconscious mind which illuminates the direction and provides aims and mission of our life.[46]

We enter in contact with the superconscious mind through our heart in moments of silence.

This contact requires that we abstain from alcohol, tobacco, drugs, and coffee, and avoid activities and habits which distract us from our inner feelings.

The superconscious mind is available to everyone, and acts as an inner teacher who guides towards the

[46] Aydin A., *Human Drama – Struggle for Finding the Lost Spirit*, 7th Symposium on Personal and Spiritual Development in the World of Cultural Diversity, 2010. The International Institute for Advanced Studies (IIAS).

solution of problems and towards wellbeing.

To better understand the role of attractors it is worth quoting Henri Poincaré's description of intuitions:[47]

> *"The genesis of mathematical creation is a problem which should intensely interest the psychologist. It is the activity in which the human mind seems to take least from the outside world, in which it acts or seems to act only of itself and on itself, so that in studying the procedure of mathematical creation we may hope to reach what is most essential in man's mind … What is mathematical creation? It does not consist in making new combinations with*

[47] Poincaré H. (1908), *Mathematical Creation*, from Science et méthode.

mathematical entities already known. Anyone could do that, but the combinations so made would be infinite in number and most of them absolutely without interest.

To create consists precisely in not making useless combinations and in making those which are useful, and which are only a small minority.

Invention is discernment, choice … To invent is to choose; but the word is perhaps not wholly exact. It makes one think of a purchaser before whom are displayed many samples, and who examines them, one after the other, to make a choice. Here the samples would be so numerous that a whole lifetime would not suffice to examine them. This is not the actual state of things.

The sterile combinations do not even present themselves to the mind of the inventor. Never in the field of his consciousness do combinations appear that are not useful, except some that he rejects but which have to some extent the characteristics of useful combinations …

It is time to penetrate deeper and to see what goes on in the very soul of the mathematician. For this, I believe, I can do best by recalling memories of my own.

…

For fifteen days I strove to prove that there could not be any functions like those I have since called Fuchsian functions. I was then very ignorant; every day I seated myself at my worktable, stayed an hour or two, tried a great number of combinations *and reached no results. One evening, contrary to my custom, I drank black coffee and could not sleep. Ideas rose in crowds; I felt them collide until pairs interlocked, so to speak, making a stable combination. But the next morning I had established the existence of a class of Fuchsian functions; I had only to write out the results, which took but a few hours. …*

Just at this time I left Caen, where I was then living, to go on a geological excursion under the auspices of the school of mines. The changes of travel made me forget my mathematical work. Having reached Coutances, we entered an omnibus to go someplace or other. When I put my foot on the step the idea came to me, without anything in my former thoughts seeming to *have paved the way for it, that the transformations I had used to define the Fuchsian functions were identical with those of non-Euclidean geometry. I did not verify the idea; I should not have had time, as, upon taking my seat in the omnibus, I went on with a conversation already commenced, but I felt a perfect certainty. On my return to Caen, for conscience' sake I verified the result at my leisure.*

Then I turned my attention to the study of some arithmetic questions apparently without much success and without a suspicion of any connection with my preceding research. Disgusted with my failure, I went to spend a few days at the seaside, and thought of something else. One morning, walking on the bluff, the idea *came to me, with just the same characteristics of brevity, suddenness, and immediate certainty…*

There was one however that still held out, whose fall would involve that of the whole place. But all my efforts only served at first the better to show me the difficulty. All this work was perfectly conscious. Thereupon I left for Mont-Valérien, where I was to go through my military service; so, I was very differently occupied. One day, going along the street, the solution of the difficulty which had stopped me suddenly appeared to me. I did not try to go deep into it immediately, and only after my service did, I again take up the question. I had all the elements and had only to arrange them and put them *together. So, I wrote out my final memoir at a single stroke and without difficulty. …*

Most striking at first is this appearance of sudden illumination, a manifest sign of long, unconscious prior work …. this unconscious work is possible, and of a certainty it is only fruitful, if it is on the one hand preceded and on the other hand followed by a period of conscious work.

These sudden inspirations never happen except after some days of voluntary effort which has appeared fruitless and whence nothing good seems to have come, where the way taken seems totally astray. These efforts then have not been as sterile as one thinks; they have set a going the unconscious machine and without them it *would not have moved and would have produced nothing.*

The need for the second period of conscious work, after the inspiration, is still easier to understand. It is necessary to put in shape the results of this inspiration, to deduce from them the immediate consequences, to arrange them, to word the demonstrations, but above all is verification necessary.

I have spoken of the feeling of absolute certitude accompanying the inspiration; in the cases cited this feeling was no deceiver, nor is it usually. But do not think this a rule without exception; often this feeling deceives us without being any the less vivid, and we only find it out when we seek to put on foot the demonstration. I have *especially noticed this fact regarding ideas coming to me in the morning or evening in bed while in a semi-hypnagogic state. …*

Now we have seen that mathematical work is not simply mechanical, that it could not be done by a machine, however perfect. It is not merely a question of applying rules, of making the most combinations possible according to certain fixed laws. The combinations so obtained would be exceedingly numerous, useless, and cumbersome.

The true work of the inventor consists in choosing among these combinations to eliminate the useless ones or rather to avoid the trouble of making them, and the rules which must guide this choice are extremely fine and delicate. It is almost impossible to *state them precisely; they are felt rather than formulated.*

Under these conditions, how imagine a sieve capable of applying them mechanically?

A first hypothesis now presents itself; the subliminal self is in no way inferior to the conscious self; it is not purely automatic; it is capable of discernment; it has tact, delicacy; it knows how to choose, to divine.

What do I say? It knows better how to divine than the conscious self, since it succeeds where that has failed. In a word, is not the subliminal self-superior to the conscious self? …

It is certain that the combinations which present themselves to the mind in a sort of *sudden illumination, after an unconscious working somewhat prolonged, are generally useful and fertile combinations, which seem the result of a first impression.*

Does it follow that the subliminal self, having divined by a delicate intuition that these combinations would be useful, has formed only these, or has it rather formed many others which were lacking in interest and have remained unconscious?

In this second way of looking at it, all the combinations would be formed in consequence of the automatism of the subliminal self, but only the interesting ones would break into the domain of consciousness. And this is still very mysterious.

What is the cause that, among the

thousand products of our unconscious activity, some are called to pass the threshold, while others remain below? Is it a simple chance which confers this privilege? Evidently not, among all the stimuli of our senses, for example, only the most intense fix our attention, unless it has been drawn to them by other causes. More generally the privileged unconscious phenomena, those susceptible of becoming conscious, are those which, directly or indirectly affect most profoundly our sensibility.

It may be surprising to see sensibility invoked à propos of mathematical demonstrations which, it would seem, can interest only the intellect. This would be to forget the feeling of mathematical beauty, *of the harmony of numbers and forms, of geometric elegance. This is a true aesthetic feeling that all real mathematicians know, and surely it belongs to sensibility.*

Now, what are the mathematic entities to which we attribute this character of beauty and elegance, and which can develop in us a sort of aesthetic feeling? They are those whose elements are harmoniously disposed so that the mind without effort can embrace their totality while realizing the details. This harmony is at once a satisfaction of our aesthetic needs and an aid to the mind, sustaining and guiding. And at the same time, in putting under our eyes a well-ordered whole, it makes us foresee a mathematical law.

Now, we have said above, the only

mathematical facts worthy of fixing our attention and capable of being useful are those which can teach us a mathematical law. So that we reach the following conclusion: The useful combinations are precisely the most beautiful, I mean those best able to charm this special sensibility that all mathematicians know, but of which the profane are so ignorant as often to be tempted to smile at it.

What happens then? Among the great numbers of combinations blindly formed by the subliminal self, almost all are without interest and without utility; but just for that reason they are also without effect upon the aesthetic sensibility. Consciousness will never know them; only certain ones are harmonious, and, *consequently, at once useful and beautiful. They will be capable of touching this special sensibility and which, once aroused, will call our attention to them, and thus give them occasion to become conscious.*

Thus, it is this special aesthetic sensibility which plays the rôle of the delicate sieve of which I spoke, and that sufficiently explains why the one lacking it will never be a real creator. Yet all the difficulties have not disappeared. The conscious self is narrowly limited, and as for the subliminal self we know not its limitations, and therefore we are not too reluctant in supposing that it has been able in a short time to make more different combinations than the whole life of a conscious being could encompass. Yet these *limitations exist. Is it likely that it can form all the possible combinations, whose number would frighten the imagination? Nevertheless, that would seem necessary, because if it produces only a small part of these combinations, and if it makes them at random, there would be small chance that the good, the one we should choose, would be found among them. …*

In the subliminal self-reigns what I should call liberty if we might give this name to the simple absence of discipline and to the disorder born of chance. Only, this disorder itself permits unexpected combinations."

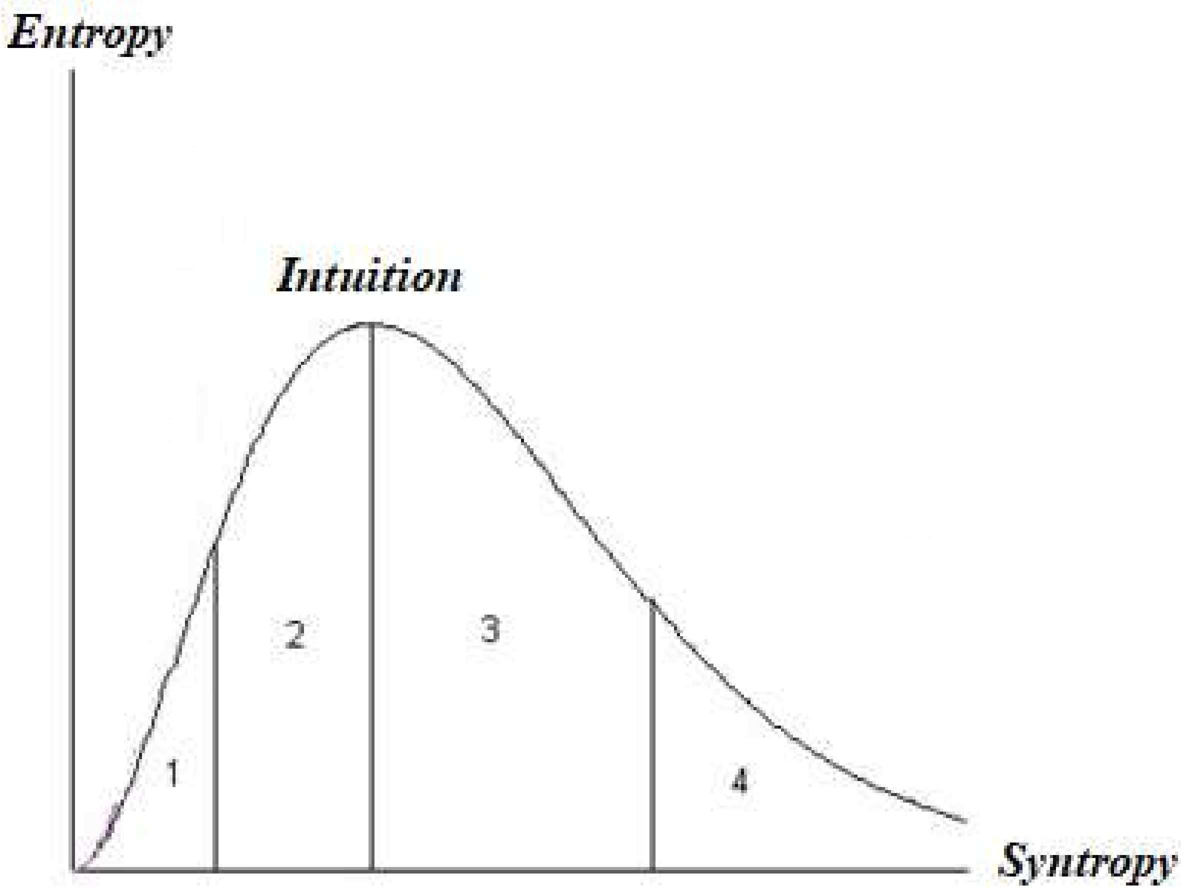
Poincaré noticed that when faced with a new mathematical problem he began using the rational approach of the mind that allows to become aware of the characteristics and elements of the problem.

But, since the options tend to be infinite and it would take infinite time to evaluate them all, some other type of process starts operating leading to select the correct solution. Poincaré named this process intuition and considered it a process which is fundamental in the production of qualitatively new information. Poincaré concluded that the process of discovery can be divided into four phases similarly to Charles Sanders Peirce who proposed a schema that considerably influenced the development of science.

In "*How to Make Our Ideas Clear*",[48] Peirce placed induction and deduction in a complementary rather than competitive context. Secondly, and of more direct importance to the scientific method, Peirce put forth the basic schema for hypothesis-testing that continues to prevail today. Peirce examined and articulated the fundamental modes of reasoning that play a role in scientific inquiry, the processes that are currently known as inductive, abductive, deductive and hypothesis testing:

[48] Peirce C.S. (1878), How to Make Our Ideas Clear, www.amazon.it/dp/B004S7A74K

– During the *inductive* phase we consciously review the know-how and unsolved problems.
– During the *abductive* phase unconscious processes take place and lead to an *intuition* which highlights the correct hypothesis.
– During the *deduction* phase the hypothesis is translated into items.
– During the *hypothesis testing* phase data is gathered and hypotheses are tested.



Phases of the process of discovery

Intuitions guide towards the right solutions and options reducing in this way entropy. On the contrary when we only use rational thinking neglecting the heart and intuitions, entropy increases. The superconscious mind constantly uses feelings as a compass that points towards the attractor.

Descartes famously distinguished between two types of substance: *res extensa*, the so-called objective reality, and *res cogitans*, our conscious experience.

In the introduction to The Conscious Mind David Chalmers states that: "*It still seems utterly mysterious that the causation of behavior should be accompanied by a subjective inner life*."[49] Chalmers divides the problems of consciousness into:

– The *easy problem*, which deals with the study of neurobiological models of consciousness and

[49] Chalmers D. (1996), *The Conscious Mind: In Search of a Fundamental Theory*, www.amazon.com/The-Conscious-Mind-Fundamental-Philosophy/dp/0195117891

neural correlates of the conscious experiences.

– The *hard problem*, which deals with the subjective qualities of the conscious experience since these subjective aspects escape classical scientific analysis.

Chalmers affirms that easy problems are easy because all that it is needed is to find the mechanisms which allow to explain them, making them compatible with the laws of classical physics. The hard problem of consciousness is difficult since, even when all the main functions are explained according to cause-effect processes, it is impossible to arrive at the explanation of consciousness, in the term of subjective experience and the laws of classical physics.

The entropy/syntropy hypothesis suggests that two forces apply to the conscious experience: one diverging (res extensa: entropy), which propagates forward-in-time, and one converging (res cogitans: syntropy), which propagates backward-in-time.

This implies that in the explanation of mind processes, feelings and retrocausality should always be considered.

- Heart or Brain?

The entropy/syntropy hypothesis of the mind is heart centered and sees the brain as a servant of the heart. On the contrary consciousness is usually associated to the brain and it is widely believed that when the brain stops working consciousness ends and the person can be considered dead.

The concept of brain death has been officially formalized in 1968 at the time of the first transplant of organs, as the criteria of natural death (end of heart activity and blood circulation) does not allow organ transplants. The concept of brain death provides the legitimacy necessary to perform transplants and the first official definition of brain death was developed by an ad hoc committee set up at the Harvard Medical School. The 1968 Harvard criteria for brain death determination have now become the bases for national laws. These criteria establish when it is permissible to “unplug” and consider the patient “legally” dead. The Harvard criteria are also the bases for the laws on organ transplantation since organs are removed when the heart is still beating.

Evidence that brain death is not valid criteria are suggested by the fact that:

– when explanting organs from a

person who is legally defined as dead (low EEG activity) the person starts defending and screams and must be tied to the operating table to allow to remove the organs.
– an awesome number of people, who had been diagnosed with brain death, awake in full consciousness.

In 1985 the Vatican accepted the Harvard Report and in 1989 Pope John Paul II talked on the topic in several occasions legitimating the removal of organs from warm bodies, despite the fact that they are still breathing and with their hearts beating.

On September 3, 2008, in the front

page of the official Vatican newspaper, "*L'Osservatore Romano*", Lucetta Scaraffia wrote an editorial dedicated to the forty years anniversary of the Harvard Report which introduced the definition of brain death. In this editorial she declared that brain death cannot be used to assert the end of a life and the definition of death should be reviewed in the name of new scientific assumptions.

The reactions of the Western medical / scientific world were immediate: "*The criteria for brain death are the only scientifically valid criteria in order to sanction the death of an individual.*"

Moreover: "*The worldwide scientific*

community approves the criteria established by the Harvard report and the criticism that comes from fringe minorities, are based essentially on non-scientific considerations."

Finally: "*Scientifically advanced countries have accepted as the norm all the criteria of brain death.*"

A book edited by Paolo Becchi: "*Brain death and organ transplantation. A question of legal ethics*" contains the statement of Hans Jonas who argues that the definition of death established by the Harvard report was motivated not by scientific discoveries, but by the need for organs for transplantation.

In 1989, the Pontifical Academy of

Sciences had already addressed the question and Professor Josef Seifert, Dean of the International Philosophical Academy of Liechtenstein, was the only one to object to the definition of brain death.

But, when the Pontifical Academy of Sciences met again to discuss the issue, on 3-4 January 2005, the positions reversed. The participants, philosophers, jurists and neurologists from various countries, agreed that the criterion of brain death is not scientifically credible and should therefore be abandoned.

These results were unacceptable for Marcelo Sánchez Sorondo, chancellor of the Pontifical Academy of

Sciences, and the proceedings of the meeting were not published. Several speakers gave their papers to an outside publisher, Rubbettino, and a book was published with the Latin title *Finis Vitae*, edited by Professor Roberto de Mattei, deputy director of the Italian National Research Council.

Experiments focused on the autonomic nervous system, suggest that consciousness resides in the heart area and not in the brain. Rita Levi-Montalcini describes this contradiction with the following words:

> "*everyone says that the brain is the most complex organ of the body. As a doctor I*

might agree! But as a woman, I assure you that there is nothing more complex than the heart; its mechanisms are still unknown. In the brain there is logical reasoning, in the reasoning of the heart there are feelings."

Heart or Brain? This is one of the main differences between the West and the East. The West is brain-centered whereas Asia and especially China are heart-centered. An example is provided by the term consciousness. If you copy the ideogram 心 in Google translator you obtain the following translations: bosom, center, core, feeling, thinking and intelligence. These are some of the main properties of what in the West we call consciousness. But the ideogram 心 indicates the heart! Chinese ideograms constantly associate consciousness to the heart!

Consequently, in China a person is considered alive and conscious until the heart beats and explanting organs from warm bodies is considered an execution. This is one of the reasons why in China organs for transplants are only provided by prisoners who, before their execution to death, agree to donate organs.

- Love or instinct?

In China love 春心 is expressed by the combination of the ideogram 春 (life) and the ideogram 心 (heart), whereas in the West love is accounted to the action of neurotransmitters and as a manifestation of instinct.

In a recent paper by two British anthropologists, Robin Dunbar and Anna Maschin[50], the need for friendship is explained as being caused by internal opioids (endorphins) that are produced during friendship relations. Friendship has always put science in

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[50] Maschin A.J. e Dunbar R.I.M. (2011), *The brain opioid theory of social attachment: a review of the evidence*, Behavior, 148(10): 985-1025.

front of a paradox because, unlike love, it is not needed for the reproduction of the species and does not imply a convenience for survival. It has therefore always remained a mystery why we spend hours with people, from whom we will probably never receive any benefit for our survival.

According to Dunbar and Maschin the cause of friendship is a neurotransmitter that is part of the group of endogenous opioids. These are substances similar to opioids, which we are accustomed to considering as drugs, but which are produced by our neurons.

Dunbar and Maschin conclude that

since friendship is caused by an internal drug it has the same addictive effects of drugs, and we cannot do without it.

Endogenous opioids (or endorphins) are neurotransmitters that are associated with a state of wellness, which encourages us to see life optimistically and reduce stress hormones. According to mainstream science, endorphins are the cause of wellbeing, and Dunbar and Maschin state that they "*are the glue that makes us keep those neurochemical complex social relationships that go beyond mating and care of offspring.*"

Endogenous opioids were discovered in the '70s and are difficult to study as they cannot be administered for experimental purposes because they are drugs which cause addiction. Since their discovery the relationship between endorphins and love was clearly shown.

Science sees the causes of love and friendship in neurotransmitters and hormones. For example, oxytocin, vasopressin, dopamine, and serotonin are believed to be the cause of erotic attraction, jealousy, the sense of motherhood and fatherhood.

The entropy/syntropy hypothesis reverses this interpretation, arguing that love, friendship and cohesion are vital, since they are properties of syntropy, and they allow to acquire syntropy. Syntropy is cohesive and converging and its manifestations are of union and closeness. When we acquire syntropy, feelings of warmth due to the concentration of energy are associated with feelings of wellbeing caused by the regenerative processes activated by life energy. Obviously, these processes produce chemical mediators and neurotransmitters, such as endorphins. The production of endorphins is here seen because of the acquisition of syntropy. Love, friendship, and cohesion are the ways by which we acquire syntropy and are not caused by endorphins or neurotransmitters.

Luigi Fantappiè stated that in the law of syntropy he could see the law of love:

> "*Today we see printed in the great book of nature - that Galileo said, is written in mathematical characters - the same law of love that is found in the sacred texts of major religions.*"

He described this finding in the following way:

> "*What makes life different is the presence of syntropic qualities: finalities, goals, and attractors. Now as we consider causality the essence of the entropic world, it is natural to consider finality the essence of*

the syntropic world. It is therefore possible to say that the essence of life is the final causes, the attractors.

Living means tending to attractors ... the law of life is not the law of mechanical causes; this is the law of non-life, the law of death, the law of entropy; the law which dominates life is the law of finalities, the law of syntropy.

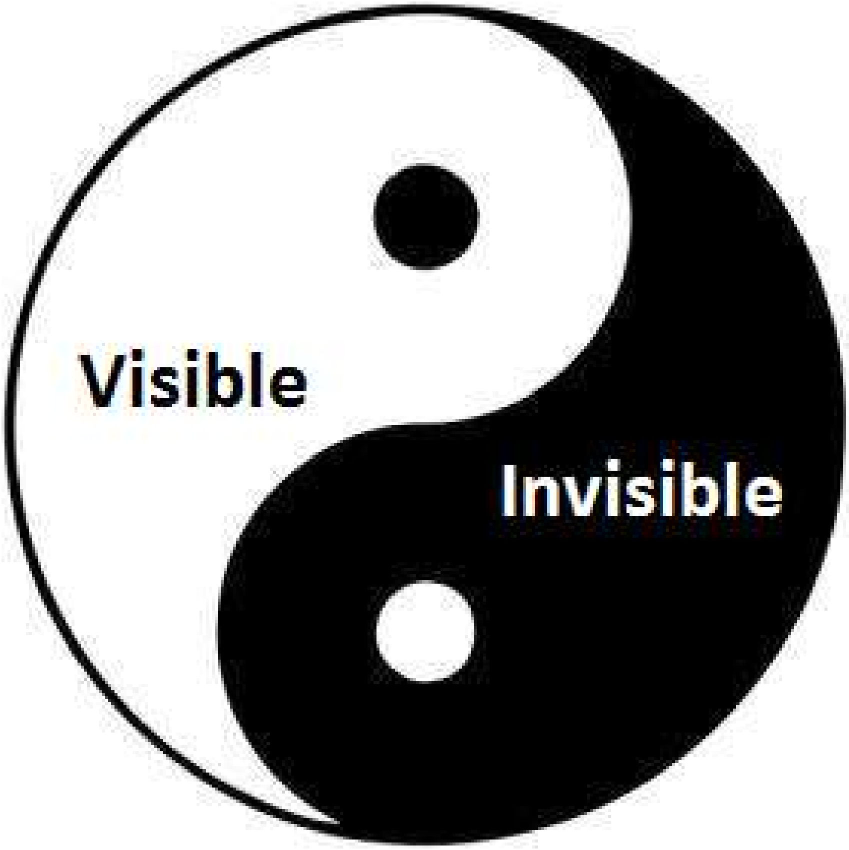
But how are these attractors experienced in human life? When a man is attracted by money, we say he loves money. The attraction towards a goal is felt as love. We now see that the fundamental law of life is this: the law of love. I am not trying to be sentimental; I am just describing results which have been logically deducted from premises which are sure. It is incredible *and touching that, having arrived at this point, mathematical theorems start speaking to our heart*!"

"*The law of life is not the law of hate, the law of force, or the law of mechanical causes; this is the law of non-life, the law of death, the law of entropy. The law which dominates life is the law of cooperation towards goals which are always higher, and this is true also for the lowest forms of life. In humans this law takes the form of love, since for humans living means loving, and it is important to note that these scientific results can have great consequences at all levels, particularly on the social level, which is now so confused. (...) The law of syntropy is therefore the law of love and* *differentiation. It does not move towards leveling and conforming, but towards higher forms of differentiation. Each living being, whether modest or famous, has its mission, its finalities, which, in the general economy of the universe, are important, great and beautiful."*

COMPLEMENTARITY

The description of two complementary forces, one diverging and one converging, one visible and one invisible, one destructive and one constructive, can be found in many philosophies and religions.

In the Taoist philosophy all aspects of the universe are described as the interplay of two complementary and fundamental forces: the yang principle, which is diverging, and the yin principle which is converging.



Taijitu symbol

These two forces are part of a unity. In the visible side of reality, when one increases the other decreases, but their balance remains unchanged. This law is masterfully represented in the Taijitu symbol, that is the union of these opposite forces, the yin and the yang, the diverging and converging forces whose combined action moves the universe in all its aspects: the sexes, seasons, day and night, life, and death, full and empty, movement and repose, push and pull, dry and wet. Water takes on yang steaming form and yin icy form. Within the yin there is yang, and within the yang there is yin.

In the Taijitu the yang principle is represented by the white color and has entropic properties, whereas the yin principle is represented by the black color and has syntropic properties. The Taijitu is a wheel that rotates constantly, changing the proportion of yin and yang (syntropy and entropy) in the visible and the invisible sides of reality. The Taijitu shows that a property of complementarity is that opposites attract each other. This property is well known in physics, but it is also true at the human level where people on opposite polarities are attracted to each other, as in males and females. Since the balance of these opposite forces remains unchanged the Taoist philosophy suggests that the aim is to harmonize the opposites, thus creating unity.

In Hinduism the law of complementarity is described by the dance of Shiva and Shakti, where Shakti is the personification of the female principle and Shiva of the male principle. They represent the primordial cosmic energy and the dynamic forces that are thought to move through the entire universe. Shiva has the properties of the law of syntropy, whereas Shakti has the properties of the law of entropy, and they are constantly combined in an endless cosmic dance.

Endless cosmic dance between Shiva and Shakti

Shakti can never exist apart from Shiva or act independently of him, just as Shiva remains a mere corpse without Shakti. All the matter and energy of the universe results from the dance of the two opposite forces of Shiva and Shakti. Shiva absorbs Shakti energy, turning it into a body and absolute pure consciousness, the light of knowledge. According to Hinduism intelligence comes from the future (Shiva), whereas fearsome, ferocity and aggressiveness come from the past (Shakti). Shakti is the energy of the physical and visible world whereas Shiva is the consciousness which transcends the visible world. However, each aspect of Shiva has a Shakti component, linked to the physical world. The evolution of this endless dance between Shakti and Shiva has the function to bring life towards Unity.

In the psychological literature of the 20th century Carl Gustav Jung and Wolfgang Pauli added synchronicities (syntropy) to causality (entropy). According to Jung, synchronicities are the experience of two or more events that are apparently causally unrelated or unlikely to occur together by chance, yet they are experienced as occurring together in a meaningful manner.

The concept of synchronicity was first described in this terminology by

Carl Gustav Jung in the 1920s. The concept does not question, or compete with, the notion of causality. Instead, it maintains that just as events may be grouped by causes, they may also be grouped by finalities, a meaningful principle. Jung coined the word synchronicities to describe what he called "*temporally coincident occurrences of acausal events*." He variously described synchronicity as an "*acausal connecting principle*," "*meaningful coincidence*" and "*acausal parallelism*."

Jung gave a full statement of this concept in 1951 when he published the paper *Synchronicity - An Acausal*

Connecting Principle,[51] jointly with a related study by the physicist Wolfgang Pauli.

In Jung's and Pauli's description causality acts from the past, whereas synchronicity acts from the future. Synchronicities are meaningful since they lead towards a finality, providing a direction to events which correlates them in an apparently acausal ways.

Jung and Pauli described causality and synchronicity acting on the same indestructible energy. They are united by this energy, but at the same time they are complementary.

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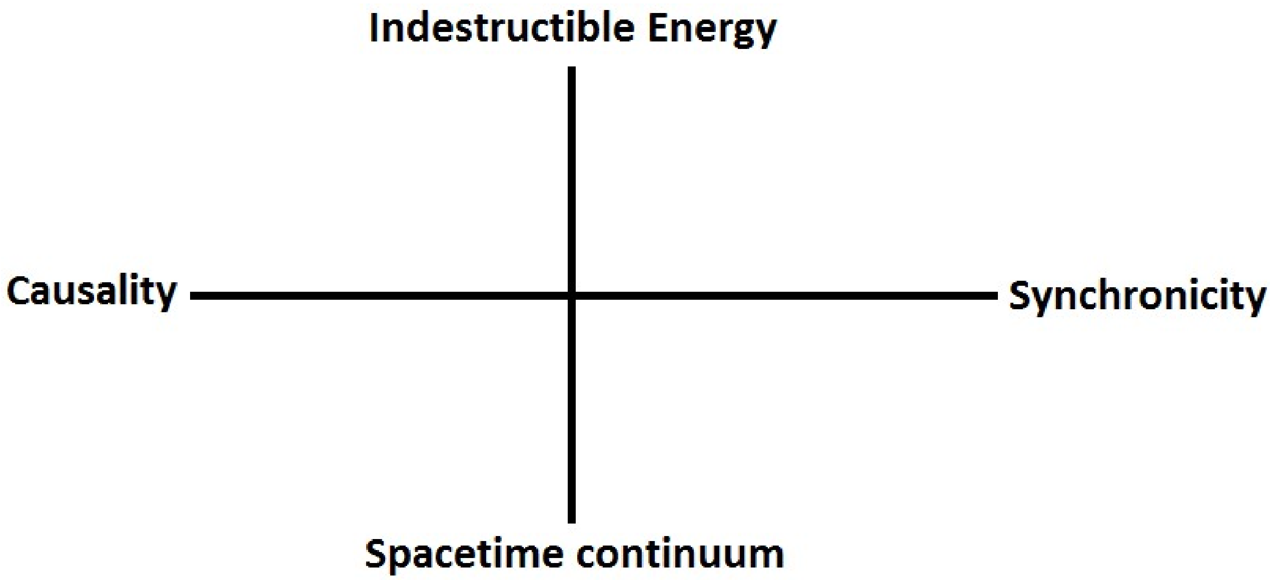
[51] Jung C.G. (1951), *Synchronicity - An Acausal Connecting Principle*, Princeton University Press, www.amazon.com/Synchronicity-Connecting-Principle-Collected-Bollingen/dp/0691150508



Syntropy concentrates energy in ever smaller spaces increasing order and organization, but since the concentration of energy cannot increase indefinitely, at some point, the system releases energy and matter, thus activating the opposite process of entropy and an exchange of energy and matter with the environment. Life naturally tends to increase syntropy, but the macroscopic level is governed by the law of entropy and tends to increase entropy. Exchange between life and the environment results in a continuous process of construction and destruction which allows life to evolve. Exchange reveals the principle of complementarity which is a fundamental property of life at all its levels of organization, from the organic/biological level to economics.

Exchange is well denoted in metabolism where *Entropy* corresponds to *Catabolic* processes, which transform higher level structures into lower-level structures with the release of energy in the form of chemical energy (ATP) and thermal energy, and *Syntropy* corresponds to

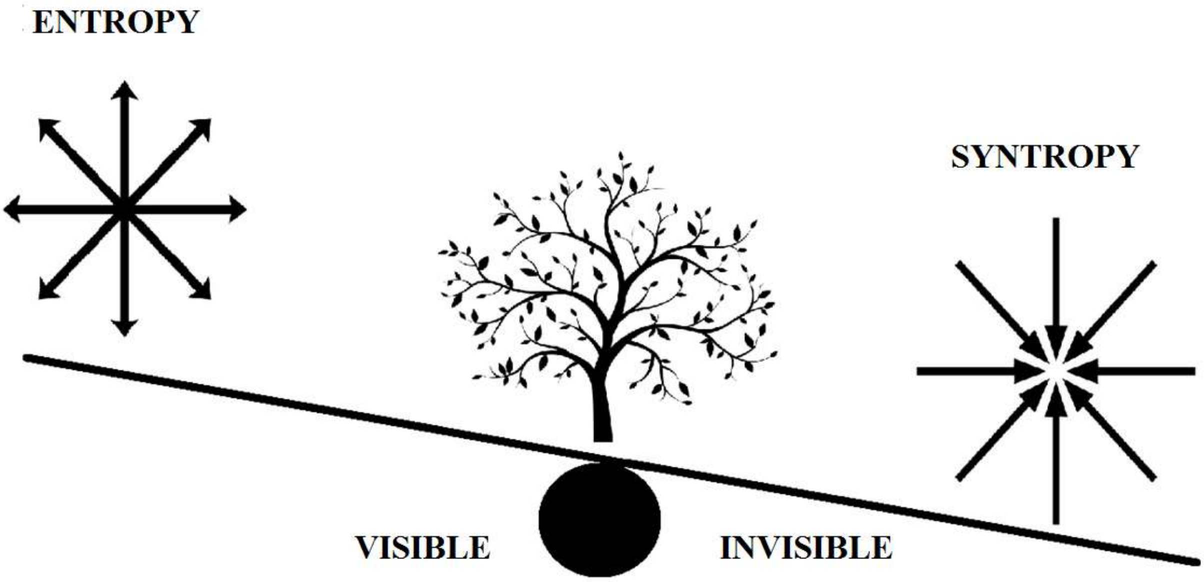
Anabolic processes, which transform simple structures into complex structures, for example nutritive elements into biomolecules, with the absorption of energy.

In the field of ecosystems, Ulanowicz suggests a description based on cycles of ascendancy and overhead. Ascendancy describes the tendency towards organized phenomena, whereas overhead the flow of disorganized energy:

> "*Real systems are the result of an on-going transaction between the opposing tendencies of both ascendancy and overhead.*"[52]

[52] Ulanowicz R.E. (2009), *A third Window*, Templeton Foundation Press.

In the entropy/syntropy hypothesis complementarity is represented with a seesaw where entropy and syntropy play at the opposite sides. This representation clearly shows that when entropy goes down syntropy rises and when entropy rises syntropy goes down. On the left side the reduction of entropy is achieved through a continuous tension towards optimization, whereas on the right side the increase in syntropy is obtained thanks to the process of intuition, which is a property of the superconscious mind and leads to innovation.


ENTROPY
SYNTROPY
VISIBLE
INVISIBLE

SYNTROPY AND ENTROPY IN PHYSICS

At the end of the 19th century physicists were faced with a fundamental paradox. According to classical physics a black body (which in physics is the best possible emitter of thermal radiation) at thermal equilibrium will emit radiation with infinite power as it would all concentrate in the ultraviolet wavelength. This prediction was named the ultraviolet catastrophe, but fortunately it was not observed in nature. This paradox was solved on 14

December 1900, when Max Planck presented a paper, at the German Physical Society, according to which energy is quantized. Planck assumed that energy does not grow or diminish in a continuous way, but according to multiples of a basic quantum, which Planck defined as the frequency of the body (v) and a basic constant which is now known to be equal to 6,6262·10-34 joule·seconds and which is now named Planck's constant.

Planck described thermal radiations as composed of packets (quantum), some small and others larger according to the frequency of the body. Below the quantum level, thermal radiation disappeared, avoiding in this way the formation of infinite peaks of radiation at the ultraviolet wavelength and solving in this way the paradox of the ultraviolet catastrophe.

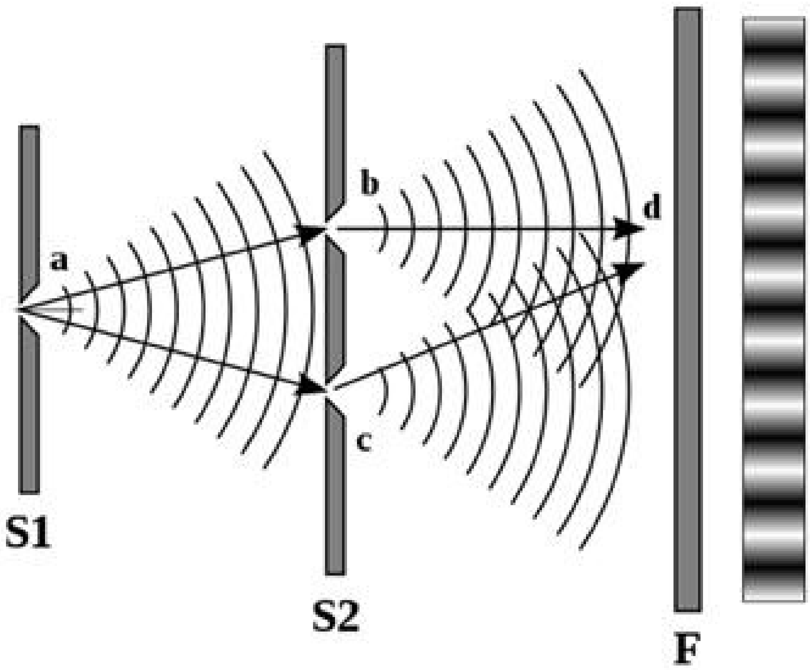
December 14, 1900, is now remembered as the starting date of quantum mechanics (QM). Quantum mechanics deals with the behavior of the microscopic world at the atomic level.

- Wave/particle

The double slit experiment was used by the physicist Thomas Young, in the 18th century, to show that light propagates as a wave.

In the presentation of his results at the Royal Society of London, on November 24, 1803, Young stated: "*The experiment I am about to relate (…) may be repeated with great ease, whenever the sun shines.*"

Young's experiment was very simple in design: a narrow ray of sunlight shines through a pinhole in a cardboard (S1), the light then goes through two pinholes in a second cardboard (S2), and then ends on a white flat surface creating patterns of lines, light and dark, which Young explained because of the interference among light waves. White lines (constructive interference) are shown when light waves add up, whereas dark lines (destructive interference) are shown when they do not add up.



Thomas Young's double slit experiment

Young's experiment was generally accepted as the demonstration of the fact that light propagates as waves. If light would have been made of particles, the interference pattern would not have shown up, but only two well localized dots of light would have been observed in association with the pinholes in the cardboard. Instead, in the double slit experiment, the brightest line is located between the two pinholes, in what would have been expected to be a dark area. Young's experiment has been considered the fundamental demonstration of the wave properties of light until quantum mechanics started to disclose the dual nature of matter: waves and particles at the same time.

In 1905, Einstein solved the paradox of the photoelectric effect, describing light as composed of particles, rather than waves. When light or electromagnetic radiation reach a metal, electrons are emitted, this is named the photoelectric effect. The electrons of the photoelectric effect can be measured, and these measurements show that: until a specific threshold is reached the metal does not emit any electrons; above the specific threshold electrons are emitted, and their energy remains constant; the energy of the electrons increases only if the frequency of light is raised. Classical light theory was not able to justify this behavior, for example: Why does the intensity of light not increase the energy of the electron emitted by the metal? Why does the frequency affect the energy of the electrons? Why are electrons not emitted below a specific threshold? Einstein answered these questions using Planck's constant and suggested that light, previously considered an electromagnetic wave, could be described as quantum packets of energy, particles which are now called photons. Einstein's interpretation of the photoelectric effect played a key role in the development of quantum mechanics, as it treated light as particles, instead of waves, opening the way to the duality wave/particles.

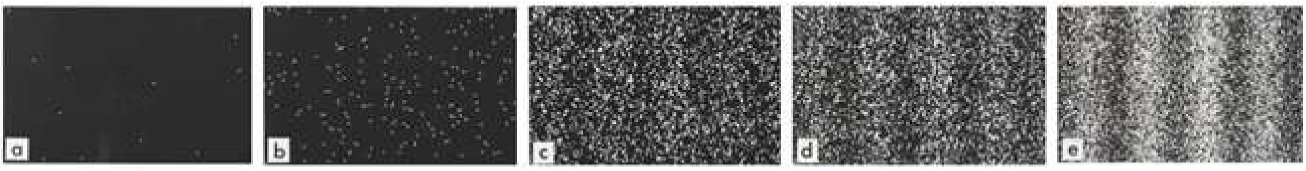
The experimental proof of Einstein's interpretation was given in 1915 by Robert Millikan who, ironically, had been trying, for 10 years, to prove that

Einstein's interpretation was wrong. In his experiments Millikan discovered that all the alternative theories did not pass the experimental test, whereas only Einstein's interpretation was shown to be correct. Several years later Millikan commented:

> "*I spent ten years of my life testing that 1905 equation of Einstein and contrary to all my expectations I was compelled in 1915 to assert its unambiguous experimental verification in spite of its unreasonableness since it seemed to violate everything that we knew about the interference of light.*"

Young's experiment can now be performed using single electrons. Electrons used in a double slit experiment produce an interference pattern and therefore behave as waves, but at their arrival they give place to a point of light, behaving as particles.

Do electrons travel as waves and arrive as particles?



Double slit experiment using electrons
a) 10 electrons; b) 100 electrons; c) 3.000 electrons;
d) 20.000; e) 70.000 electrons.

If electrons were particles, we could conclude that they would go through one of the two slits, but the interference pattern shows that they behave as waves going through the two slits at the same time.

Quantum entities seem to be capable of going through the two slits at the same time and know how to contribute to the interference pattern.

If matter were only made of particles, quantum entities would go through one slit at a time, and no interference pattern would be visible. If matter were only made of waves no dots would be observed on the screen, but only interference lines would show.

Richard Feynman[53] known for his contributions to the development of

[53] www.feynman.com

quantum electrodynamics, considered the dual nature of matter (particle/wave) the core mystery of quantum mechanics:

> *"The double slit experiment is a phenomenon which is impossible, absolutely impossible, to explain in any classical way, and which has in it the heart of quantum mechanics."*[54]

- *The dual solution of the fundamental equations*

In 1924 Wolfgang Pauli, one of the pioneers of quantum mechanics,

[54] Feynman R. (1949) *The Theory of Positrons*, Physical Review 76: 749.

discovered that electrons have a spin, a momentum which can never be equal to zero and which nears the speed of light. Therefore, when combining quantum mechanics and special relativity the full energy momentum mass equation needs to be considered.

In 1925 the physicists Oskar Klein and Walter Gordon formulated a probability equation which could be used in quantum mechanics and was relativistic. Klein-Gordon's equation depends on a square root and yields two solutions. The positive solution describes waves which propagate from the past to the future (delayed waves), whereas the negative solution describes waves which propagate backward-in-time, from the future to the past (advanced waves).

Klein and Gordon explained the dual nature, wave/particles, of matter as the continuous interaction between delayed waves (forward-in-time solution, which is determined) and advanced waves (backward-in-time solution, which is probabilistic).

This interpretation was rejected by Heisenberg, who in 1927 formulated, together with Niels Bohr the Copenhagen interpretation of Quantum Mechanics.

The Copenhagen interpretation explains the results of the double slit experiment in the following way:

electrons leave the electronic cannon as particles, they dissolve into waves of superposed probabilities, in a superposition of states, the waves go through both slits and interfere creating a new state of superposition. The observation screen, performing a measurement, forces the waves to collapse into particles, in a well-defined point of the screen. Electrons start again to dissolve into waves, just after the measurement.

Essential components of the Copenhagen interpretation are:

– The *Uncertainty principl*e formulated by Heisenberg, according to which a quantum entity cannot have a precisely defined moment and place at the same time.

– The *Complementarity principle* which states that a single quantum mechanical entity can either behave as a particle or as a wave, but never simultaneously as both; that a stronger manifestation of the particle nature leads to a weaker manifestation of the wave nature and vice versa.
– *Schrödinger's wave equation*, reinterpreted as the probability that the electron (or any other quantum mechanical entity) is found in a specific place.
– The *superposition of states*, according to which all the waves are

superposed together until a measurement is performed.
- The *collapse of the wave function* which is caused by the observation and the act of measuring.

According to this interpretation consciousness, through the exercise of observation, forces the wave to collapse into a particle, creating reality.

In this way Heisenberg introduced the notion that consciousness is a prerequisite to reality. This interpretation states that the existence of the electron in one of the two slits, independently from observation, does not have any real meaning. Electrons seem to exist only when they are observed. Reality is therefore created by the observer.

In 1927 Klein and Gordon formulated again their equation as a combination of Ψ, Schrödinger's wave equation (quantum mechanics), and the energy/momentum/mass equation of special relativity:

$$E\Psi = \sqrt{p^2 + m^2}\,\Psi$$

This Klein-Gordon equation involves on a square root which yields two wave solutions: delayed and advanced waves.

In 1928 Paul Dirac, an English

theoretical physicist who made fundamental contributions to the early development of quantum mechanics, tried to eliminate the advanced waves solution by applying the energy momentum mass equation to the study of relativistic electrons. He was faced again with a dual solution: electrons (e^-) and neg-electrons (e^+, the anti-particle of the electron). Dirac's equation predicts a universe made of matter which propagates forward-in-time and antimatter which propagates backward-in-time. Dirac stated:

> "*One gets over the difficulty by arbitrarily excluding those solutions that have a*

negative Energy. One cannot do this in the quantum theory."[55]

Dirac named the anti-particle of the electron *neg-electron*, and in 1932 it was experimentally observed by Carl Anderson, who renamed it *positron*.[56] Positrons are produced naturally in certain types of radioactive decay and in 1934 the Swiss mathematician Ernst Stueckelberg and later Richard Feynman, provided a formalism where each line of a diagram represents a particle propagating either backward or forward-in-time.

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[55] Dirac P.A.M. (1928) *The Quantum Theory of the Electron*, Proc. Royal Society, London 117:610-624; 118:351-361.

[56] Anderson C.D. (1932), *The apparent existence of easily deflectable positives*, Science, 76:238 (1932).

This formalism is now the most widespread method of computing quantum fields and, since this picture was first developed by Ernst Stueckelberg, and acquired its modern form in Feynman's work, it is called the Feynman-Stueckelberg interpretation of antiparticles.

- *Ether?*

Dirac's 1928 equation is consistent with special relativity, it is mathematically flawless, and it can account for virtually everything, since it is the relativistic generalization of the Schrödinger wave equation, which was already generally applied.

But beside negative energy and retrocausality, it requires every charge to be surrounded by the opposite charged ends of electron-positron pairs (named "*epos*"). Experiments have always verified the presence of epos and the fact that the vacuum between interacting particles is not simply empty space.

Unfortunately, in 1928, this sea of epos recalled ether. For decades the ether war had raged in every faculty. And only in 1905 Einstein managed to put an end to it, declaring that the "*luminiferous ether*," the supposed carrier of light, is unobserved, hence nonexistent. For Heisenberg, any reference to a universal substance that undetectably filled space sounded too much like ether. He was therefore the most upset by Dirac's equation and the requirements of unlimited negative energy states.[57]

Dirac tried to solve the conflict with Heisenberg suggesting that if all the negative states and none of the positive states were filled, the two energies could have no effect on each other. This hypothesis was named the "*zeroth order subtraction*," and was later used by Heisenberg to remove from the Dirac's equation those parts which refer to the negative energy.

Heisenberg found that he could go

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[57] Heisenberg W. (1934), Zeitschr. f. Phys., 90, 209.

around the "sea" of negative energy states, just replacing the operator that requires unlimited numbers of epos with a creation operator which magically makes epos appear from nowhere. Because epos must be present, Heisenberg's operator creates them on the spot, and similarly, when they disappear, they are annihilated. Using the zeroth order subtraction, which forces all results to be positive, an ocean of negative energy no longer exists: there are no negative solutions. In this way Heisenberg made the equation become blind to the negative energy solution.

Quantum vacuum zero-point energy

is the lowest possible energy that a quantum mechanical physical system may have; it is the energy of its ground state. But experiments show fluctuations around these zero baselines, which are now called zero-point fluctuations. Dirac's equation explains these fluctuations as particles which jump out of the sea of negative energy.

According to Heisenberg every physical system has a zero-point energy greater than the minimum of its potential well, and this results in the creation of particles even at absolute zero.

Heisenberg's creation operator requires the creation of unlimited numbers of epos without the contribution of energy photons, or, indeed, any measurable energy input at all. Furthermore, when particles are annihilated, the epos vanish without a trace, producing no high-energy photons or any other detectable energy. This massive violation of the principle of energy conservation (first law of thermodynamics) did not bother Heisenberg who used the uncertainty principle to state that epos are *virtual* rather than *actual*.

When epos are created they borrow a virtual energy and when they annihilate, they give back this virtual energy to the uncertainty relation. For Heisenberg *virtual* meant *having* *whatever properties we need*. In this way the unlimited numbers of virtual epos could violate the energy conservation law and general relativity and offered an escape window that could save the ruling paradigm. In 1934 science took this escape window:

> "*Science frequently makes choices between alternatives. Once the choice is made, however, scientists tend to unify behind the accepted alternative to the extent of denying and eventually forgetting that there was any real choice made. Subsequent textbooks gloss over any possible alternatives, depicting science as a straightforward march up the one correct path toward truth. Since it is forgotten and*

denied that such choices existed, the results of these choices are rarely reviewed. Not only is there no provision, or incentive, for such a review, there is positive, and powerful, peer pressure against any such questioning of basic premises."[58]

Now physicists ignore the negative energy solutions of the two most used and respected equations in modern physics: the energy momentum mass equation of special relativity and Dirac's relativistic equation.

The energy equation calls for negative energy, and Dirac's equation calls for electrons and positrons in unlimited numbers.

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[58] Hotson D. (2002), *Dirac's Equation and the Sea of Negative Energy – part 1*, Infinite Energy, 2002, 43: 1-20.

Experiments confirm the validity of these two equations, but Heisenberg final argument was always the same: "*Negative energy is impossible, with no imaginable physical meaning.*"

After nearly a century this statement is generally accepted among physicists even though the created electron has sixteen times more energy than the photon that creates it. Current theories state that this excess in energy (in the form of angular momentum) is an intrinsic attribute of particles. Calling it an *intrinsic attribute* is supposed to close the discussion and provide a justification for a 1,600% violation of the conservation principle.

For Heisenberg to put physics into the creation business, violating the law of energy conservation, was more politically correct than accepting the negative energy solutions and retrocausality.

It seems that in particle physics energy conservation is something to respect when it agrees with the model, but to throw away when it proves inconvenient.

Ignoring these massive violations of conservation, the idea that complex entities, such as electrons and positrons, could be created out of nothing has become generally accepted. But energy per se does not supply the information necessary to make the highly complex little entities that we call electron and positron.

Since 1934 physicists are asked to reject the negative solution of the fundamental equations, even though this puts science in the creation business, on a scale rivaling God and religions, and has given birth to the New Age interpretations which violate science's most basic laws of causality and conservation of mass/energy. Rejecting the negative solutions seems to negate science itself. One wonders to which extent main-stream science will go to reject the negative time solutions. When faced with a choice involving a paradigm change main-stream scientists almost invariably, since Galileo's time, choose the solutions that save the paradigm, regardless of the evidence.

Einstein's energy momentum mass equation, Dirac's fabulously successful equation and Klein-Gordon's equations call for symmetry between positive and negative energy: forces that blast matter apart and forces that bind matter together.

Dirac's equation describes a field which contains unlimited symmetrical amounts of negative and positive energy. When approaching the zero-point, everything is bound closer together and negative energy becomes predominant. At very low temperatures a Bose-Einstein Condensate (BEC) is formed. BEC act as single units rather than as a collection of molecules, permitting states in which negative (binding) energy overcomes positive (freeing) energy. A BEC results from the dominance of negative (binding) energy over positive. It is an energetic system, completely ordered, governed by a single wave function which is destroyed by positive energy.

Zero-point is reached not at 0° Kelvin, but a few degrees higher. This value differs for different substances, and certain substances manifest BEC properties at much higher temperatures. At the zero-point, instead of no energy, there is suddenly a flood of it. This is real energy, with measurable effects. What BEC applications show is that the negative energy sea called for by Dirac's equation must exist and becomes available at zero-point. Dirac's equation suggests that we are surrounded by an immense, all pervasive Bose-Einstein Condensate, which allows for non-local effects, effects which propagate instantly, no matter how great their spatial separation. If an electron is inserted into one end of a BEC, however large, an electron emerges from the other end instantaneously, travelling that distance faster than light, this is the phenomenon of superconductivity.

The theory of the electromagnetic ether was developed by Hendrik Lorentz (1853-1928) mainly between 1892 and 1906, with the cooperation of Poincaré, and was based on the theory of Augustin-Jean Fresnel, Maxwell's equations, and the electron theory of Rudolf Clausius. Lorentz introduced a strict separation between matter (electrons) and ether, where ether is completely motionless. Lorentz died in 1928, when Dirac formulated his equation. If he would have survived longer, he would have surely recognized the electromagnetic ether theory in the negative-energy sea. With his influence, he would have probably limited the devastating effects on science of Heisenberg's positions.

- Non-locality

In his second paper on "*Dirac's Equation and the Sea of Negative Energy,*" Don Hotson states that:

> "*Dirac's equation simply, intuitively, and clearly explains the size of the nucleon, the mass of the nucleon, the very peculiar shape of the strong nuclear force, the strength of the strong nuclear force, and the strange fact that the very different proton and electron have charges of the same strength.*

No other model explains any of these features."[59]

However, the rejection of the negative energy solution has made the two theories upon which all modern physics rests, relativity, and quantum mechanics, seem incompatible, since when they are combined an unacceptable universe of backward-in-time energy arises

The Copenhagen interpretation posits that the collapse of the wave function (the collapse of the wave into a particle) happens at the same moment in all the points of the wave. This requires an instantaneous

[59] Hotson D. (2002), *Dirac's Equation and the Sea of Negative Energy – part 2*, Infinite Energy, 2002, 44: 1-24.

propagation of information which violates the boundary of the speed of light considered by Einstein the limit in the propagation of information and causality. Einstein considered causality always local, and information could only propagate at speeds lower or equal to the speed of light, never faster.

Starting from these assumptions Einstein refused the idea that information relative to the collapse of the wave could travel faster than light and, in 1934, he formulated these considerations in the EPR paradox.

The EPR paradox (named after the initials of Einstein-Podolsky-Rosen) remained unanswered for more than

50 years.

EPR was presented as a conceptual experiment, to demonstrate the absurdity of the Copenhagen interpretation, raising a logical contradiction. According to Pauli's discovery that electrons have a spin, and that in a specific orbit only two electrons with opposite spins can find place (Pauli's exclusion principle), the Copenhagen interpretation concluded that couples of electrons, which shared the same orbit, remain entangled showing instantaneous opposite spins independently from their distance, violating in this way the limit of the speed of light in the propagation of information.

No one expected that the EPR experiment could be really performed.

In 1952 David Bohm suggested to replace electrons with photons and in 1964 John Bell showed that the change introduced by Bohm opened the way to the possibility of a real experiment.

At that time even Bell did not believe that the experiment could be performed, but 20 years later several groups had developed the precision of measurements required, and in 1982 Alain Aspect published the results of an experiment which showed that Einstein was wrong, and that non-locality was real.[60]

Aspect's experiment measured the polarization of photons. It is possible to force an atom to produce two entangled photons, which go in opposite directions. Each photon, of an entangled pair, has opposite polarization.

The Copenhagen interpretation predicts that when the measurement is performed on one photon it instantaneously determines the state of the second photon. This is what Einstein named "*a spooky action at a distance*."

Aspect measured the polarization of

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[60] Aspect A. (1982) *Experimental Realization of Einstein-Podolsky-Rosen-Bohm Gedanken experiment*, Physical Review Letters, vol. 49, 91, 1982.

photons according to an angle which he could regulate. According to non-locality, changing the angle with which the polarization of a photon is measured would instantaneously change the measurement effected on the second entangled photon.

The experiment was conducted on series of entangled pairs of photons. Bell's theorem stated that if locality is true, the measurements of polarization performed on the photons moving through the first apparatus, which could be regulated changing the angle, should always be higher than the measurements performed on the second set of entangled photons (Bell's inequality theorem). Aspect obtained opposite results violating Bell's theorem showing that non-locality is real. Einstein's good sense lost the competition. Aspect's experiment proved that in nature instantaneous correlations are real and possible.

In 1947 Oliver Costa de Beauregard, a French relativistic and quantum physicist and philosopher of science, proposed to Louis de Broglie his interpretation of the EPR paradox which questions the notion of time. He suggested that Alain Aspect's experiment could be explained by the theory of retrocausality.[61] According to de Beauregard, when the negative-

[61] De Beauregard O. (1953) Comptes Rendus 236, 1632-1634;

time solution is considered quantum mechanics and relativity become compatible.

- *Retrocausality*

In 1978 John Archibald Wheeler proposed a variation of the double-slit experiment in which the detectors could be activated after the passage of the photon through the slits.

When, in a double-slit experiment, a detector is used to measure which slit the photon goes through, the interference pattern disappears. In the delayed choice experiment the detector is located between the slits and the screen on which the interference pattern is observed.

Quantum theory tells that when the detectors are turned on the interference pattern disappears, forcing the waves to collapse and the photons to go through the slits as particles. This should happen also if the detection is activated after the transition of the photons through the slits.

The delayed choice experiment became possible thanks to the speed of computers, which can choose randomly when to activate the detectors between the double slit and the screen. The result is that this choice effects the way in which the photon has gone through the slit (wave/particle), and that this effect operates backward-in-time.

The first two experiments which verified this model were performed independently in the 1980s in the University of Maryland and Munich, Germany.

These experiments showed that the decision to activate the detectors affected the nature of photons backward-in-time.

Wheeler noted that it is possible to devise a double slit experiment at the cosmic level using light coming from quasars and a galaxy which operates as a gravitational lens on the way to Earth. This light would generate an interference pattern showing that light has travelled as waves. But if a measurement would be performed before the screen on which the interference pattern takes form, the pattern would dissolve, and the photons would change from waves into particles.

In other words, our choice on how to measure the light coming from a quasar influences the nature of the light (particle/quasar) emitted 10 billion years ago. According to Wheeler this experiment would show that retrocausal effects operate at the quantum level.

In 1986 John Cramer, physicist of the Washington State University, published the Transactional interpretation of quantum mechanics. In this interpretation the formalism of quantum mechanics remains the same, but the difference is how this formalism is interpreted.[62]

Cramer was inspired by the absorber-emitter model developed by Wheeler and Feynman[63] which used the dual solution of Maxwell's equation. As is well known, also the generalization of Schrödinger's wave equation into a relativistic invariant equation (Klein-Gordon's equation) has two solutions, one positive, which

[62] Cramer J.G. (1986) *The Transactional Interpretation of Quantum Mechanics*, Reviews of Modern Physics, Vol. 58: 647-688.

[63] Wheeler J. e Feynman R. (1945) *Interaction with the Absorber as the Mechanism of Radiation*, Review of Modern Physics (17).

describes delayed waves which propagate forward-in-time, and one negative, which describes advanced waves which propagate backward-in-time. This dual solution allows to explain in a simple way the dual nature of matter (particles and waves), non-locality and all the other mysteries of quantum mechanics and permits to unite quantum mechanics with special relativity.

The transactional interpretation requires that waves can really travel backward-in-time. This assertion is counterintuitive, as we are accustomed to the fact that causes always precede effects.

It is important to underline that the

transactional interpretation considers special relativity, which describes time as a dimension of space, in a way which is totally different from our intuitive logic. The interpretation of Copenhagen, instead, treats time in a classical Newtonian way, and therefore it required the introduction of consciousness, in a mystical way, with powers of creation, to solve the dual nature (particle/wave) of matter.

Cramer states that the probabilistic equation developed by Max Born in 1926 contains an explicit reference to the nature of time and to the two possible solutions which describe advanced and delayed waves.

Since 1926, every time physicists

have used Schrödinger's equation to calculate quantum probabilities, they have considered the advanced waves solution without even realizing it.

Cramer's mathematics is the same of the Copenhagen interpretation. The difference lies solely in the interpretation. The dual solutions interpretation solves all the mysteries and puzzles of quantum physics, making it also compatible with the requirements of special relativity. This miracle is achieved, however, at the price that the quantum wave can travel backward-in-time. This, at first glance, is in sharp contrast with common logic, which tells causes must always precede their effects.

In his book "*The Road to Reality*" Roger Penrose underlines that usually physicists tend to reject as "*unphysical*" any solution which contradicts classical causality, according to which causes always precede effects.[64] Any solution which makes it possible to send a signal backward-in-time is usually rejected. Even if Penrose chose to reject the negative solution of the energy equation, he states that this refusal is a consequence of a subjective choice, towards which other physicists have different opinions.

Penrose dedicates nearly 200 pages of his book to the paradox of the

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[64] Penrose R., *The Road to Reality: A Complete Guide to the Laws of the Universe*, Rizzoli, Vintage Books, 2005, ISBN 0-09-944068-7.

negative energy solution.

According to Penrose it is important that the value of E is always positive because negative values of E lead to catastrophic instabilities in the Standard Model of sub-atomic physics.

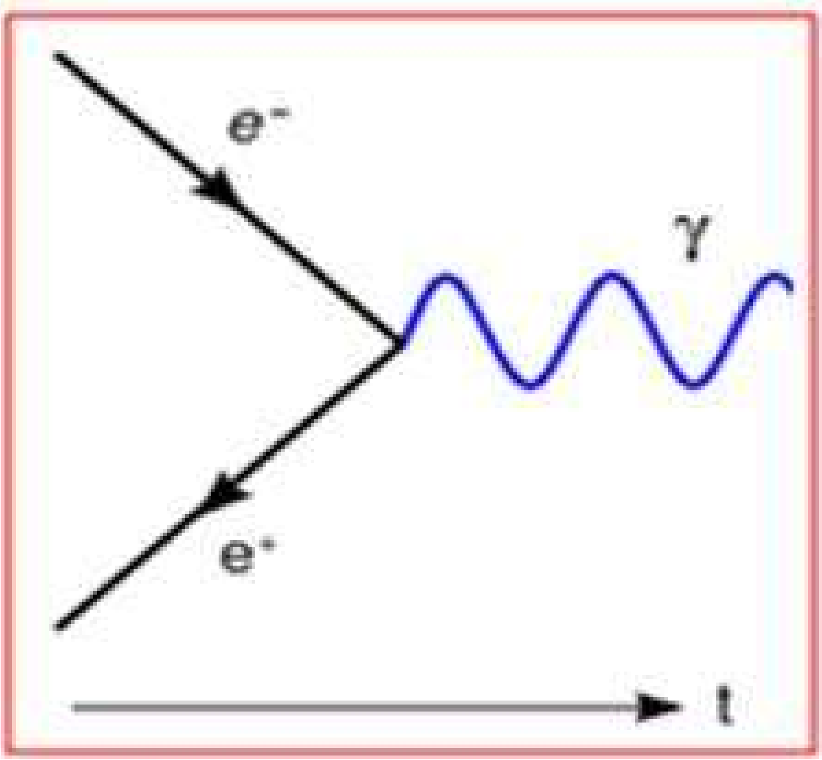
> *"Unfortunately, in relativistic particles both solutions of the equation need to be considered as a possibility, even a nonphysical negative energy has to be considered as a possibility. This does not happen in non-relativistic particles. In this last case, the quantity is always defined as positive, and the embarrassing negative solution does not appear."*

Penrose adds that the relativistic version of Schrödinger's equation does not offer a procedure to exclude the negative solution. In the case of a single particle this does not lead to any real problem, however when particles interact, the wave function cannot yield only the positive solution. This creates a conflict with the law of classical causation.

In order to remove the embarrassing negative solution, Dirac suggested a hypothesis which Penrose describes simply as crazy. Dirac used Pauli's principle, according to which two electrons cannot share the same state, to suggest that all states of negative energy are occupied, thereby forbidding any interaction between positive and negative states of matter. This ocean of negative energy which occupies all positive states is called Dirac Sea. The Standard Model of physics is based on this assumption.

Even if classical physics rejects the negative time solution of energy and the possibility of retrocausality, several respected scientists have worked and are working on this possibility.

An example is offered by Feynman's diagrams of electron-positron annihilation. According to which electrons are not destroyed by the contact with positrons, but the release of energy is caused by electrons changing direction in time and becoming positrons.



In the diagram arrows to the right represent electrons, arrows to the left represent positrons, wavy lines photons

When Feynman's diagrams are interpreted, they imply necessarily the existence of retrocausality.[65] Feynman has used the concept of retrocausality to produce a model of positrons

[65]Feynman R. (1949) *The Theory of Positrons*, Physical Review 76: 749.

which reinterprets Dirac's hypothesis of the sea of negative energy occupying all possible states. In this model, backward-in-time electrons would acquire positive charges.[66]

Yoichiro Nambu[67] has applied Feynman's model to the processes of annihilation of particle-antiparticle couples, arriving at the conclusion that it is not a process of annihilation or creation of couples of particles and antiparticles, but simply a change of the time direction of particles, from the past to the future or from the future to the past.

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[66] Wheeler J. e Feynman R. (1945) *Interaction with the Absorber as the Mechanism of Radiation*, Review of Modern Physics (17).
[67] Nambu Y. (1950) *The Use of the Proper Time in Quantum Electrodynamics*, Progress in Theoretical Physics (5).

Until the XIX century, time was irreversible, a sequence of absolute moments. In 1954 the philosopher Michael Dummett showed that there is no philosophical contradiction in the idea that effects can precede causes.[68]

In 2006 AIP (American Institute of Physics) organized a conference in San Diego California titled "*Frontiers of Time: Retrocausation – Experiment and Theory.*" The proceedings contain more than 20 contributions on retrocausality.[69]

In November 2010, President

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[68] Dummett M. (1954) *Can an Effect Precede its Cause*, Proceedings of the Aristotelian Society (Supp. 28);

[69] *AIP, American Institute of Physics, FRONTIERS OF TIME: Retrocausation - Experiment and Theory*, Proceedings: http://scitation.aip.org/content/aip/proceeding/aipcp/863/

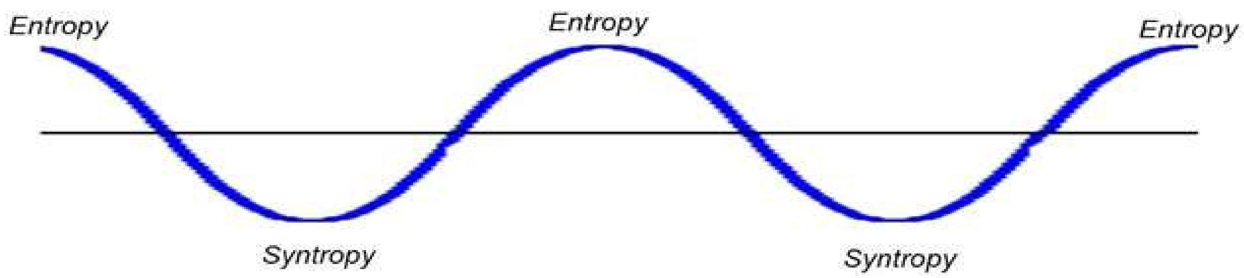
Barack Obama awarded the physicist Yakir Aharonov the National Medal of Science for the experimental studies which show that the present is a result of causes which flow from the past as well as from the future. These results suggest a radical reinterpretation of time and causality.[70]

- *Diverging and converging cycles*

The entropy/syntropy hypothesis suggests that any system, organic or inorganic, vibrates between peaks of entropy and syntropy acquiring in

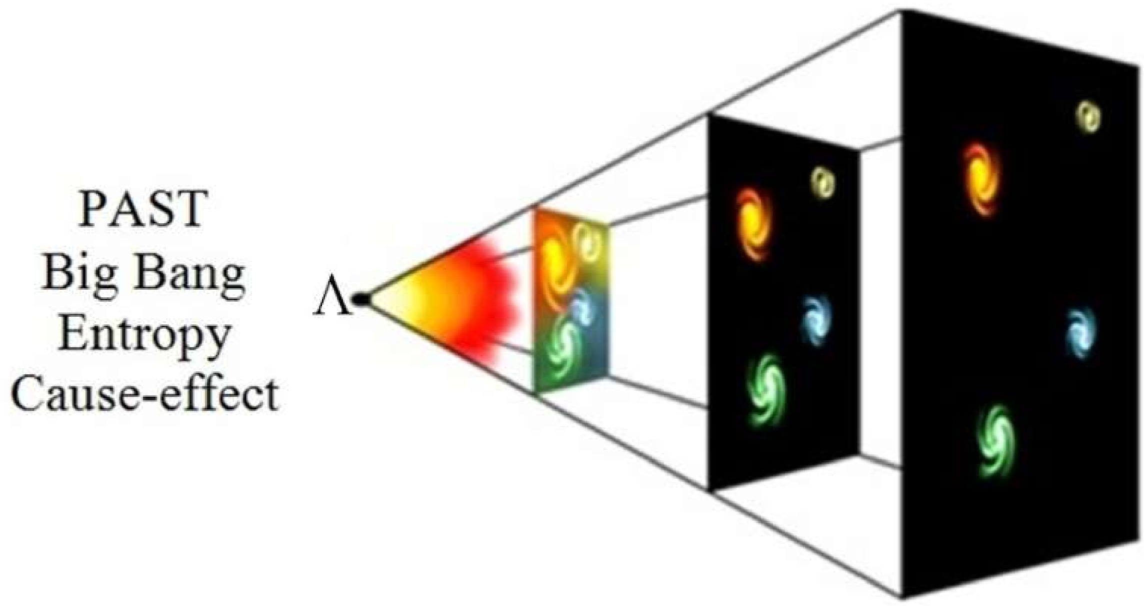
[70] Aharonov Y. (2005), *Quantum Paradoxes*, Whiley-VCH, Berlin, 2005.

time specific resonances.



Entropy/syntropy cycles can be observed in any system and at any level, from the quantum to the macro and the cosmological level.

The entropy/syntropy hypothesis supports Einstein's cyclical cosmology of endless Big Bangs and Big Crunches.



The first formulation of the theory of the Big Bang, by Lemaître, dates to 1927, but was generally accepted only in 1964, when most scientists were convinced that experimental data confirmed that an event like the Big Bang took place. Georges Lemaître, a Belgian Catholic priest and physicist, developed the equations of the Big Bang and suggested that the distancing of the nebulae was due to the expansion of the cosmos.

He observed a proportionality between distance and spectral shift (now known as Hubble's law).

In 1929 Edwin Hubble and Milton Humason noted that the distance of galaxies is proportional to their redshift, the shift towards lower frequencies of the light. This happens usually when the light source moves away from the observer or when the observer moves away from the source. More specifically, it is called red shift when, in observing the spectrum of light emitted from galaxies, quasars, or distant supernovae, it appears shifted to lower frequencies when compared with the spectrum of closer corresponding objects. Since the red color is the lowest frequency in visible light, the phenomenon received the name redshift, even though it is used in connection with any frequency, including radio frequency radiations.

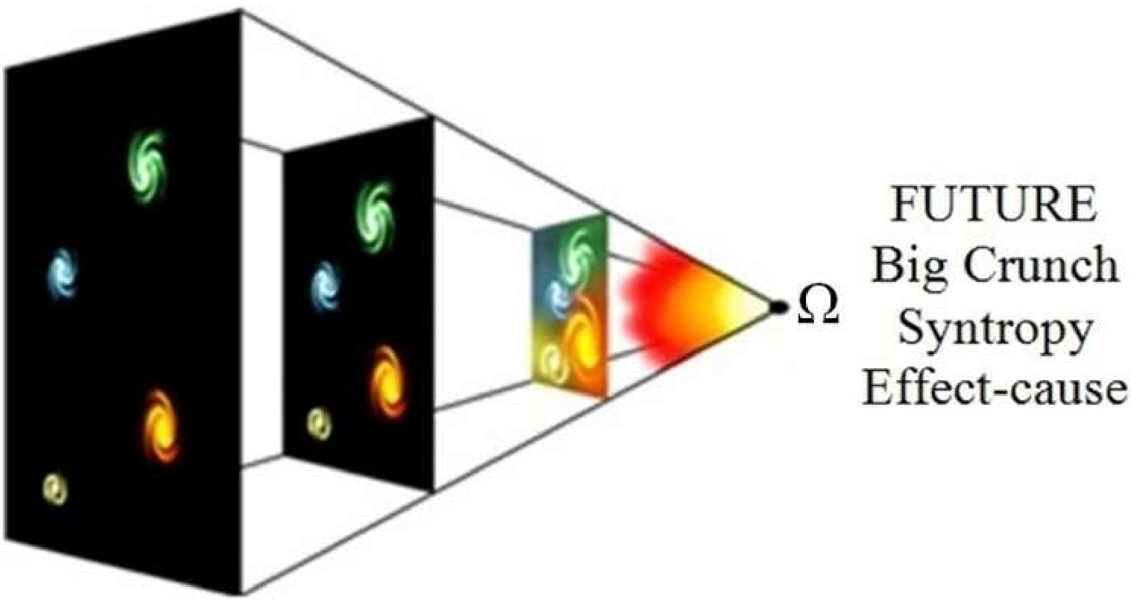
The redshift phenomenon indicates that galaxies are moving away from each other, and more generally that the Universe is in a phase of expansion. Furthermore, redshift measurements show that galaxies and star clusters move away from a common point in space: the more distant they are from this point, the higher is their speed.

Since the distance between galaxy

clusters is increasing, it is possible to deduce, by going back in time, density and temperature increasingly higher until a point is reached where maximum values of density and temperature tend towards infinite values and the physical laws of the forward-in-time equations are no longer valid.

In cosmology, the Big Crunch is a hypothesis on the fate of the universe. This hypothesis is exactly symmetrical to the Big Bang and maintains that the universe will stop expanding and begin collapsing on itself.

The strength of the gravitational forces will stop the universe from expanding and the universe will collapse back on itself. The contraction will appear very different from the time reversal of the expansion. While the early universe was highly uniform, a contracting universe will be increasingly diversified and complex. Eventually all matter will collapse into black holes, which will then coalesce producing a unified black hole or Big Crunch singularity.



The theory of the Big Crunch proposes that the universe could collapse to the state where it began and then initiate another Big Bang. So, in this way the universe would last forever, but would go through phases of expansion (Big Bang) and contraction (Big Crunch).

Recent evidence, namely the observation of distant supernova, has led to the speculation that the expansion of the universe is not being slowed down by gravity but rather accelerating. In 1998 the measurement of the light from distant exploding stars lead to the conclusion that the universe is expanding at an accelerating rate. The observation of the redshift luminosity of supernovae suggests that supernovae are spreading apart faster as the universe ages. According to these observations the universe appears to be expanding at an increasing rate. These observations contradict the hypothesis of the Big Crunch.

In the attempt to explain these observations physicists have introduced the idea of dark energy, dark fluid, or phantom energy. The most important property of dark energy would be that it has a negative pressure which is distributed homogeneously in space, a kind of antigravitational force which is driving the galaxies apart. This mysterious antigravitational force is a cosmological constant, which will lead the universe to expand exponentially. However, to this day no one knows what dark energy is, or where it comes from.

On the contrary, the dual solution of the fundamental equations suggests that the observed increase in the rate of expansion of the universe is not caused by dark energy or to any other mysterious antigravitational force, but to the fact that time is slowing down.

In June 2012 Professor José Senovilla, Marc Mars and Raül Vera of the University of the Basque Country, Bilbao, and the University of

Salamanca, Spain, published a paper in the journal Physical Review D in which they dismiss dark energy as fiction. Senovilla says that the acceleration is an illusion which is caused by time itself gradually slowing down:

> "*We do not say that the expansion of the universe itself is an illusion, what we say is that the acceleration of this expansion - that is, the possibility that the expansion is, and has been, increasing its rate – is an illusion.[…] we naively kept using our equations to derive the changes of the expansion with respect of 'a standard flow of time', then the simple models that we have constructed in our paper show that an*

effective accelerated rate of the expansion takes place."

The corollary of Senovilla's team is that dark energy does not exist.

The team proposes that there is no such thing as dark energy at all and that we have been fooled into thinking the expansion of the universe is accelerating, when, time itself is slowing down. At an everyday level, the change would not be perceptible. However, it would be obvious from cosmic scale measurements tracking the course of the universe over billions of years. The change would be infinitesimally slow from a human perspective, but in terms of cosmology, the study of light from stars that exploded billions of years ago, it could easily be measured.

Currently, astronomers discern the expansion speed of the universe using the so-called "red shift" technique. This technique relies on the understanding that stars moving away appear redder in color than those moving towards us. Scientists look for supernovae of certain types that provide a sort of benchmark. However, the accuracy of these measurements depends on time remaining invariable throughout the universe.

If time is slowing down it turns into

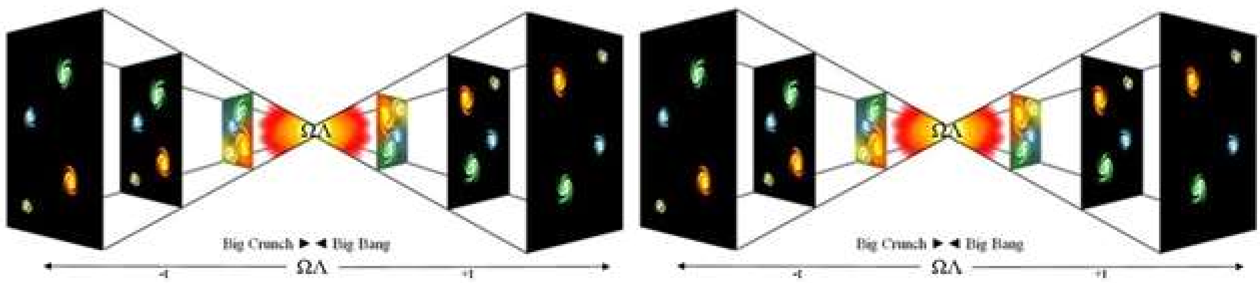
a space dimension. Therefore, the far-distant, ancient stars seen by cosmologists would look as though they were accelerating. "*Our calculations show that we would think that the expansion of the universe is accelerating*," says Prof Senovilla. Though radical and in many ways unprecedented, these ideas are not without support. Gary Gibbons, a cosmologist at Cambridge University, says the concept has merit:

> *"We believe that time emerged during the Big Bang, and if time can emerge, it can also disappear - that's just the reverse effect."*

When the dual solution of the energy/momentum/mass equation is interpreted a cosmological representation of the universe vibrating between peaks of expansion and concentration, is obtained. During the diverging phase time flows forward, whereas during the converging phase time flows backward.

In this representation causality and retrocausality constantly interact and endless phases of expansion (Big Bang) and contraction (Big Crunch) characterize the universe.

The Big Bang is governed by the positive, diverging solution of entropy, namely energy and matter that diverge from an initial point of origin, whereas the Big Crunch is governed by the negative, converging solution of syntropy, namely energy and matter that converge towards an end point of infinite density and temperature.

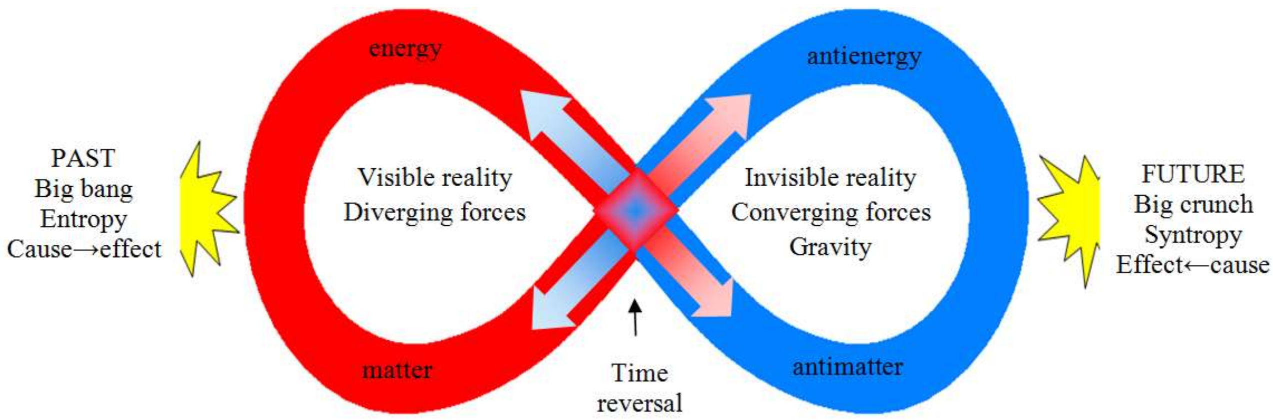


Big Bang and Big Crunch cycles

The Big Bang is indicated with the first letter of the Greek alphabet, Λ = Alpha (the Beginning), whereas with the letter Ω = Omega (the End) the Big Crunch is symbolized.

The question that is often heard

among cosmologists "*why we live in a world predominantly made of matter. What has happened to antimatter?*" can be easily solved when we consider the negative solution of the fundamental equations. At the Big Bang the amount of matter and anti-matter was the same, but antimatter diverged backward-in-time, whereas matter diverged forward-in-time, distancing instantly and preventing annihilation.



According to this interpretation, the

universe is composed of an equal amount of matter and antimatter, but they move in opposite time directions. These symmetrical planes constantly interact in the form of a continuous interplay between diverging and converging forces, causality and retrocausality, entropy and syntropy.

All what is diverging is governed by the forward-in-time solution, whereas all what is converging is governed by the backward-in-time solution.

Therefore, the physical and material plane interact continuously with the nonphysical and intangible plane of antimatter which moves backward-in-time.

The inherent complexity of the physical Universe would be a consequence of the interaction of matter and energy with the cohesive forces of anti-matter and anti-energy.

- *Gravity*

We continuously experience gravity, but even to the brightest minds in science it remains a mystery. Scientists don't know why there's gravity.

According to the entropy syntropy hypothesis gravity is a backward-in-time diverging force. But, since we move forward-in-time, this backward-in-time diverging force is for us a forward-in-time converging force.

Equations show that forward diverging forces cannot exceed the speed of light, whereas backward diverging forces can never propagate at speeds lower than that of light.

Consequently, if the entropy syntropy hypothesis is correct, we should observe that gravity propagates at an instantaneous speed. This would contradict the Standard Model of particle physics that states that gravity is caused by massless particles called gravitons that emanate gravitational fields. Gravitons tug on every piece of matter in the universe and prevent gravity from propagating at speeds higher than that of light.

But can we perform experiments in order to measure the speed of propagation of gravity in order to test which of the two hypotheses is true?

The answer has been provided by Tom van Flandern (1940-2009), an American astronomer specialized in celestial mechanics.

Van Flandern noted that no aberration is observed when measuring gravity and that this puts the propagation of gravity at a speed higher than 10^{10} the speed of light.[71]

With light the aberration is due to its limited speed. For example, light from

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[71] Van Flandern T. (1998), *The Speed of Gravity What the Experiments Say*, Physics Letters A 250:1-11. Van Flandern T. (1996), *Possible New Properties of Gravity*, Astrophysics and Space Science 244:249-261.Van Flandern T. and Vigier J.P. (1999), *The Speed of Gravity – Repeal of the Speed Limit*, Foundations of Physics 32:1031-1068.

the Sun requires about 500 seconds to travel to Earth. So, when it arrives, we see the Sun in the sky in the position it occupied 500 seconds ago rather than in its present position. This difference amounts to about 20 seconds of arc, a large and noticeable amount to astronomers. From our perspective, the Earth is standing still, and the Sun is moving. So, it seems natural that we see the Sun where it was 500 seconds ago, when it emitted the light now arriving.

Consequently, the light from the Sun strikes the Earth from a slightly displaced angle and this displacement is called aberration. Light aberration is due entirely to the finite speed of light.

If gravity would propagate with a finite speed, we would expect gravity aberration. The Sun's gravity should appear to emanate from the position the Sun occupied when the gravity now arriving left the Sun. The Earth should "run into" the gravitational force, making it appear to come from a slightly displaced angle equal to the ratio of the Earth's orbital speed to the speed of gravity propagation.

But observations indicate that none of this happens in the case of gravity! There is no detectable delay for the propagation of gravity from the Sun to Earth. The direction of the Sun's gravitational force is toward its true, instantaneous position, not toward a delayed position, to the full accuracy of observations. Gravity has no perceptible aberration, and this tells that it propagates with infinite speed. Van Flandern notes that gravity has some curious properties:

– One is that its effect on a body is apparently completely independent of the mass of the affected body. As a result, heavy and light bodies fall in a gravitational field with equal acceleration.
– Another is the seemingly infinite range of gravitational force. Truly infinite range is not possible when forces are conveyed forward-in-

time.

- The other curious property of gravity is its instantaneous action and propagation which can be explained only if we accept that gravity is a backward-in-time diverging force.

Van Flandern's experiments discard the hypothesis of massless particles called gravitons and support the hypothesis formulated by the entropy/syntropy model.

- Scientific Theories

In the development of a scientific theory six criteria are fundamental:[72]

– Simplicity: a theory should embody as few "entities" as possible (this criterion is known as "*Ockham's Razor*").
– Few or preferably no adjustable parameters.
– It should be mathematically consistent.
– It should satisfy all the known data, including unexplained or anomalous data, or data dismissed

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[72] Hotson D.L. (2002), *Dirac's Equation and the Sea of Negative Energy*, Infinite Energy, 43: 2002.

as a “coincidence” according to previous theories.

– It should obey causality: every effect should have a cause (forward or backward-in-time causality).
– It should be falsifiable, making testable predictions.

The *first criterion* known as Ockham’s Razor was stated by Guglielmo of Ockham (1295-1349) and affirms (in Latin) that “*Entia non sunt multiplicanda praeter necessitatem*”: Elements are not multiplied if it is not necessary to do so.

This criterion means that the trend of universal laws is that of economy and simplicity: the lowest possible number of entities are used.

Science should therefore evolve from more complex models to simpler ones, and in any demonstration, it should always be necessary to use the lowest number of entities, for example:

- before modern chemistry it was thought that the chemical elements were infinite.
- in 1890 it was shown that all chemical elements are derived from the combination of 92 atoms.
- in the 1920s the 92 atoms derived from the combination of the 3 basic particles (electrons, protons, neutrons) and 4 forces. In this way

science moved from 92 atoms to 7 elements.

– The energy/momentum/mass equation reduced the entities to two: the forward and backward-in-time forces.

The universe always shows economy of means. For example, DNA, which is at the basis of life, and which is now considered the most complex entity, codes information using 4 elements, the 4 azotize bases. Complexity theory shows that 3 elements would not have been sufficient, whereas 5 would have been redundant; DNA could have used an unlimited number of elements, but only 4 were necessary and only 4 have been used.

Similarly, to produce stable matter, only 3 particles were necessary: electrons, protons, and neutrons, and again only 3 particles are used. Information science shows that it is possible to generate any sort of complexity simply starting from two elements: yes/no, false/true, 0/1, +/-. Only two elements are necessary and because the tendency towards economy is a basic law of the organization of the universe, it is plausible that only the interaction of forward and backward-in-time forces are sufficient to produce all the complexity of the university.

The *second criterion* implies that a valid scientific theory should allow for few or preferably no adjustable parameters. The Standard Model of particle physics requires at least nineteen parameters which must be entered by hand, among which the rest mass of the electron which results infinite. Most of the particles of the Standard Model are considered to have properties but no mass, as for example: leptons, quarks, bosons, and gluons. When masses are entered the values of the equations tend to infinite. A universe without masses is however very distant from our universe, where all particles pretend stubbornly to have masses! Adding particles "ad hoc" to explain what has been left out from the previous particles is also a violation of the second criteria. A well-known case is the gluon which has been added to justify why the different parts of the atoms are glued together. The Standard Model considers only the forward-in-time solution of the fundamental equations and cohesive forces continue to be un-explained, this fact produces the need for specific particles.

Closely related to the second criterion, the *third criterion* requires that no equation should lead to impossible results, such as infinite values. In the Standard Model divisions that tend to infinite are common, and this impossible operation can be solved only entering the results manually. When the results of the Standard Model tend to infinite, values need to be normalized, which means that they must be entered by hand. For example, the Standard Model calculation of many ordinary values, such as the rest mass of the electron, results infinite. However, from experiments we know the electron's rest mass to be 0.511 MeV. To get rid of this "impossible" result, "renormalization" is invoked: the desired value of 0.511 MeV is then simply entered by hand. This admitted fudge would not work if we did not already know the answer.

Equations lose their predictive power and require the a-priori knowledge of the results, violating in this way also the *fourth criterion* which requires that the results of the model and empirical data should agree.

The *fifth criterion* states that every effect should obey causality (forward or backward-in-time causality). The standard approach rejects the idea of retrocausality and therefore finds it impossible to explain the causal chains which produces the "anomalous" effects which are observed in quantum mechanics, such as non-locality, the unified field and entanglement. Accepting the negative-time solution, all the mysterious properties of quantum mechanics become clear consequences of causes which act from the future. For example, backwards-in-time diverging energy must propagate at a speed which is always greater than the speed of light. The information carried by this energy can therefore travel infinite spaces instantly. The classical example is the EPR experiments which changes the spin of particles instantly whichever is the distance. The converging properties of the backward-in-time solution permit to explain in a logical and causal way (even though the cause is in the future) all the attractive forces (such as gravity) which in general remain mysterious in the Standard Model.

The *sixth criterion* requires that a scientific model should produce hypothesis which can be verified.

Heisenberg's refusal of the negative-time solutions has led to develop a Standard Model which does not meet the basic criteria of a valid scientific theory. The immediate consequence is that this model is not able to correct itself and solves its contradictions adding ad hoc particles such as gluons and gravitons, which are nothing more than patches applied to save a failing model.

Heisenberg's refusal of the negative solution has led to the hardening of the mechanistic paradigm, and to the systematic violation of the basic requirements of science.

- Negentropy, syntropy and information

In the same year in which Fantappiè discovered the law of syntropy the American physicist Robert Lindsay coined the term negentropy, a term which acquired a certain level of popularity in 1950, thanks to the work of Claude Shannon, Schrödinger, and the equation on the transmission of information that the French physicist Léon Brillouin formulated in 1956.

Brillouin produced a formula to

quantify the propagation of electrical signals in a telegraphic wire and found that the propagation of information is in close correlation with the inverse of entropy. Brillouin concluded that entropy measures the lack of information of a physical system and that the price which is paid with the increase of entropy is the reduction in the information, whereas the increase in information leads to the decrease of entropy.

Yet the word information can have profoundly different meanings

– Descartes believed that nature could be described using simple motion equations, in which only space, position, and moment were relevant. "*Give me position and movement*", he said, "*and I will build the universe*." In his vision an entropic universe requires more information (space, position, and moment) to be described and predicted. On the contrary syntropic universes requires less information. Crystals provide an example. They require less information to be described than what is needed to describe the same molecules when floating freely as water. This example shows that physical information increases when entropy increases.

– Norbert Wiener's[73] definition of information is instead linked to cybernetics, and it is based on choices and feedbacks. In Wiener's definition the quantity that is defined as the amount of information is the negative of the quantity usually defined as entropy in similar situations. Wiener's concept of information is, from its very conception attached to issues of control.
– In relational science information is provided by correlations. For example, a system gets its meaning by the correlations it has with the

[73] Wiener N. (1948), *Cybernetics or Control and Communication in the Animal and the Machine.*

context. Classical science considers only causal correlations. Relational science distinguishes between causality and retrocausality and between qualitative and quantitative and opens the door to the study of syntropy in the field of science.

– When information converges into core equations and principles which allow to describe, explain, and predict a large variety of situations, such as the Einstein's energy momentum mass equation, we can see an identity between information and syntropy.

Negentropy is often mistaken for

syntropy, and people arrive to the wrong conclusion that an increase in information corresponds to an increase in syntropy.

On the contrary, negentropy is strictly related to points 1. and 2. and is defined as the opposite of entropy:

$$Negentropy = - Entropy.$$

Whereas syntropy is related to points 3. and 4. and is defined as the complement of entropy:

$$Syntropy = 1 - Entropy$$

The difference can seem small, but it means that syntropic information is finalized and future oriented, whereas negentropic information is mainly physical and mechanical (past oriented). This small difference makes syntropy and negentropy two totally different concepts.

EPILOGUE

Science has gradually developed, becoming significantly different from what it originally was. Looking backward, it is possible to spot at least three ages of modern science, which are beautifully described in Henry H. Bauer's papers "*Three stages of modern science*," published in the Journal of Scientific Exploration.[74,75]

– The *First Age* was made by seekers of authentic knowledge, such as

[74] Bauer H. (2013), *Three stages of modern science*, Journal of Scientific Exploration, 2013:27, 505-13.
[75] Bauer H. (2014), *The Science Bubble*, EdgeScience #17, February 2014, http://www.scientificexploration.org/edgescience/

Galileo and Newton and results were shared among the community of knowledge seekers. The essential point is that they were amateurs, seeking to understand Nature, or God, and doing what they loved. This first age of modern science has left its mark on the contemporary view. Many people imagine that scientists nowadays are just self-driven by curiosity, that discovering the truth is their only interest.

– The *Second Age* turned science into a career. In 1833 William Whewell coined the words scientist and physicist, and in the later 19th century Germany pioneered what have become research universities. In this second age of science, making great discoveries could lead to high social status and industrial scientists could benefit from making patentable discoveries. From about mid-19th century to about mid-20th century, science was an attractive career.

- The *Third Age* started during the Second World War when research provided great wealth and considerable influence. The aim became profit rather than truth. The distinction between pure science, seeking basic understanding, and applied science became meaningless, as scientists are funded by patrons interested only in profitable outcomes, rather than in new understanding. From the 17th century to the mid-20th century science had doubled every 15 years in the number of articles published, of scientific journals and of people who could be called scientists. But at the end of the Second World War, nations were devoting more than 2% of their GDP (Gross Domestic Product) to science. Science had reached its limit of growth and it could not continue to grow exponentially.[76]

[76] Bauer H. (2012), *Dogmatism in Science and Medicine: How Dominant Theories Monopolize Research and Stifle the Search for Truth*, McFarland, 2012

The distinction between pure and applied science has vanished, and scientists are now profit-seekers and patent-greedy. This new situation has caused serious consequence, among which:

– *No free sharing*. Profit-seekers scientists have made sharing of information a rarity.[77] Individuals as well as institutions have become secretive, and authors often insert wrong information in their manuscripts, so that the reviewers cannot benefit from early knowledge of crucial details of the

[77] Mirowski P. (2011), *Science-Mart: Privatizing American Science*, Harvard University Press.

work. The articles are corrected only when they reach the proof stage of publication.[78]

– *Outright fraud*. Deliberate fraud and dishonesty have increased to the point that they are now considered endemic within science.[79] In 1989, the National Academies of Science (NAS) published a booklet entitled *On Being a Scientist*, in 1995 it added the sub-title *A Guide to Responsible Conduct in Research*. In the same period, the National Institutes of Health (NIH) established an Office of Research Integrity[80], which all

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[78] Hazen R.M. (1988), *The Breakthrough: The Race for the Superconductor*, Summit Books / Simon & Schuster.

[79] Broad W. and Wade N. (1982), *Betrayers of the Truth: Fraud and Deceit in the Halls of Science*, Simon & Schuster, 1982.

[80] http://ori.hhs.gov/

too often reports penalties enacted on individuals who have been found dishonest in grant applications or in other ways. Much of the media still find astonishing the upsurge in the number of scientific papers that have had to be retracted because they were wrong or even fraudulent. On the first of October 2012, The Guardian published the article "*Tenfold increase in scientific research papers retracted for fraud. Study of 2,047 papers on PubMed finds that two-thirds of retracted papers were down to scientific misconduct, not error.*"[81] The proportion of scientific research

[81] www.theguardian.com/science/2012/oct/01/tenfold-increase-science-paper-retracted-fraud

that is retracted due to fraud has increased tenfold in ten years. The study, published on the Proceedings of the National Academy of Sciences (PNAS)[82], found that more than two-thirds of the biomedical and life sciences papers that have been retracted from the scientific record are due to misconduct by researchers, rather than error. A similar article was published on 5 October 2012 in the editorial of the New York Times, titled "*Fraud in the scientific literature*."[83] One possible explanation is that too many

[82] www.pnas.org/content/109/42/17028
[83] www.nytimes.com/2012/10/06/opinion/fraud-in-the-scientific-literature.html?_r=0

would-be researchers are competing for inadequate available resources, under pressure for patentable discoveries.[84]

– *Dogmatism and barriers to progress*. The absolute necessity for uninterrupted flows of grant money brings enormous pressure not to be wrong. Seeking to avoid making any mistakes or to take on only projects that are guaranteed to succeed, means restricting research to banalities. Furthermore, if one nevertheless goes wrong, the incentives are strong to resist

[84] Freeland Judson H. (2004), *The Great Betrayal: Fraud In Science*; Etchells P. and Gage S. (2012), *Scientific fraud is rife: it's time to stand up for good science. The way we fund and publish science encourages fraud*, The Guardian, 2 November 2012.

acknowledging the mistake for as long as possible. Established scientists, who control available resources - grants, hiring, publishing - show a marked tendency towards dogmatism. Dominant theories monopolize research, stifle the search for truth, and have turned science into a dogmatic doctrine.[85]

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[85] Bauer H. (2007), *Dogmatism in Science and Medicine: How Dominant Theories Monopolize Research and Stifle the Search for Truth*, Amazon Kindle, ASIN B008AHNIGS.