

ENTROPY AS CAUSALITY

Mathematics, like poetry, are always consistent with any idea that can be expressed in its bureaucracy, and it may not be more certain because its beauty or simplicity. Properly managed it can often demonstrate a thesis and its antithesis. A paradigm is a set of questions, principles, idealizations, language and procedures. Inside a Linear Principle, or Reductibility, or Ergodicity, or Completibility, or Reversibility,... the most fundamental processes became understandable with maths procedures, yes, but that has the price to idealize the inter-relation between fundamental elements. Reductibility and Idealization are powerful tools, but always attached with conditions of applicability. It is useful to factorize any type of function to polynomials of linear relation between its terms grouped by powers, but never forgetting that the validity of the approximation is restricted to intervals, often as narrow as a critical point itself. Any random and finite set of numbers can be ordered to be represented in a series with a formula and just limited by its applicability interval (J. Balmer proposed the bet as a better method of scientific projection than the verification and deduction).

Physics split linearly on ideal worlds of superconductors, perfect gases, incompressible fluids, zero viscosity, frictionless movements, elastic shocks, independent variables,... which worked and works usefully, until analyzing the transformation of heat into work and the angular momentum conservation of quantum, we had to look for other mathematics. Each paradigm has its idealization to reduce complex to simple variables, but there is not a single paradigm in physics, so makes different theories intrinsically incompatible and this has led to the misunderstanding. Starting from different abstract worlds, we do not know how to marry deterministic paradigms of continuous general relativity and jumpy quantum fields, determined and indeterminate, both in equilibrium; with dissipative systems with qualitative mathematics and topology. Dividing to the infinitesimal, arise discrete patterns and indivisible boundaries. Despising friction and randomness, we arise laws that declaim them: Entropy.

Like Life and Time, Energy and Entropy, seem to be clear concepts, but they are not: we know what they are but we do not agree to define them, because it depends on the perspective of every paradigm and hide nuances that at a deeply level, discover our ignorance. From the relativistic, thermodynamic, statistical, chemical, quantum,... even philosophical point of view, they energy definitions are related but they are not the same: from scalar to canonical energy-impulse tensors and each one described from different metrics (Hilbert, ...). Physics Disagreement is only a new version of an eternal argument between "Gestalt", where the scale of the man mind is the measure of all things and we tend to ask nature in reference to what we understand according to our access to variables; and its recurrent "Umweltz", with variables of each system according to criteria we do not share. What a cat knows about the origin of the wool ball? What a particle knows about what is a moment? Maybe they just do not understand the question. I do not know how to build the computer I am using, I do not even deeply understand how it works, we need compilers and translators between both.

Energy comes from the Greek root for "activity". Entropy is ethymologically "turn around" in the figurative sense of transformation: "evolution" in a never ending history. Change between microstates with same state values, does not change anything. Activity may or may not change a system according whether there is asymmetric interaction with other activities or not, and the rest is in imbalance and friction. By modifying asymmetrically a state of motion in a system, we transform energy into work and defiance, which at the atomic level is transformed into excitation of quantum fields. Kinetics for us is temperature, T; means inefficiency for us, S; and internal energy that remains flowing inside the structure of the system, U. What do T, S or U means for the elements of the system, which only understand its each one movement?

Quantum fields are ideally inelastic without rest (the energy absorbed and released by a change is indistinguishable, identical and symmetric or antisymmetric). Are their changes really reversible and independent of the arrow of time? In each frame of a film which tell us the evolution of a system from one point of its phase-space to another, there will be a distribution of energy flow that will vary over time and there will be many histories from the same to the same points. The entertained energy U , is distributed between kinetic energy flowing at different speeds due to the structure of the system, friction and the "investment" of energy in system structure transformation, which can modify properties at other scales. Between one and another state the energy distribution according to its speed of transformation may be locally variable if there is some asymmetry and friction, but always to add zero. The motion of a particle in a collective will be conditioned to discrete stochastic decision situations -interacting with another particle, with another kinetic energy, such that its interaction has several identical solutions, and there must be some choice-; but a whole stochastic-particles system does not has to be stochastic when we measure the state values and not the movement of each particle. Scale heals and ruins everything.

In any hierarchy, flow is a conserved magnitude and if the space is concentrated, the time elongates, or vice versa. One way of looking at it is relativistic -it can be thought as the conservation of energy in four-dimensional spacetime-; but another Liouville classic way, may be from motion must not break the space-time fluid. Movement is not lost between scales, but its mathematical description is pulverized and dispersed quantumly in a useless way to be useful to our hierarchy. Without any barrier -membrane-, without supplying energy and in the adiabatic case, since all the atoms are fields of similar internal configuration -from our scale we idealize them as indistinguishable-, it takes an elapsed time for the excitation to spread from the local to the general. Due to such diversity of speeds, some actions may not have enough time to evolve into that elapsed time, to get to uniformity and autism that characterize the state of minimal energy at all points. The flow to a homogeneous state, can be laminar or turbulent, radiative or convective and from one energy state to another, the way back could be in many equivalent trajectories, but not exactly the same.

From the smallest to the largest, the variation of the internal energy stored in the excitation is reversible as a state function -while it is idealized as conservative at the subatomic level- but irreversible once energy is inverted to generate a non-optimal stochastic structure or "roughness". It is subjective: a cause can have several effects with some probability each, like a pencil on its tip when dropped. There is only one reality, space and time are limited to take a decision: the pencil will "decide" to fall into one and only one of the angles... but it will not hesitate to fall. While probabilities are identical, there is not any better path, but if not there will be different efficiencies. Taken as a continuous function -flow-, the energy spreads to different rhythm according to "roughness" of space-time: the different speeds that tumbles in the system, has degrees of elasticity according to the nature of the flows that are configured. Since perfectly elastic quantum mechanics does not allow such a loss -it is reversible-, friction must be the established kinetic relations between fundamental elements of a system and not in themselves: the trajectories history of the collisions, the stability of the bonds, the electrostatics characteristics of polarity, the molecules shape, their crystallization, the offered surfaces to interact, their volume relation,... irregularity and asymmetric distribution of fundamental elements, transform a reversible process into a temporally anisotropic, by ideally splitting space-time analysis into "rough" and discrete positions in space and "smooth" and continuous positions in time, when it is the other way round: time is what introduces the asymmetry in space.

Reality is often presented as simple when it is analytically predictable. To visualize it, imagine Sisyphus raising a water-filled pitcher to an ideally smooth hill -to be a metaphor of quantum mechanics, the hill soil has to be waterproof-: with no effort energy will flow evenly to the

constructual base of minimal energy, at the same flow. It does not matter the path were water run down the cliff while any angle has the same probability. If the soil would not be waterproof or the slope would not be identical in every direction, the flow would not be the same depending on the path. If the pitcher is large enough, water will fall equally over the whole surface, but if it only sprinkles a drop, it will not cover the whole hill, the offer of coordinates would be higher than the demand, and decide a path by which to fall. Without the irregularity, or with no several different roads, there is no roughness, and both energy and flow are conserved: one path will statistically be identical to other and compensate over time. There may also be complicated, unpredictable but reversible, non-analytical or non-linear systems, which remain simplifiable (we call them chaotic).

To introduce the concept of reversible flow different than the energy conservation, we can imagine a non waterproof soil, that may drain energy at different rates over or underneath, and we could extend the metaphor to periodic -reversible complexity- and allow non-retention filtration: "tunnel effect". In such a world, Sisyphus would still have only the First Law of Thermodynamics, not the Second, as long as the flow in one path and the other was and will be always the same; but it would complicate his work if both roads were random for a loose drop. In any case a homogeneous "smooth" Universe will be invariant to the scale, because the flow would not attend to local irregularities. If for any reason a local modification, a crossroads of roads, a random local rough situation is created, if there is only random, can be always leveled by the whole,... or amplified by some mechanism only if irregularity has an asymmetry. Imperfection.

St. Augustine claim for perfection in Heaven, and Urban VIII declared against "ex cathedra" Copernican thesis, but also, above all, Galileo's arrogance because its offering to their prosecutors to observe by themselves the imperfections of the Perfect Cosmos, through its telescope: eclipses on Jupiter moons, shadows in the Moon craters,... The story was repeated with Darwin, whom maybe could have been tolerable as a way back to a "Creation", but again was worse because the overthrow of "natural theology" with concentrated and randomized local change: an extension of the measure of good and evil according to the "Gestalt" view of Nature, with its victims and sinners, predators and parasites. Despite Darwin Evolutionary Theory, such a moral vision of Nature resists with strength and remains in our society through Disney and the "purpose" for the better in the Evolution. How does a smooth and predictable Universe transform surjectively in a Universe with random options.

Only a "non-smooth" universe, by interaction, with both inhomogeneity and asymmetry, has a chance for locality, and if so, the flow in the transformation of energy between two identical states, depends on the path. If we accept Chance, that is also the Causality Principle, we do not live in a perfect world where Nature selects the efficiency through the better future, because it does not know the consequences of its decisions. Decisions are always extrapolated as reality would be deterministic, but it does not select options according to an optimum utility, because it does not know the best path until it has walked from cause to effect. Configurations, like organisms, inherit form and style, structures and functions, vices and messes, which limit and offer random opportunities to immediate and local. The mechanism of adaptation to the future depends on the serendipity.

Was the Universe born with chance or was it introduced in the Universe by a hooligan god? With a small non-linear disturbance, some torus will be deformed and others will be destroyed. Those who survive are those who have a sufficiently irrational ratio between frequencies. The Kolmogorov spectrum describes from homogeneous initial and isotropic conditions, the cascade of energetic structure of the turbulences. From a completely smooth system, the amount of energy entering defines the scale of the primary turbulence, to another output scale in a "rough" dissipation. The excessive contribution of energy, seem to break some symmetry of scale. Is an energy overflow

enough to break the symmetry?

Sisyphs evolve from equilibrium to equilibrium, but an overflow can force a pass through a dissipative microstate, out of equilibrium, introducing irreversibility through stochastic decisions and decompensating the system: called Fluctuation of Nothing, which nothing means. We can go forward the metaphor and imagine in a larger hierarchy, Zarathustra on the way to his cave from where he sees many Sisyphs, who have established relations of mutual help, in a mountain range of irregular and porous hills, each of different height, shape, slope,... all smooth, but organized according to molecular and systemic attributes from the configuration of the hills in the mountain range. With the desertification resulting from overgrazing, the camels succeeded the cart and the wheels in the Near East, the future returned to the past. Nothing force to advance, but irreversibility make changes that makes the flow cost in energy different depending of the arrow.

At the beginning of its punishment, the pitcher of Sisyphus always carries the same amount of water and by having alternative paths, accumulates an account of interactions, which if forgotten -excess flow leads to turbulence, chaos, but with no asymmetry, no dissipation to irreversibility-, nothing happens although the ergodicity: many decisions will compensate mutually. Interferences between them compensate in a sum-zero if the symmetry is maintained, but if not, and we do not know why not, the next trip will take a somewhat different amount, which will modify the subsequent trips. If there is no local irregularity, with time enough those quantities will converge in an average of the water that infiltrate respect to which it drains; and only if there is interference from outside, can some local convergence of chance occur in scarcity. Every atom of the Periodic Table has no intermediate or proportionate attributes of the nearby atoms: boron has no similar or intermediate properties to carbon, nor oxygen to sulfur. In the changes of scale there is autosimilarity but no progressivity.

Some of the water will drain, part will wet and/or evaporate, part will filter but will also be retained by the soil and in some proportion will transpire later, in its interception will form puddles, will decrease humidity in the atmosphere and then the probability of rain, leaks will take different paths and will not arrive at the same time the surface drain that the runoff of the rivers, the plants will grow and they will die,... variables become dependent and quite not linearly. Several flows will evolve in several different probability ways to add water in a just in time overlap, making the system seems to be discrete. Every system stores energy according to the properties of the energy levels of the atoms, but also of the polarity and shape, of the electrostatic relations and bonds of the molecules between them,... to macroscopic levels, and even to encompass the whole Universe.

The quantity of water in a system will not be created or destroyed if closed -canonical-. Rain will be transformed into water flowing at different speeds because its different paths. The flow will be concentrated in rivers and will be delayed in random walks, because singular points where roughness, as naked singularities, offers several crossroads options equally valid. Each flow at its rhythm, by more and more randomized paths, to the same homogeneous sea of the minimum energy. Inhomogeneity and asymmetry introduces random walks if this consideration of the energy in time, diversity is introduced through asymmetrical interaction in the becoming. This becoming delays the flow distribution by diversity of paths, locally reducing the flow and increasing the surface of the phase-space, getting more time to complete a cycle, which makes complexity to concentrate locally, against the natural tendency of the rest of the Universe to become more and more smooth and homogeneous. A star is alike to a locally puddle that concentrates energy flow in a system, which at a global scale is diluting... and with enough time the energy of the star will add to the general trend of homogeneity... the puddle will dry up or geology will move the soil and the water will drain.

If radius of interaction between particles are smaller than those of the scale of the system as a

whole, but with time enough to allow the equilibrium, organization will be local in space; and the rebalances will be structured by discrete layers of locality and temporary. Equilibria in time and scale, will structure particles discretely into space and time. Energy of quantum states of different atoms would not be equal, the properties of each element and each isotope would diverge, the bonds would not have the same energy, nor would the molecules be symmetrical, their reaction would not be alike according to their spatial location, or according to their neighbors, and the irregularity in the storage, dosing and displacement of energy. If in addition the system is not isolated and/or has its own dynamics set: it expands as the Universe, rotates as a planet, or falls like a stone, it will present inhomogeneous behaviors by external or internal friction. It is more difficult to build, collect and assemble the Library of Alexandria than to burn it.

A diverse landscape emerges changing the scale from hill to mountain range of many different hills, with valleys, cracks, rivers,... roughness, with more and more complexity up to locally and eventually converge in randomness if a solution of a relation is a discontinuity at some derivative level. Any isolated and symmetric Complex System will tend to have all potential energy as kinetic and with enough time, tends to uniformity. If it is not isolated and/or an asymmetry remains on the system, the energy it exchanges with the outside must also be stable for balance: it rains and the river does not dry, but if it does not rain enough it reduces the flow or if it rains too much it increases.

The measure of randomness, inefficiency and irreversibility is the distance between idealization to reality. An isolated system will tend to the statistical convergence of random paths -recurrence theorem-, and only local or temporal circumstances can punctually modify a phase-space region where relations are asymmetric and stationary. If a local valley holds the water, the pitcher Sisyphus will climb the hill with less water and will make a non-optimal trip, but he will not know before going down, but when climbing (we extrapolate the future, but we do not know for sure, if something unknown or unexpected happens). Your uphill walk will be inefficient with the unfilled pitcher, however, if it rains too much than the drainage capacity is exceeded, the water will not wait its turn to go down by the stable channels and it will run on either less efficient side: speed of the flow exceeds the paths due to previous information and experience no longer knows how to optimally allocate the potential energy transformed into kinetics.

Temperature as a state variable of higher hierarchy in scale than the kinetic energy of the particles, is a statistical value that can be irrational, if transformation has losses due to inefficiency: between n quantum states the average values may not correspond to any "allowed" level. The division between energy and probability gives a rest, except when both values are the same or proportional: in a Harmonic Cycle, or adding an imaginary dimension to achieve an Analytical Cycle. Even increase of complexity, this is not too much for Sisyphus, however complicated the process may be, from periodic to chaotic: both change at the same rate and are found according to consonants "chords" that follow one another with resonance patterns. From Zarathustra's point of view the rhythm of several Sisyphs playing in tune, if there is no mechanism of self-organization of rhythm among them, breaks the harmony, but nature is wise and chaos remembers up to a esthochastic singularity occurs. Some of the potential energy of the water is retained in puddles or in moisture and when reaching down, kinetics has declined, having remained part of the entertaining potential along the way. The overlapping of melodies produce noise and harmonized sounds: music.

The difference in energy between two points will be equivalent to the flow at any moment if and only if the system waits until the last drop to restart the cycle. If it rains before all water reaches the sea, cycles will overlap. If all sisyphus are autistic, music becomes cacophony or even there may be uncomfortable silences. It is the description of the Deterministic Chaos itself, but if they coordinate by resonance, auto-sincronization emerges, and they can offer a composite symphony, but for this they must listen to each other, interrelate, accumulate an increasingly complicated story of

experiences. Just in case the flow is greater than drainage capacity, turbulent dynamics will occur and by noise or melody, the interaction that breaks the harmony and symmetry, produces viscosity, randomness and complexity. Even the turbulence it has a limit for stabilize cycles, although they may be far from equilibrium, and because the generated information of the relations, the system may eventually propose randomly a configuration, a new procedure or way to manage the overflow, maybe draining at a better ratio in return for the investment of energy in organizational change. Change can emerge to an upper scale leaving a rest of not used ashes, when the system put the counter to zero on a new scale of state variables. The ashes are inefficiencies in the trajectories increasing its length and therefore means roughness. Roughness of the environment modified with the energy of the system, proposes stochastic decisions to the system itself, and random introduces irrational values in between rational values: when comparing their ratio is not periodic anymore and that rest, appearing to consider the randomness, is lost but does not disappear, remaining on the lower level in non constructual microstates... with enough time, it will find its way.

Alike the water is distributed in the surface by drain, infiltration, evapotranspiration, ... the heat is distributed between mechanical work, "elastic" energy that spills over the entire system in the form of temperature, enthalpy or friction energy in various orders of magnitude of exchange time rate with the environment, and entropy or load loss and investment in structural changes of the landscape. The one is transformed into the other and different rhythms establish different voices, which only over time couple in chords by natural selection of efficiency flow to another scale. What is smooth at some scale may not be at a different scale. Who is used to play jam with friends, knows that each one of the band extrapolates what the others are going to do on the basis of the melody they all share. Each instrument extrapolates the notes that the others will sound, but since there is no partiture -Law of Causality, means the effect does not cause the cause, and extrapolations will not always play perfect-. Reality plays music by ear.

For practical reasons, given the complexity of hydrological processes, the path followed by each drop of water is not considered and the collected flow is taken as a collective value -state value- in an interval of time, assuming the sum of the probabilities of the paths of the story for each drop, grouped in paths of the same length (same energy states). When stops raining, rivers and fountains continue flowing, the soil wets and there is still water coming to the sea, where it mixes and there is absolute autism among all the drops of the system. Different paths have different flows, but the incremental result between what comes out and what arrives adds a constant and stationary value in equilibrium. According to their length, there will be those formed by more paths -the easiest way- and by less -from the most absurd to the most optimum or efficient route-, which will compete in arriving before the sea, by the well-known process of Natural Selection, following a statistical pattern or partition function. The average length, median, modal, will not be the optimal solution. In the undemocratic difference between the majority -constructual- and the optimum, between local and general interest, we begin to glimpse the better for the drop may not always be the best for the flow.

Even without randomness, the extreme complexity of the process with respect to the utility of the result, recommend by efficiency to idealize a state function, even if it is reversible, rational, determinable and periodic, because its difficulty, with enough process capacity, a computer could travel back on time through interactions -like rewinding a pool game-. However, even in much less convoluted histories, the occurrence of any random decision makes the story irreversible, since the inverse space-time trajectory finds crossroads in which, on its way back, it should also decide at random and by definition of Chance, they may not coincide. Not by utility, but by intrinsic limitation, the first random decision also recommends a state function, which forgets the preconditions for not knowing why it came out heads and not tails, or why the path took a particular road instead of any other alternative. By the Causality Principle, a random decision can not be

reversed, because to have no memory of an effect is to have no cause, and the absence of causality is chance. Entropy as a rest appears when Energy and Energy Flow has both to be conserved.

Egyptians calculated π approximating the circumference by an inscribed polygon: as more sides, more accuracy (Ptolemy did it with 720 sides). A freehand curve can be divided into ideal functions and the more they are, the better they approximate reality, if they converge to a fractal value, but the more they distort reality if they diverge. More pieces in the approximation means more points in which the inertia of projecting the past behavior in the future may fail. In order for the Principle of Causality and the Constructive or Minimum Energy Principle to coexist, the future can not be part of the decision to choose the path of least effort, but its estimate under the natural assumption of inertia: a "well-behaved" projection. Theory extrapolates analytical extension of the behavior immediately passed to immediately future according to a continuous function, derivable until necessary, concave, without singularities,... The better we approach that curve by hand, the more inefficiency accumulates when we assume that it behaves well, when or where in reality there is a local irregularity, a "whim", a "break" or a "leap".

The most traveled trajectories will be at an optimum between the value of a better degree of approximation and the cost in errors of forecast, but they wont be in general the most efficient flow. Reality and theory -idealization- will remain away by the rest of the imperfection, the distance between optimal and majority, for the drop and for the flow, for the local and for the general. Most tentatives will tend to extrapolate linearly what happened in the immediate past, as the most likely to happen in the immediate future. The length of the coast of Great Britain has an optimal fractal dimension if we consider a ratio of cost between more sides of a polygon, the better accuracy and the time available to answer to the question of "which is its length?". So the average distance to the efficiency would be a potential that means how much differs the Energy conservation to the Flow conservation, due to the errors in extrapolating when reality is not well behaved.

The physics of a multiple pendulum or a complicated system of two non-linear functions does not incorporate any random decision, but the physics of a surprise punch on the face, it does. Rebuilding trajectories backwards, change the effects to the role of causes and the asymmetry appears as a consequence of chance: the on go path may not be the one back. Or may be chance that appears as a consequence of asymmetry? Except for simple, deterministic, periodic or also for completely random cases -infinite variance-, a microstate, a narrative trajectory of conversion of potential in kinetics, will be between both ends, to contain at the same time cause and chance.

If all trajectories of each drop are possible -the different path to balance two microstates with a given potential difference- they are not alike -the most traveled path will be the most predictable and conservative, which is the more random roads that lead to the same lenght-, and will not be the most efficient, the least energetic, nor the most entropic, but the optimum between information and decision selected by its Natural Selection. In a reversible Universe, there are no questions that chance could answers, and the most traveled path would be the geodesic optimum of a geometry in which the answer is the least effort, that may happen only if reality is "well behaved": inertial, or the last happened, offers enough information to safely predict the next thing to happen. The arrow of time limits the journey in time to a reversible not-random succession, since only the optimal path can be known if it is predictable, which implies that it is limited in complexity and/or periodic: chaotic but never stochastic.

When asking a particle for its decision according to the constructual principle of minimum action, it will only take the optimal walk between efficiency and availability of space and time. The particle can be sure only if it can calculate the potential difference between the different options, and not only idealize with certain probability of well behave, where it will end: determinism. Reversibility

requires a complete reminder of the path to return, but to go from one state to another through an intermediate decision subject to chance, reversibility requires that chance is not chance, but the result of throwing a coin into the air may be back upped somehow and interlace the result of the same operation on the return. All trajectories will contain the level of chance as an statistical distribution, according to the decisions made by extrapolation in the assumption of "continuous and n-derivative function" and if there is a mistake in the forecast because not continuity at any level, forgotten. Freedom is in the forgetfulness of the previous conditions.

The more thoughtful and informed decisions, with more variables, the more optimized paths... as technocratic managers know. They wait to have all the information to make the best decision, even if it means losing the window of opportunity (companies are looking for profiles of managers who combine experience with knowledge, but also intuition). The Buridan Donkey will never decide his path waiting for more information,... but because his hunger he decides one or another way before, there will be a lose the information. Principle of Information Conservation means a deterministic, well behaved and continuous prejudice. Boscovich Priest claims that only continuous forces may drive a deterministic Universe with Destiny and God. The best is somewhere between the most efficient and the opportunity. As "good" broker, Natural Selection does not have patience and does not choose the entrepreneur who succeeds with the best product, but the one who succeeds with less information: the optimum will not be the path of minimum energy, but the oportunistic path which supposes the "bad-behaved" and has chance or intuition. Natural Selection is uncompatible with Information Conservation Principle. Easy decisions are conservative, in a "well-behaved" and constructive basis, -good performance at minimum effort-, but best managers find an optimum between the available information and the right decision, between probability and action in a non idealized well behaved reality. We can calculate easy the trajectory of a cannonball with two variables, but the many bodies problem is disproportionately complicated.

"It is very difficult to make predictions, especially if they are about the future" (N. Böhr). Microstates test other very close perturbed microstates, which survive only if they are more efficient than the energy difference that separates them, but uncontinuity means to test far away microstates. When they reach equilibrium, the essays and perturbations persist in test that demonstrate that the near equilibria are not better: different paths of the same length could compete, but as no one provides a better path, they do not bother to change without scarcity of options of reality. This is what we call stationary state. Let us suppose several microestates with the same lenght in their random walk: a path that has better memory than another because it has fewer questions from the environment and requires fewer random decisions to obtain from the same potential energy, the same sum of kinetic energies in less succession of decisions, would be more likely by Natural Selection over time. With the best information, taking the optimal decision has no merit, but Poincaré showed us that it was impossible to have that security, (maybe he realized that he was reformulating the concept of Entropy).

To know if extrapolate fits with reality, we must test. If random walk indeterminate, chaotic, complex or aperiodic, it is only possible to know the path of least leght when arrived and we can send a message to the past, breaking the Causality Principle, to rectify if chance did not decide optimally. Maximum efficiency would be the length of the path that did not offer random choice: all extrapolated decisions fits because its well behaved. Choices existence is only because the speed flows and does not drain according to the capacity of the transmission environment and information process, which is the less fast if the more complex, and if flows does not wait for all the information to decide the path,... Like characters of a novel with less freedom for its behave while the story progresses until the killer is discovered, this may describe "Lamarckian" processes of genetic drift or interrogation methods of suspects: autosimilarity evolution (Bénard Cells).

The most probable length walk or microstate converges far from efficiency as crossroads increase, but randomness does not linearly affect a system if there is a scarcity of realities -random decision- or excess energy flow -turbulence-. In a storm on a smooth hill the water descends first on either side, and then concentrates on channels built by previous storms. In the abundance of realities that allow all possible options, oblivion is completely random: ideal gas (non interacting and not ditinguishable particles). In the scarcity of reality, and the more stressful the environment is, the more memory is required for a better strategy: less entropy and more flow concentration and internal configuration (randomness vs complexity). Randomness is a convergent succession: mixing more than 7 times a deck does not bring more disorder (Bayer-Diaconis) or the Kruskal-Wallis Game to guess words. The level of inefficiency in a walk converges and stabilizes when increasing the number of decisions, from which more randomness does not make it more inefficient. But turbulence is a divergent succession.

Referring to markets and brokers, B.G. Malkiel bases the obvious financial errors and equates them with astrologers, because the history of the prices is forgotten by the mathematical process of "random walk". Depending on the number of choices to decide, their probabilities and the decision strategy, the evolution of each element of a system will undergo a Wiener or Brownian process, but the "lengths" of walks will converge obeying Central Theorem. The bad chess player barely remembers or predicts a movement, a master takes into account a few, and Big Blue a few more, but always limited. The grazing of a cow has a "martingale" strategy, different to the hunt of a hunger tiger, according to the memory of the trajectory that each one saved: if there is no food after several short displacements, a long displacement is decided to forget and start again.

The entropic law of the inefficiency of randomness is valid at all levels and Markov processes are invariant to the hierarchy of scales. The road more traveled by the drunkards who leave a bar to look for his car, will not be the one that would have chosen in sight of bird by an engineer, faster and optimum unless the parking is uniform, without obstacles. The most unlikely and most efficient microstate is the path that has the best memory, and though less random. The more randomness the flow requires, the more options there are in more crossroads, the walk becomes longer and more diffused by making more decisions. The faster the flow and the longer the path, the more "mistakes" in the decisions that may had optimized the flow of energy; but also the more slower is the dosing of energy or greater the time in which part of the kinetic energy that was to be temperature is stored in the system, to be released later, more slowly.

We are gods for the two-dimensional inhabitants of a flat world, subject to a future in which they are presented with several doors to choose, without knowing that you can jump on the wall. They do not see what lies behind each one, but a God like us in space-time of one more dimension, we do see what is behind. We can optimize their way because we can extrapolate even when reality is not well behaved, they do not. At each door they may make a mistake, if by mistake we understand a non-perfect decision. Thus randomness is perhaps a concept dependent on dimensional limitation. For us a God should live in more dimensions and what is freedom in our dimensionality, would be destiny in his dimensionality.

We equate oblivion with randomness, with irregularity, ignorance, with errors, with decadence and with inefficiency because the causality fail in the benefit extrapolation of the investment of the savings that have not been used for expenses... affecting the flow of hijacked energy, by the attributes of the system for its investment in bureaucracy, but there is nothing that time does not heal and sooner or later the puddle dries up... if there is no emergency in a symmetry rupture of the scale, in which case that rest is fossilized as a loss of charge or entropy.

The lake dries, but the energy invested in the geomorphological formation of the lake remains in the

system as a rest, out of the balance conservation. The relative irreversibility of the random decision -Recurrence Theory: the trajectory may not be reversible, but rather return to the same point by most probably another longer path-, it translates into absolute irreversibility: the kidnapped energy is sacrificed by not receiving the ransom. Energy is not lost, but fossilized in potential stochastic form in the own reconfiguration of the system by forgetting the initial conditions and/or by resetting the independence of the variables in a new emerging system, in a new hierarchy of the scale.

Planck was the father of quantum mechanics, but Boltzmann, while hardly fighting against so many well-formulated criticisms, was his grandfather (and by the way, J. Dalton great-grandfather because his "multiple proportions law", or Democritus and Leucippus of Abdera ancestors): the paradigm shift occurred by giving up continuity and changed for a finite number of particles, a concept that would then be used reluctantly to explain the hump of the black body and began another time. In deterministic apriorism, scientific consensus of that time and even in our days, before the analytical critic of E. Zermelo -the energy is expressed in infinitesimal terms, reason why its conversion must be reversible-, to demonstrate that the Second Law of the Thermodynamics is statistical, Maxwell placed a goalkeeper in the hole between two boxes of gas with a mandate: if it comes from the right and fast passes, but if it comes slow does not pass; if it comes from the left fast do not pass, but if it comes slow, yes. By Recurrence a system has no non-zero probability of returning by the same path, but it would take tens or thousands of Universes to be able to observe this circumstance in any of them.

Because the virial theorem, we can measure the lost potential on reconfiguration in the process of conversion of potential energy into kinetic energy, with the level of forgetfulness, disinformation or inverse to memory capacity, through the addition of improbabilities with respect to chance of alternative ways to distribute the energy between two points of different potential W ... which is what expresses the classic Boltzmann formula $S = -k_B \lg W$, and incorporates the logarithm to make it be identical to that of Clausius $S = dQ/T$. They are both alternative ways of measuring the distance between the average walk and the optimal walk, but it also measures the minimum amount of random decisions and introduces another alternative to the analysis of the energy flow in a system. A Rubick cube can be solved in a minimum of 20 turns if the slope is "smooth" -ideal and reversible-, but also in any other natural number, and therefore not all solutions are equal for energy efficiency purposes: there will be a number of movements greater than 20 easier, which will be the one with a sufficient number of attempts, more often solve the cube. A Carnot machine wants to be a reversible and cyclic temperature operator: a machine of continuous motion, and the Third Law of Thermodynamics can be enunciated as "perfection does not exist". So Second and Third Law may be more deeply changed by Causality and Flow Conservation laws, with any change but a better understanding.

The entropy as information loss is not new. In the 29 L. Szilard and C. Shannon published their interpretation of the goalkeeper's role if, instead of gas molecules, he managed information, and for the purpose of calculating the binary quantity that could be send and received, Shannon came to calculate the lost information $I_N = -k_B \sum p_i \lg(p_i)$, where p_i represents the probability of a random event. J. von Newman was from Hungarian origin, such as Szilard, and on a visit to Shannon they described him the concept of "information loss", and he suggested them that they call it "information entropy": "A very similar development exists in Statistical Mechanics and in addition, nobody understands the entropy too well, reason why in front of a polemic, you will have advantage". It measures the surprise, or probability when exploring a non-consecutive microstate so far away that it can not know the path between them (or know what is behind a door). According to R. Landauer, the loss of information is thus also heat/temperature loss, $(1K = 0.95697 \cdot 10^{-23}$ joules/bit, which if we refer to the Avogadro number, is 0.17352 bits/molecule). With forgetfulness, the information is not conserved, and information conservation is a Principle for other branches of

physics, so with no changes in this topic never will be reconciled under a same mathematical umbrella indetermination and chaos.

If we incorporate inefficiency, we can reach a game to zero-sum when flowing temperature, water, information, kinetic energy... from a stationary state in which there is a local distribution to a homogeneity, where no change can offer energy improvement. Rain and river flow and remain dynamic and constant, in a stable but not static cycle of days and seasons that occur regularly. Turbulence destabilizes the system with droughts and floods, which produce sandstorms, landslides and soil erosion, reducing productivity and though transpiration. To retain water, the roots of plants must be adapted to what they interpret is a climate change of a more disorganized and scarce ecosystem. Biodiversity is triggered by excesses and with degradation the landscape becomes monotonous. Solidarity is complemented with equality by contradiction: they can not be both at the same time on the same place. The maximum forgetfulness will ever be in the maximum relationship of all with all, either in deep autism or perfect communism: no one wants to know anything about anyone, each one minds about his business and although some go faster than others, in the next instant the others go faster than the ones and they all end up being the same, if not in space, but in time; and if not in time, in space. A gas raises its entropy with higher temperature and lower density, but also with pressure.

Any new proposal of bureaucracy in the flow of energy requires an investment of own energy, maybe deviates from excesses, or it is imported from the outside. There is no novelty for free and no benefits with no risk. Something new must happen to make everything change or the renewal of the old delays changes. "We can not solve problems using the same way of thinking that we used to create them" (A. Einstein). H. von Helmholtz saw it from his perspective: in a chemical reaction that produces a gas that has no reality, part of the energy must be invested to make a hole and occupy a volume at a pressure that allows it to exist in equilibrium with the environment (the same process in the breeding of a sparkling wine). Gibbs also forced the amount of energy exchanged with the environment as friction or enthalpy, H , to go one step further: the investment in making a hole, does not have to be the cost to replace the gaps. It is not the same water that is entertained in the system in a stationary way, the invested in changing the system by creation of soil or by erosion. A smooth slope becomes rough with flow excess, interaction and oblivion.

From negative perspective in establishing the Second Law of Thermodynamics, about loss, error, non-optimization, decrepitude and exceptionality, the multiplier effect of an investment of a random change in novelty that improves efficiency by building a new bureaucracies was ignored... and until the 60s and 70s, the tendency towards evolution within each phase from equilibrium to equilibria that inevitably happens was taken as absolute, until the formulation of Dissipative Thermodynamics,... local non-conservative changes, non-equilibria, abrupt change, and with this, we includes in physics self-organization, self-resilience, resonance, emergency. Another way of creating order by convergence of excess randomness. Each change of hierarchy or phase consumes or yields energy discretely: the phase change between solid and liquid or between liquid and gas, invests energy and information in digging random channels that will be selected and fed back by efficiency or forget without increasing the temperature. The change of complexity in the organization in a system, invest energy and does not balance with the expenses, because the change of phase itself costs energy derived to new bureaucracies.

In the development of positive reasoning, we have found irreversibility, irregularity, loss of information, burden, errors, decay, investment, inefficiency and randomness,... egalitarianism and autism, but for the moment, neither disorder nor exponentiality in the benefit,... or virial behave. The increase in energy may or may not have a multiplier effect in the "aggregate demand" = investment + savings + consumption, -or increase in heat = exergy+entropy+temperature-, since any

increase in the income of some that increases expenses, will lead to an increase in income of others configurations, who, in turn, will be in a position to increase their consumption. Irreversible random decisions that collectively regain their reversibility statistically on another scale through the oblivion, the loss of the rest and new ideal and independent state variables!

State functions know what comes in and what goes out, at the cost of ignore what happens to each individual and in between: they give up detailing the intermediate phases like filtration, retention, evapotranspiration,... because they are dependent and interrelation is hard to describe, with complex relationship and definition, irreversible and far from equilibrium. If they are reduced and simplified to analytically describable subsystems, the margin of applicability is lost at local intervals of space, time or scale, but from a new scale perspective, the system is easily described. A black hole can be described by angular momentum, mass and charge, at the price that we can not know what happens beyond. A gas can be describe by pressure, volume and temperature, at the price that we can not know the kinetics of its particles. Costs, incomes,... benefits are not linear, except in smooth intervals of reality.

To describe situations of explosive benefits, there are various versions of accelerators that, based on marginal rates of savings, expenses, imports, taxes, money supply, ... establish positive feedback models that move the system away from equilibrium, and tries to promote growth of employment, welfare, wealth of families,... Kinetic energy that does not transform into work or temperature, is saved over time or lost in bad decisions and inefficiencies. The worse memory the system has, the less legacy it is restored to the heirs, (how much gold without a known owner may remain in Switzerland banks?). The more independent are the particles of a system, the more uncoordinated behave they are; but without discontinuities and bad decisions also generate equality through the exponential increase of the variance. Without savings there is no investment or multiplication of the circulating capital, but too much savings represses the consumption that reduces the demand,... The excess of order, scarcity and saturation arrives at the same port as the disorder. The system is energetically equivalent having N indistinguishable particles because the turbulence -consequence of the excess of demand of flow with respect to the offer of drainage- or because the decoherency -by excess of capacity of drainage with respect to the flow-.

The excesses generate turbulence in saturated environments accelerate the imbalance and its resonance, but also gives a probability to non-linear profit and divergence -according to the Cantor orders of infinity-. Against all forecast, start ups, innovation, serendipity,.. and no traditions, may create empires. No critics praised Van Gogh and any editor wanted to publish Harry Potter. The energy saved and made available for investment is transformed into proposals for novelty and reconfiguration, that may have multiplicative growth with some probability, sustained development, tranquility for the future and an accelerating effect of the organization. Not because there is a "Categorical Imperative" or a Natural Law, but simply because the energy does not disappear if overflow the drainage capacity of the environment.

In stability any minority innovation that improves the efficiency of energy flow, constitutes a solution overwhelmed by the macrostates (in equilibria, a better configuration can not easily displace but with high investment, the old ideas that arrived before); but if there is a bifurcation, a moment of phase change, discontinuity, instability, there may be a reconfiguration of the niches on which to compete, and opportunities for proposed improvement co-opts with the existing solution, being fed back into a resonant phase. Thus, the random decisions that make a space-time path irreversible, can with the scale recover the reversibility, from smooth elements a smooth behavior. Many random microstates with the same length in their trajectories are described as a single new and independent macrostate chaotic but deeply organized. The cost of recovering simplicity in a state function is to lose the ability to reduce to linear-arithmetic the relation between its parts and

the loss of information. Each scale accumulates in its emergence ashes, losses, inefficiencies, organization and oblivion, which translates into our models into local application intervals -always understood in space, in time, or in scale- and unexplained constants or arbitrary values. Every arbitrary constant means a black box or a black hole, where we only know inputs and outputs, state values, at the price of giving up about what happens beyond its walls.

Infiltration, retention, evapotranspiration, rainfall, runoff,... are processes with different periodicity, and being conversion of potential energy into kinetic energy dynamic residues, can be either removed, or enter into resonance, multiplied, or even in a feedback accelerated, with droughts and floods (deterministic chaos). The accelerator can come from the addition -several circumstances that merge happily in a better configuration, typical in stable systems close to equilibrium, mature-; or either from multiplication -several mutually reinforcing circumstances, typical of periodic homeostatic systems, that use to grow and reproduce in similar proposals-; or even form exponentiality -emergence, typical of systems in the process of collapse, that far from equilibrium find a new path, recover the initiative of the organization in the described "pulse" between chance and scale, and that evolve-. The mild rebellion of zero sum likes linearity and periodicity, conservation and homeostasis; and the drastic revolution of sum-non-zero, likes irrationality and non-linearity, symmetry ruptures, phase changes, and non-conservation dynamics.

Except in the ideal case of an abelian group symmetric to time arrow, in our reality when this or another symmetry is broken, the order of the factors alters the product and tires more to go up the hill that rests go down the slope. Transformations do not use to be elastic, nor symmetrical. Thus the exergy increase by creation of a new bureaucracy with each increase of scale, allows new less-efficient ways to transform heat into work, which is a generic consequence and not local. If Soft Cosmological Principle applies, -the laws of physics and chemistry are invariant in space- there is a spontaneous order throughout the whole Universe in systems in which flow is locally concentrated faster than drainage capacity and some configurations survives stationarily, finding a new equilibrium. Machine code is more efficient than ASM, which is more efficient than Cobol, more efficient than Generators, and so. Although we do not know with what density, there have been, there are and there will be self-organized systems at all biochemical, vital, ecological, cultural and technological scales collectively, even in other inconceivable hierarchies. If Perfect Cosmological Principle applies -also to time-, there will be life like systems in any age of the evolution of the Universe which have to solve a turbulence, and if Strong Cosmological Principle -also to scale-,...

Resonant operator between periodic subsystems delivers configurations that belong to the same solution space -phases- than its anti-image: no matter how complex, the proposed and possible configurations are of the same paradigm as the previous ones and there is not emergence of novelty, but improvement. Playing in something like checkers, M. Langston proposed in 1979 parameters to measure the boundary between the collapse of deterministic chaos and stochastic chaos, between complex periodicity and exponentiality, between reversibility and irreversibility. The imbalance by excess energy in the flow, requires the feedback loop which transforms the non-zero-sum game into action-reaction, non-equilibria dynamics: leaving a lost rest when emerges a new hierarchy of scale. There will be no revolution as long as the change is enough to give out the flow of energy with turbulence on the same dynamics, if the surplus is not invested in innovation or if there is no change of scale in the organizational perspective of the system.

Only if energy is beyond the storage and drainage capacity of the system, being its configuration a bottleneck to the flow, will it be constructual -in Bejan sense- to take the risk of a new configuration, a novelty in dynamics, coming from random unrelated systems linked to another scale, aperiodically and irreducibly. It is a much more expensive option than the improvement, because many more combinations must be tested and discarded, losing quality in energy and

information. When landscape is not able any more to accept more water flow, even after building dykes, piles, terraces,... the alternative to collapse, slice or dragging the hillside, is rebellion, destruction of the landscape itself and change the ecosystem to introduce a new clean path, smooth and decoherenced, so with a waste of lost rest, more complexity and ideal new system in a upper scale.

In look-back-time to the original eras of the Universe, the waste of energy after an emergency of new ways to drain energy flow, diminish in relative terms to the flow, until some very primordial moment in the time in which the conversion of energy into exergy would tend to be with no rest, complete, perfect, elastic... and energy would have no demand for particles of matter to invest in changing the way to drain the overflow: a smooth slope. There was no time if there was no change, and there is no change if all microstates changes in the same energy level, when all particles of the collective, whatever that word might mean in those ages, were identical and indistinguishable at all scales. Going forward with time, the Universe evolves to systems in larger scales with greater loss of load and inefficiency -accumulation of errors, decisions and impurities- or worse ratio of conversion into work.

Local concentration of the flow over the drain capacity of the turbulence, eventually produces emergence of new management configurations, leaving behind leftover wasted energy and information, and investing other part of the energy in structures for the new configuration. If energy is not created or destroyed, inefficiency in flow management is the rest of the energy discarded, and imperfections -the overlength of the path of the majority over the optimum- must grow with change and scale, which also expend energy in novelty. Each local configuration works according to its self energy interest, with time they relate to others and becomes dependent on others, accumulates a history of random decisions, and generates a spontaneous order by the same mechanism of the Invisible Hand of the Market, optimizing although each particle or each individual has his own history of decisions with any mind about the ensemble.

Saturation over the turbulence, leads to the local organization of the twistors, which evolves losing information when changes. Such contradiction describes a dual reality. Backward in time arrow, less and less information by disorganization within each paradigm; but forward also less information in the process of erasing in every change of hierarchy, by the contrary processes of organization, complexity and evolution by jumps -quantum-. As it expands, the arrow of time locally concentrates information, temporarily concentrates flows, concentrates more energy into higher hierarchies, but more local... while the rest of the Universe continues to dilute in greater volume, uniformity, and randomness.

As long as the evolution is predictable, it will be reversible and the system will have information to extrapolate the better trajectory and look for the constructuality (it does not know about the future, but supposes it with good probability). Only while there is continuity and derivability, the evolution in time of energy states can be formalized by Lagrangians or Hamiltonians -depending on whether degree or number of equations is more useful- and as appropriate for the calculation of the gradient or trajectory of maximum efficiency, respect to the path with the highest number of configurations that get the same result.

Tomorrow will be sunny and we will go to the beach, but if tomorrow the car is damaged by a drunker driver while it was parked, the plan will have to change, so any other is equally possible: go to see the grandmother, go to the cinema, shopping,... " A priori " was not planned by the extrapolation of a smooth function, and the plans we decided for the day after tomorrow become irreal and reality can not stop and go back to ask: which way to take for the better family day? The information has been lost and the Ass of Buridan does not mind about the one path or another, so

that reversibility is lost and, as he is stupid and does not know what is beyond, he also loses the possibility of following the optimal trajectory. The wheel is more efficient than the step, but there are no animals with wheels because the discontinuity of the axis was not a path explored by evolution. We are functionally built on the least efficient path structurally easier: evolution acts with what it is available among what is real. God is maybe Great but not an Architect, while reality is not optimized.

The Constructual Principle, -of minimum effort for the better, with enough but not all time and information-, defines that there is a decision-maker in an random question, however the scooters do not think about anything to decide to take the maximum slope. In fact they do not take it, they follow well-behaved geodesics. Particles do not think of Feynman's different paths to make a decision with certain probability, nor do systems think of different random paths to collectively add a pressure value. The actions are inertial but the reality is not: the scooter does not conceptualize the slope, but takes the previous gradient as initial condition and prescribes it as an inertial projection of the immediate differential gradient. But in the reality there are rocks, bumps, curbs,...

When inefficiency stationarily stabilizes with respect to the optimum gradient -converging towards a finite value in which more stochastic decisions, hardly modify the flow-, the inertial configuration acquires an "opportunity potential", quantified by that energy value wasted with respect to the optimum of God's Trajectory. The probability gap between length trajectories will thus be the measure of the potential of opportunity: by the Principle of Causality, the decision will be based on the extrapolation of the immediate past to the immediate future. Does Y. Aharonov's disconcerting experiment invalidate Causality, or is this interpretation of entropy invalidating the principle of least energy? When the particle is observed in an intermediate state, that conditions the previous states because they are inertial projections to the past, therefore continuous and derivable: invertible and deterministic. There are no bumps or curbs in the experiments, but reality is rough.

Even not being the best, the length of the average trajectory will get higher potential than the most efficient flow. The first answer to a question requires extra energy to demystify it: the first bacterium that occupies an intestinal fold does not allow to other bacteria equal or even more efficient to be installed because its potential; or the impurity that in a diamond or a semiconductor, is more expensive to draw than if it had been designed from the beginning with perfection. The inefficiency in the walk with respect to the constructual optimum, or the God's Algorithm, gets its potential energy from opportunity, so to conserve energy that must be another loss of energy in the evolving dynamics of flow.

Randomness generates inefficiencies, inefficiencies become errors, errors accumulate decaying impurities a loss of rests, beyond turbulence overflow push for locality and the investment of energy in reconfiguration, substitution energy is greater than occupancy energy, and in asymmetry, it is forgotten. Thus the entropy is the result of the deviation of energy to solve the overflow in a rough reality: configuration and proposals for change; privileges and substitution as energy gained by having arrived earlier; defiance to change to upper degree of complexity and organization; in decay, inefficiencies and accumulation of errors and impurities; and uncertainty as settled between sensibility and oblivion of initial conditions,... Capital is energy, but needs to flow, and if there is no CEO -medieval God, not only Creator as it has been demoted since the Renaissance, but involved in daily operations- Buddha's elephant legs and tusk? Do they overlap? Do they leave holes in between? Some yes, others sometimes, others half and some not?

So Entropy can be defined in many ways because it is not fundamental but a consequence of Causality, Constructuality and Continuity Principles: degree of autism, level of oblivion, rate of

change, as well as the inverse of the quality of energy, which is also its capacity to transform into work. Neotomist theology of the late nineteenth century argued that if entropy grew, it means that at the Beginning there was a Great Order, and that this is a proof of God's existence. Influenced by the school of Leuven, this line of argument was taken up again in 1927 by Lemaître in the first statement of the Big Bang theory, which Pope Pius XII taken on with the enthusiasm of the Bias of Confirmation: "Initiation implies a Creation... and therefore Creator and then God". The algorithms of the limitations of the virtuality prescribe that if the entropy always grows, the Universe is more and more ignorant... God has bad memory.

The Olympus of the Gods is a retirement home with plenty of gods with senile dementia and keep little experience to offer to men. By oblivion randomness cancels out the experience that compensates the dynamism of the youth. Two trajectories of different length; two microstates of different energy; two ways and expenses to solve the same problem; two times between equilibria; two compressibilities; like two configurations candidates to full fill the same niche, of which one has arrived before the other;... Chance and Change. The advantage of having occupied the niche before, is also the amount of noise and dust, the degree of accumulated dross, erosion, stubbornness and difficulty to convince, loss of load, energy quality, tendency to waste, the maximum fragility -resilience or minimum resistivity-, the uncertainty of oblivion, returning again to the link from complexity to randomness.

If the friction in the transmission of a message is weak, reliability is high, the level of error, the lose of information, the increase of ignorance, forgetfulness,... potential derived to privileges is low and the message is easily compressible. The formalisms of Boltzmann and Shannon are identical because they describe the same "elephant" through his legs and trunk: from accumulation of randomness and oblivion, in the inertial extrapolations from the past to the future in each system, whether they are hydrological, computing, electromagnetic or thermodynamic. The environment dialogues with the system boosting or inhibiting advantages for certain options, which may even overwhelmingly be the same of the inertial ones, but not always: perhaps a greater concentration of such substance, strengthen the reaction rate in a certain sense instead of in other; perhaps the construction of a bridge, a channel, a dam, .. modify the share of water retained in the system on equation of state... The system does not know what is beyond the present until after opening the door. You can not always be right in all decisions, but if there is not a choose, is not possible to fail.

Reality is not inertial, nor smoothy, nor drives between equilibria, nor obbeys Cauchy, nor it is always "well behaved". The orography and the rainfall are both independent, although at geological scales of time -in greater hierarchy-, their interactions generate dependencies: that agrees the flow of rain with the capacity of drainage of the system. In the well behavior of the system, both reach a balance with enough time or not that much turbulence to allow dynamics between equilibria, but in extraordinary events, when time is not enough to extrapolate the best and more efficient path, becomes more casual than causal. Flooding occurs where the section of the channel with a certain slope and friction does not provide the mass of water enough speed to drain the same flow that other sections manage (perhaps larger) upstream, with their slopes (perhaps larger) and frictions (perhaps minor).

If it rains less than the orography can drain, excess of flow capacity is transformed into randomness in a manner consistent with causality/casuality. In overrun and lack, both are far away from equilibrium and can be estimated quantitatively through the difference between the incoming and outgoing flows -the sign distinguishes them-, which is called Field Divergent, and is a scalar value wich actually preserves energy in space-time: if there is more energy per volume unit, it takes less time; but if there is less energy, it takes longer to drain. Lyapounov's candidate functions, -paths for minimum, maximum or inflection functions,...-, define a space of convergent level curves to stable or unstable equilibria zones, locally attractive.

A Lyapounov function with negative derivative will be attractive for destabilized situations; as positive values will spit out these configurations in a random way, offering broken reversibility when encountering singularities. Assuming that the configuration of reality does not always behave well and smoothly, and changes, the energy that get inside the system and does not drain quickly or very slowly, but accumulates and clogs, produces imbalance in a value that nothing means, if the distance between where the system is in equilibrium and when the bifurcation occurs, as an impatient solution to local overturbulence-without enough time to have absolute full information to decide-. To measure the equilibria in the phase space, happen something similar to measuring the randomness: with enough variables and good behavior, statistically we can go to a normal distribution, but case by case, emergency to emergency, each statistic will be of his father and his mother, intelligible, although not predictable, indeterminate "a priori" according to a probability, and explainable only when it is already happened.

"Strictu sensu" entropy is not disorder, but randomness that comes from disorder in cases of non-saturation or decoherence, or from cluttering with respect to its drainage capacity. Systems do not tend locally to clutter but to conserve energy in space-time-scale, and the overrun can be solved by more and more turbulence with no change of organization, or emergence of other different organization. Rests from clutters in the capacity to drain to saturation, may be invested in more speed of the same configuration in the ensemble or new configuration with new state values. When locally the system gets profit from the order in the concentration and complexification of the energy flow with less random walks, the reduction of inefficiencies between energy conservation and flow conservation, that profit tends to be copied: reproduction because it is already tested and by constructuality it is cheaper to use a better, stable and tested emergence to manage the overflow, than to speed turbulences.

Time do not brings randomness to the efficiency, nor the addition of local interests sum to the general interest. The selfish interest of each local subsystem in manage its overflow may not coincide with the interest of the general system, beeing the gap linear, multiplicative, logarithmic, exponential, potential, factorial, potential-exponential. The local management by water storage in a lake, may not agrees with the optimal solution to the overrun of the river in general. The sum of behaviors by local interest, can produce a collective behavior of different nature. The sum of the intentions of maximizing the benefit for each individual of a market, it produces a minimization of the benefit of the set,... or not: they are not linearly related, if the relation between them is asymmetric (merchants have different advantages). Complexity is concentrated locally in space (life increasingly expensive, in time (evolution accelerates) and scale (hierarchical emergence of organization increasingly complex). Growth in space means Expansion, in time is Entropy and in scale, Complexity.

The story of the continuous-discrete disparity of relativistic and quantum mechanics is repeated again and again in the dynamics of energy management with the scale. If the spatial flux is continuously concentrated in time, the hierarchy rises abruptly from level in jumps, in a sense aesthetically analogous to quantum, and which we call emergencies. Similar emergent levels may speak different languages -diverse cells understand chemical messages differently-, but they can share meanings: there are grammar, translators, codes and a semiotics. The levels of different hierarchies do not share not only language, but more than this, paradigms or properties: there are no translators and they can not always be understood, only tolerated and collaborate, even if they do it without intention or knowledge about their relations (a tiger is related to a deer but he do not has any intention to collaborate with the tiger because he is hunger, and they deeply collaborate in another scale: with no tigers, deers will have not enough grass). By jumping to a greater level of organization, the locality concentrates and the time references increase in order of magnitude. A cell

lives a few days in the body that lives for tens of years. Societies live for centuries... In the reducing frame of locality and time, turbulences has to flow with less surface the same energy, so they grew in intensity. If the time between turbulences happens faster and faster, it does in fractal reference to increasing units. Will their derivatives be related, converging or diverging?

While space and time references does not get another scale, humans will not conquer the outer space or aliens will visit us, because their references of time are not in the order of magnitude affordable to the interstellar distances. However emerging entities that may have some resemblance to the Matrix or the Borg Hive, with Gaia or Skynet, will have temporary reference frames of another order of magnitude capable to relate with the scale of distances. If it agrees according to cost&profit laws, they will seek their counterparts, with which they can understand and share a story, accumulate a history of inefficiencies, but they would not look for us. We would not understand them and perhaps we would not even know how to identify them as they identify themselves. If the Internet were aware and conscious of itself perhaps we would never know. We can imagine green little men, but we do not imagine that our cells want to contact theirs and wish for peace and love. There are no explorers of the galaxy at our level, but at higher hierarchical levels with other vital referents who live thousands of years. An amoeba does not travel from puddle in puddle, if it is not towed in the shoe that has stepped it.

In an expanding universe, with an arrow of time from the past to the future, the emergence of novelties is a generic consequence of the local agreement between Conservation and Continuity Energy when turbulence is not constructuality enough to solve. It is not a local exception. By Bernouilli Law, the extension of vital time forces to local space concentration, to maintains homeostasis -unstable and stationary equilibrium-. Changes and Causality accumulates inefficiencies and loss of information in its flow until it returns energy to the environment -became older-, and the subsystems -from the hexagonal cells of Bernard to the organs of the body-, specialize, modularize and unlink to a lower coherence level, one from each other. On the other hand, with the emergence, functionality is transferred from the structure of the configurations to the holistic and relationship, from the topology -geometry without metrics- to the dynamics -story of inefficiencies -, becoming increasingly dependent variables inside each subsystem. Thus, homeostasis costs energy but occasionally invest randomness, and inefficiency is the waste accumulation dump where novelties are generated, so reproducing is a need to reset the error counter and vices. From time to time the profit of an emergence is higher than all the dust left behind. Emergence takes as constant inputs from a probabilistic distribution of values defining independent new attributes clean of stories between them.

As we mix different perspectives -from saturation and unsaturation- of disorder -generates turbulence or diffusion, convection or conduction-, we also mix antagonic concepts in equilibria: more chairs than asses promotes disorder by entropy, and more asses than chairs unbalance the system by turbulence, and if it is not enough occasionally with stationary emergence of new configuration... some times called Life. Complicated is not identical to complex, nor disorder is identical to chaotic, not random as normal, nor sensitivity as to forget the initial conditions. There may be linear, multiplicative and non-linear stochastic chaos; but also multi-linear determinism, so complicated that we may confuse it with complex because insufficient process capacity of our minds and outsourced computing. If the imbalance is the accumulation of overflow by saturation of the drainage capacity of the system, it manifests itself in turbulence and is like the pressure on a surface of which we do not know "a priori" its resistance. The measure of the non-equilibrium is the tolerance of the container to the turbulence, the overrun rate relative to the drainage capacity of the channel: the flood intensity. In this hydrological topic analogy the drainage capacity can be calculated by slope, section and roughness; and it is possible to evaluate the probability of a flood for each flow. But do we know the energy drainage capacity of each process of non-equilibrium?

Lyapounov's candidates are sufficient but not necessary condition.

As long as energy can be stored and dissipated at a faster rate in the flow of what is absorbed by the system, it will be distributed with some randomness dependent on the decoherence of variables of the solution space -or phases-, below the capacity of the system to drain it and will be unused rest. It will be spilled to occupy with some degree of randomness the available configurations or chairs -like a gas in the volume of its container, or the clothes in the closet-, wasting that expenses in stay seated, but not in investment that produces complexity and flaws, successful companies and bankruptcies, without multiplier effect of innovation and competition. If there is more market than proposals, poor innovation and competition will favor more optimized, conservative, thoughtful and less original configurations, conserving most of information and energy flow; but if there is difficulty in obtaining, only the most risky ones will be able to survive at the extra-cost of information loss.

The equilibrium is stillness from the macrostate on the average values of those observable to its macro-scale, but conservative dynamics from all possible microstates to its microscale (lots of changes with no level increase or decrease). In microcanonical conditions Liouville's theorem reminds us of the conservative dynamics of a volume in the phase space, which is flux on a hyper-surface. If locally a contribution of energy overrun the capacity to be stored and drained, or the accumulation of information without being able to be processed, the postulate of microstates without being able to be realized, the trajectories that want to run the race will stumble as runners and bulls at the entrance in a San Fermin, and local imbalance will grow, creating pressure on the system limited by the maximum dissipative flow capacity, which can lead to instability and collapse... or to genius. The locally unbalanced and turbulent can be arranged in a balanced and entropic general environment with emergence, and vice versa.

The fact that not all chairs, niches and opportunities are occupied offers non-convergent decisions and prescribes a Boolean algebra, linear, or even multiplicative, with reversible operators. Leipzig type models (the minimum energy flow path is defined by the limiting factor, which by such condition does not have to have a normal distribution). Systems grow, evolution is continuous, development is soft,... every body live in wellness and equality kills proactivity. Death itself as a solution of thermodynamic equilibrium, supports the thesis of Darwin's cousin, F. Galton, who preannounced the Central Theorem -with the size tends to the bell distribution-, proposing the "Regression toward the mean": systems tend with linearity and independence, to mediocrity.

Death by minimizing energy when there is more chairs than asses; Turbulence by minimizing its derivative -flow- when there are more asses than chairs; and Life when there is investment of energy in change of configuration. Thermodynamic equilibrium vs homeostatic equilibrium. The stabilization of the energy flow -homeostasi - is the dynamic equilibrium of the system against the variability of the flow; and it dies when it surrenders because the stationary state costs more energy because the solution of minimum energy: not expenses in being carried by the environment. In stationary state the flow coincides with the dissipative capacity and all pharmacies and tobacco shops have a profit, the market is "perfected", with stable prices and no innovation. Marketing is then increasingly hard to differentiate the very similar products, and as the market matures, the marginal benefit is reduced until the launching of a new business, that never succeeds if there is not novelty in demand. The living lives in homeostasis at the price of mature markets, getting old: "when everyone thinks alike, no one thinks very much", (W. Lippman).

On the other side, the one that has more configurations than opportunities, prescribes a turbulent, non-linear "free of scale" algebra (Barabasi), with operators that break the symmetry and define an arrow of time that the system itself really forgets: in current terminology we call it viral. Viral

algebra systems emerge or collapse, there are hierarchical property changes to new state values, the addition or multiplication of local interests does not produce a convergent random walk in its inefficiency toward equality in trajectory length. Everything is uncontrollable until the counter is set to zero through the emergence of a upperscaled configuration in the holistic of a new system that is born free of the vices of its parents.

The KAM Theorem determines that a small nonlinearity introduced into a system produces a selective pressure against pure and rational harmonic movements, promoting the repetition of non-identical self-similar irrational patterns -rests, inefficiencies, errors,...-. When non-linearity is extended and reinforced, convergence is destroyed by a no return critical value, from which it is not possible to infer the survival criteria of some configurations before others... development and soft reforms may, hopefully, lead to self-similar or convergent political systems, but revolutions do not fit with revolutionaries expectations and each will be self-similar to others, but never a novelty may be known before the bifurcation. Every sudden rupture of the temporal symmetry proceeds from the bifurcation and amplification of an instability, from linear, through proportional, exponential and even viral. From a critical value of energy, the disorder and the unpredictable novelty, occasionally convergent towards some attractor, are progressed without any remedy... "autosimilarly" again and again, until in one of the jumps the hand slips or does not grasp the next branch and dies.

Chance fits the boundary between divergent hypersensitivity and convergent forgetfulness of the initial conditions. Hypersensitive may be an overreacheable complication for any ever computing capability, but what is not possible for the greatest of computers, may be determined by weak gods, and determinism is still there, maybe beyond our understandability, maybe inside a black box. The random chaos is something else: not even the main gods remember the wayback trajectory, unless they have the power to be observers in more dimensions and see at the same time causes and effects as points of a space-time smaller at any scale. After picking up statistics as a hitchhiker, dissipative thermodynamics, stopped at the bakery to negotiate with the irreversibility the definition of Freedom.

The thermodynamic irreversibility from the statistical mechanics perspective, distinguishes between evolutionary processes in the quasistatic microstates, reversible from equilibrium to equilibrium; and explosive and irreversible processes, which do not have time to pass through equilibria, and evolves between non-equilibria states (alike in quantum it is conceptualized resonant or intermediate particles, which do not conserve energy but the other numbers). The dynamic stability of emergent and/or catastrophic singularities: points of the phase space converging in stationary solutions or divergent in "jumps", introduces stochastic decision makers in non-equilibrium. The irreversibility without a balance with respect to which to refer, necessarily implies unplausibility: and causality on one way, means causality in the way back. Poincaré had already demonstrated recurrence, which means that divergence does not preclude a non-analytic approach to a pattern, but it will not be from the dynamics between equilibria, but from the similarity between the dynamics of imbalances.

Despite retaining information, hypersensitivity may arise chaos that seems irreversibility being only incapacity; however from oblivion the spontaneous order may also appears trough autosimilarity. Mathematical metaphors for string theory have been developed defining n-dimensional landscape of valleys, plateaus and mountains, some stable and other unstable, as configurations to look for a ball that we throw randomly in the system: "bifurcations" of parameter space and "attractors" of the solution space. By throwing a sufficiently high number of marbles into this "game", they will accumulate similarly to "geomorphologies", although with more than five coordinates, local stabilities tend to infinity, modulating the system into independent subsystems: as we see dependent

but autonomous functional organs if we look at lungs, heart, kidneys,... When it rains, puddles are always at the same sites and their size are of proportional: for several systems with similar variables, the "spontaneous orders" on which the Natural Selection will act, will be multiple and locally convergent.

A football match has initial conditions and well known rules, prediction of the movement of 22 players may be only possible if there are not random decisions, but we can not even forecast the score. The tree does not matter in the development of complex nonlinear or adaptive dynamic systems into turbulence, the purpose is not prediction because it does not always fits with extrapolation, but the description of patterns that emerge in the forest. A fully random system like lottery, has a better known statistical distribution than a partial random and complex system, although the "randomization" is not known "a priori"... but some times it is, and we call that Entropy.

It is not the same the sensitivity to the initial conditions -in which there are several degrees-, that the forgetting of the initial conditions -in which there are also degrees-. In deterministic chaos, so complicated that it is apparently random, by definition there is an underlying structure of order, but divergence does not allow the conserved information to converge. Being too complex to be predictable does not mean that it is not a deeply structured system and the indeterminate order that determines it, will eventually emerge. In the forgetfulness, it will not be the information conserved, but the convergence of paths of better probable solutions -not optimal-, from which will arise probabilistic patterns.

Deterministic statistics work pretty well when the average means more than variance; the randomness applies when the values are so dispersed that description becomes from the variance, better than average, median or modal value. Lévy's flight: the attributes of the systems that converge by different random high-variance rides are neglected into a bifurcation -a Markov property-, are not deductible from the state properties and laws of the resulting system. E. coli has a scourge which moves in long stretches separated by random changes of direction. When stops, interact with the environment, "smells", and the chemical messages that it perceives makes converge in its trajectories towards the place where the food is. Every stop, every synapse, every crossroads, every random decision, every singularity, every entropic provocation, is an opportunity for a dialogue with the outside world.

Symmetry: the environment modifies life and makes it evolve pushing towards some angle the random decision, while life modifies the environment and makes it evolve. Maybe to the right there are clouds and to the left it is sunny or maybe someone signs a fresh water source, and pushes towards a preferent trajectory. Singularities in bad-behaved functions are crossroads in which the system listens to the environment to decides modifications of the randomness in the inertia between past and future. Given a decision between left and right when there is a wall if following straight, randomness can be biased... promoting an advantage to some decision in respect a full random option. Not all letters have the same random probability in the alphabet, and after an A, B or a Z has not the same probability depending of the story development. In such a way, environment or intention can enter into becoming. There must be singularities, random decision crossroads, for a communication between system and environment, so those opportunities to talk are defined by the degree of freedom.

The homeostatic equilibrium is adaptation to the imbalance of the environment provided by an overflow, and the one knows about the other through discontinuity and squabbles, without which there is no capacity for interaction and though, adaptation. Two neurons communicate through an

intersynaptic space in which the concentration of hormones of some type, inhibits or spikes one path better than another. If the environment is not perfectly homogeneous, it will influence towards the more traveled decisions and as it happens in a path of a row of ants, the feedback of one of the options converges the system towards that option. Termites leave mounds of saliva containing a hormone of pleasant smell with a critical range, so other termites go to leave their deposits and the pillars of the termite grow at similar distances and build similar termitarium without need of architects or blueprints, nor sending them information.

A system will tend to be divided into specialized behaviors of subsystems that are increasingly independent from each other, rather than being divided into individualized behaviors of each of its elements, even if it is more constructive, as this would indicate a randomness without influences between particles: a total oblivion of the interactions and a maximum entropy increase. Because the story of interactions, every system tends to autonomy and dependency, being individualism and independence the optimal extremes in which the systems dies. Entropy and randomness promotes a increasing variance to infinity and beyond. Non-derivability and discontinuity, give us the capacity for decision, choice and error,... Freedom.

In statistics the average nothing means without variance or even without the analytical description itself. In classical formalisms, non-solvable functions by analytical methods, "factorize", "linearize",... but from numerical computation, this allows more effective approximation into better-behaved functions, at the price of applicability intervals. We can not withdraw the error range of an approximation or the interval surrounding a minimax of a factorization. Relationships between modular subsystems are combined by the relationships between its elements: lungs and heart are both influenced by red blood cells as messengers, which are specialized cells of the same hierarchy as the cells of each organ, introducing an additional axis of Scale, to the structure and functionality, time and space. Enzymes handle time and space magnitude orders, different to the genetic frame information that codifies its concentration in time and space. The axons development handles time and space magnitude orders, higher from the transmission between neurons of electric potential. Paradigms handle time and space magnitude orders higher than the ideas, experiences, observations, theories, prejudices and experiments which define them.

Each hierarchy of scale reset the memory of the system to zero interaction: as a black hole with no hair, the emergence of the story of friction between elements of the system is forgotten by the new system. Among other elements, friction manifests itself with other state attributes because it is the story teller of inefficiencies and vices between particles, and randomness is translated as entropy when considering temperature or pressure as translations of kinetics: they do not deny the existence of friction in a minor hierarchy, but have another statistical way of describe it. Language changes and to understand the criteria of the higher level at a lower level, it must be summarized... like order a dog with a short and language. The Entropy Law is to recognize without explicitly accept, that ideal systems come from real systems, which only in their beginning are immaculate, that age and accumulate vices and mistakes, that not all credits are returned, that not everyone is good, or bad, that we do not always fullfill expectations, that we can not go backwards to life and decide again with no error, that there is no inertial movement or well-behaved systems in all space, time and scale.

We could enunciate the Second Law of Thermodynamics as the price for the First Law of Classical Mechanics: in any change there is friction and it is not possible to idealize a dynamics in which the motion of the particles of a system is decoherent and extrapolable. We measure our ignorance -the degradation of our knowledge- by the prejudices assumed: ideal non interrelated systems do not exist. Almost all systems that change over time are dissipative, but in laminar numbers some can approach to inertial. Entropy is the cost of fitting in a finite time and space Energy Conservation an

Continuity Conservation with Causality restrictions; and disorder increase it though a consequence of deeper reasons. And by the way, Life is the same but on over turbulence flow.

By resetting the counter to zero in the initial conditions of a new hierarchy, the continuous variables are replaced by their statistical state values, simplifying the story and forgetting that they are sons of much complex processes. In a match, the ball is not described by the kinetic attributes of the inside air temperature, the resistance of its leather, the suture strength of the seams, the color, their dissolubility, the adhesives,... but as a sphere of radius, elasticity, weight,... and beyond that, for the "football match" system becomes a dimensionless point located in its center of gravity, where a kinetic moment is applied, and the calculation of its trajectory is idealized and approximates inertially, forgetting the movement of the gas particles on the inner walls. Ressetting the counter to zero, the air particles of a ball in a leather cover with a statistical description to continuous, and which was continuous can be quantified in numbers of balls, players, goals... Continuous and quantized description take turns on scale.

In its mathematical description an electron is an space-time distributed field, and in the next hierarchical level it is described by the properties applied to a point in its gravity center. How can we define it as Fundamental -not divisible-, if to define it we have described it as a "cloud of probability"? Everything is fundamental in its hierarchical level if it is defined according to the language of properties in a determined scale. Fundamental must be reconsidered as Inertial... "smooth" (Sisyphus): the freehand curve match at any scale for any interval, with a fully derivable function, without rest. The fundamental world is fundamental geometry and quantum means emergence from deeper scales. The constituent elements of a hierarchy level are resseted dimensionless points that summarize complex distributions of interrelated variables, and thus the dimensions are the state variables of the upper emergent level. Is there viscosity in the excitation and de-excitation of an energy level in an atom? Does the Fundamental Level exist or even the subatomic particles are fractal systems? If so, what happens in between the Planck scale and de "zeptoscale", from -21 to -44 seconds and meters?

The Theory of the Everything, better be called Theory of Anything, needs to get rid of the inertial to unify the questions in a single paradigm, to have one instead of several answers. This premise is not fulfilled if the inertial movement without friction of the dynamics and the principle of relativistic equivalence, must coexist with the movement with friction, inefficiencies or entropy of thermodynamics; the determination of the position, with the indetermination of the moment; and the fractality of laws maintaining attributes and language, with hierarchy. Development within each phase -progressive, even chaotic evolution with time invariance-, must coexist and take turns with the change of phase and attributes in hierarchical systems -evolution with jumps-; determinism and irreversibility. In a negotiation everyone must reconsider their position and transform something essential into an accessory to build up from what is common. There will be no TOE without POE, - "paradigm of everybody".

Changing the scale, dynamic laws of the particles movement, changes to the laws of thermodynamics forgetting something at rest. If we take the scale as another alike dimension of the system with space and time, the rupture of symmetry evolves the phase to change the attributes with scale, and the spatial -structure- and/or temporal -functionality- may not be conserved. The accessory may be inertial at the beginning of a resseted emergent and non-saturated system: "ab initio" systems in which the addition of individual actions produce a collective behaviour vs. systems in which the sum of good intentions, generates an unfair, authoritarian and cruel system (universal love leads to the Inquisition, or the vote of ignorant, interested, selfish, cowards,... reach a democracy with better decisions than a philosophers dictatorship). Which magnitude does not conserve in such a broken symmetry?

In locally oversaturated environments, the overflow in relation to the divergent supply limit or drainage of the energy, generates turbulence as desperation to recover by bad ones the balance with the constrain of space and time frame, when by the good ones it does not arrive in time: a hurricane is a hurried way to recover homeostasis and lower a few degrees of temperature to approach to equilibrium, wide areas of the ocean. If it is done by conduction or radiation, it would be slower than the rate of accumulation and would collapse or eventually emerge a new equilibria in a higher scale. Nonlinear, dissipative and non-conservative turbulence, for some alike a non-zero-sum of action&reaction, is for others a broken symmetry, and necessarily implies non-conservation of a magnitude. Only in the imbalance between non-equilibrated stationary states is it possible to have a commercial relationship in which both contractual parties obtain profit (“Coase's Theorem”: equilibrium, balance, equality or justice are death) or prejudice (“Entropy”: inefficiency of distance to optimal walk), and by interpreting E. Noether, do not add-0 and the distance to the equilibrium could be sized by a net flow.

Rescuing a previous metaphor, imagine again the inhabitant of Fatland, living in a world of two spatial dimensions, to which reality offers several doors to decide his career. They are closed and he can not see behind them, but chiral observers of a tree dimensional world will see their world from "above" as enantiomeric deities. They know the path from the Sky, but the flatlanders do not. Each choice confronts our mouse to another decision between closed doors that for him are the same, but have different loses and profits. From our dimensionality we have the information to know the optimal path, but the system in a less dimension loses the reference when choosing to enter by a door, because when passing, it closes and looking back, the door that entered is identical to the others. The probability of walk the lower cost with greater benefit trajectory, is reduced with each random decision. The lengths of the possible routes of choice make up a statistical partition function, whose the average length is not the most optimal path. If we equate the length of each trajectory with the energy of each possible microstate, we converge in the definition of Entropy as cost or friction of adaptability to the environment. We make many decisions in our life but we do not get the best ride, just because our dimensionality limitation. Entropy warns us that nothing is perfect, we are all mistaken and mistakes left a rest behind,... nothing new, but the story of its why. If Freedom and Random are synonyms, Fate and Entropy are antonyms.

Identity in a description is formally understood in maths by the disambiguation in the result of the formalism used (the sense of the consequence does not depends on the perspective or paradigm). At least from its story and without interpreting mathematical with phenomenological coincidences, Feynman's multiple ways method was shown to be identical to Heisenberg's matrix and to Schrödinguer's wave function. All of them are also identical to the random walk method of stochastic walks to quantify randomness -freedom degree- with respect to the combinatorial numerical calculation of the "divine algorithm", which also estimates the potential of the exclusion privilege or advantage, including the degree of perfection. Inefficiency as a rest because Causality, is equivalent to the improbability of Boltzmann's microstates, and this converges to Clausius's method, which both are alike to the “loss of information” of Shannon. Entropy is the direct consequence of the Principle of Causality: the cause always precedes the effect... and because the unknowledge of the future, the choices in scarcity, makes us not always follow the best path for Continuity and Energy Conservation. The inertial extrapolation of a function, can be counteracted by discontinuities, where and when they communicate and interrelate system and environment.

We all know, to decide is eventually to make mistakes. With this perspective, the Second Law of Thermodynamics is the same Law of Causality -the ignorance of the effect generates the inefficiency through the gap between inertial decision and reality-, the Law of Reality itself. Nothing is perfect or the optimal, well behaved, deterministic, microstate has the “divine algorithm”

probability. Natural Selection of the most inertial trajectories or solutions in interaction limited by the speed of response required by the flow management, will evolve the system to a distribution that will prefer those microstate or algorithms, that optimize a better local result with the information available in local, modifying the distribution from "smooth" to "rough". The number of paths of equal length or number of solutions with the same number of steps, is the probability of each path or steps for the solution, and they form statistical distributions identical to the Partition Functions, which thus have "Identical" ways to be defined: independent from the formalism.

Apparently nothing new to redefine what is "identically" defined by equivalent modes,... but consider the mathematical definition of entropy as inefficiency in a random walk dependent on randomness in solutions, and interaction as "friction", establishes another bridge between the physics of the macro and the micro world through the irreversibility of non-equilibria dynamics. If the entropy is the inefficiency of the weighted combination of the energy flow trajectories with respect to the optimal path, formally the average of the statistical distribution of the lagrangian of the energy states; and the distance from equilibrium is its standard deviation. In homeostasis the system is maintained with energy inputs, stationary because it remains at the same distance from the equilibrium, and death is the increase of the variance to the infinity and beyond: when, however much the microstates move, the macrostate remains quiet.

A film with all its ordered frames makes sense, but the story becomes foolish as its entropy increases because perfection is for gods. If the mathematical condition for free will is the imperfection and forgetfulness of the initial conditions that a god invented, would not we be the scrap of his failure? Why create something perfect and at the same time provoke with the expansion its degeneracy? Are we forgotten feces and freedom our stench?

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