PROPOSAL OF IMPROVEMENT ON THE ENUNTIATION OF THE LAWS OF STATISTICAL MECHANICS AND SOFT DEFINITIONS OF FREEDOM, LIFE AND DEATH: CAUSALITY-CONSERVATION-CONTINUITY

A paradigm is a set of questions, principles, idealizations, simplifications, assumptions, language and procedures, even prejudices, but not necessarily answers. Against the Totalitarism Principle, "*Everything not forbidden is compulsory*", Cognitive Dissonance states "*Concept existence depends on language*". In physics the language is mathematical, which, like poetry, is 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 is a language that can often rationalize and even demonstrate a thesis and its antithesis, but as any language it is the limit of the existence: what is mathematically inconsistent cannot be real, but even if it is consistent, may or may not be physically real. Reducibility of Classical Physics, linearity of Quantum Physics or Reversibility of Relativity Physics do not share fully the paradigm with Statistical physics and though cannot be unified without negotiation between all of them.

Inside a Linearity, or Reducibility, or Ergodicity, or Reversibility, or even Complexity,... the most fundamental processes became understandable with maths procedures, yes, but that has the price to idealize the inter-relation between more fundamental elements scale dependent, creating a model that may or may not be real. Reducibility and Idealization are powerful tools, but always attached with conditions of applicability and observability. 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 point vicinity 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, but is that algorithm the optimal or the better efficient? J. Balmer proposed the bet as a better method of scientific projection than the verification and deduction, which is precisely what Monte Carlo its local and multilevel improvements apply.

From Malthus to Logistic Equations, it is stated that growth and knowledge has limits. Not only for the man kind, but also in the computability of the real interactions in a system. Every nonlinear system can be described locally through a linear approximation -taylorization- or exactly by a variable substitution at the price of increasing dimensionality (ex. nonautonomous trajectories on the phase space can be autonomous adding a variable), which can or cannot be worth of and if not, the complexity may emerge. The distance between reality and its polynomial description it is sometimes used as a measure of Complexity. So, nonlinear phenomena are not always the same as a description with nonlinear equations, but in general terms the response of a linear perturbation, will obtain locally nonlinear outputs that can often be described with a scale-free and universal power law (renormalization). The more useful and powerful tool, the more dangerous and risky.

Physics split linearly on ideal worlds of superconductors, perfect gases, incompressible fluids, zero viscosity, frictionless movements, inelastic shocks, independent variables, uncorrelations,... which worked and works usefully, until analyzing the transformation of heat into work and the angular momentum conservation of quanta, and 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. As it is a well possed formalism based on a blurred word definition, this multi-concept also means the distance from the model to reality, because the idealization.

Like Life, Time, Complexity, 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 and disagreement between paradigms. From the relativistic, thermodynamic, statistical, chemical, quantum,... even philosophical point of view, the energy definitions are related but they are not the same: from scalar to canonical energy-impulse tensors and each one described from different metrics. 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, it and me.

Energy comes from the Greek root for "activity" in an implicit direction. Entropy is etymologically "turn around" in the figurative sense of transformation: "evolution" in a never ending history, in a cycling direction: in our times, means are up side down. A change between microstates with same overall energy 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 may be in its 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 is temperature, T; means inefficiency in the use of this energy to move, S; and internal energy 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’s hamiltonian?

Quantum fields are ideally inelastic without rest (the energy absorbed and released by a change is indistinguishable, identical and symmetric or antisymmetric, but not asymmetric). 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 -trajectories as microstates- from the same to the same points with identical T,U,S. The entertained energy U, is distributed between kinetic energy flowing at different speeds due to the structure of the system, friction with the environment and the “investment” of energy in system structure transformation (which means information increase), 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. So when we change the scale from micro to macro, the system determines itself. Scale heals and ruins everything: in any change for every trajectory, some agents wins, some of them loses, but it is not possible than all of them wins the optimal for each… it is not possible to change anything with no critics, and there will be always inefficiencies: the optimal change has not the highest probability in a single stochastic configuration.

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. Reality caps the space-time: with more space, less time and with more time to reach the next state of energy and information (structure, which means memory), less space will be equilibrate. 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 of the non-hair transformation from TUS_2 to TUS_1, but not exactly with the same space and time.

Adiabatic transformation, as a very slow change, are idealizations of Statistical Mechanics and the Entropy is consequence of holding it as fully real. Systems will have to decide its trajectory with space-time limitations and if they have enough time to decide the optimal microstate set, they will not have enough space to apply and will remain local; while it the system wants to decide knowing the energy of all microstates of the systems, it will never has enough time. As times goes on at a certain speed of causality, c, with systems of a huge amount of agents, will never change ideally with all the information needed for the optimal trajectory.

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 for everybody, stochastic structure or "roughness". The investment of memory on structure is extracted from energy. 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 and things happens with out waiting to the optimal option: as one scale has not the size or space of another scale, they neither have the same time. 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 and microstates are equivalent, but if there is an asymmetry, there will be different efficiencies. Different price/performance options. 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-, it means that there is not investment in memory and 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, but also limitation of space and time for making real the options, 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 also the other way round: time scale is what introduces the asymmetry in space, and vice versa.

Only in scarcity of space and/or time, with many options of trajectories from one point on the phase space to another, they will have a Darwinist selection process, because not all of the states could present its option to be evaluated for the reality and then selected because its efficiency in the flow. Regarding the Bejan concept of optimal flow for the minimum effort, the constructual process to find the optimal flow will not always success to the optimal because the scarcity of space and time to find the best configuration for every single element of the collective, and the system as a whole will have to evolve into the better between all option that in a limited time and space reality may

offer, which maybe is not the best microstate flowing to choose if the system would have enough time to randomly essay. The investment in memory would be selected and persist if the structure increase the probability to choose a better configuration with the same limitation of space and time (like a search in a data base, that would be better if it is referential than sequential or random).

Maximum Entropy Principle from Gibbs, states that for any exhaustive, mutually exclusive set of events without background, the distribution will be the one defined by the Principle of Indifference: uncertainty, or every event has the same options to be true; but if the distribution is constrained by the stored information, the most likely probability will be a maximum less maximum that the first one. So, any information remaining on the system which improves the predictability, reduces the entropy through some kind of organization. From a completely noisy and random distribution, self organization is just a consequence of been able to store information of the past, locally diverse from other sites on the space.

Reality is often presented as simple when it is analytically predictable. To visualize it, imagine Sisyphus raising a water pitcher to an ideally smooth and symmetric hill -to be a metaphor of quantum mechanics, the hill soil has to be waterproof-: with no effort water from the top will flow evenly to the 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 (any trajectory belongs to the same microstates set). If the soil would not be waterproof or the slope would not be identical in every direction -asymmetry-, 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 depending on the past paths scratched by other drops (memory). Without the irregularity, or with no several different roads, there is no roughness (any structure will give a better path), and both energy and flow are conserved: one path will statistically be identical to other and compensate statistically over time. There may also be complicated, unpredictable but reversible, non-analytical or non-linear systems.

To introduce the concept of irreversible flow different than the energy conservation, we can imagine a no-waterproof soil, that may drain energy at different rates over or underneath, increasing by one the degree of liberty 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 statistically the same (same set of microstates); 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 is the origin of a Perfect Creator God.

St. Augustine claim for perfection in Heaven, and Urban VIII declared “ex catedra” against Copernican thesis. 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,... was rejected with action-reaction arrogance from Inquisition. The story was repeated with Darwin, whom maybe could have been tolerable as a way back to a "Creation", but again was worse because its opposition to the "Natural Theology"(an extension of the measure of God and Devil according to the “Gestalt” view of Nature, with its victims and sinners, predators and parasites, good and evil). 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. Botzmann showed us again a development of imperfection and non-objective of nature: how does a smooth and predictable Universe transform

surjectively in a Universe with random options. From determinism to irreversibility.

Only a "non-smooth" universe, by interaction, with both local inhomogeneity and time asymmetry, has a chance for local “roughness”, and if so, the flow in the transformation of energy between two identical states, depends on the path: the environment. 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 best future, because it does not know the consequences of its decisions and has no time to evaluate through a natural selection process for the best, only for the better. Decisions are always extrapolated as reality would be deterministic, but it does not select options according to an optimum utility in the energy balance, 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. Each trajectory between states will have randomly different investments in information, and with scarcity of reality there is a “darwinism” for the options to perpetuate and the better structure, built with memory investment, but not the best, will persist. The mechanism of adaptation to the future depends on the Serendipity.

The quantity of information is the average number of yes/no “boolean” questions to determine all possible observables: position, moment, charge, mass,... with finite computational resources. To determine a state completely it is possible to ask questions in different ways with more or less efficiency and in a different sequence. The structurelessness can be estimated only in a finite set by KCS simplicity, as the minimum size of a program to compute a trajectory of questions; and trajectories may be an statistical distribution. In Operational Research it is called the "God’s Algorithm" as the minimum number of questions that determines completely an observable, that with limited time will not coincide with the average, and the distance to efficiency or inefficiency, will be the entropy of the information.

The Traveling Salesman Problem. A salesman, must visit a number of cities in the desert. There are no mountains, rivers or other obstructions in the region. He wants to know what is the shortest route that goes through all the different cities. Each specific instance of the problem is particular collection of cities or, mathematically speaking, a set of points in the plane. The size of an instance of the problem, n, is simply the number of cities involved. How hard is this problem? When the data is presented pictorially, human beings can solve it pretty well. However, we must remember that even if Maria is exceptionally good at solving the problem, what Maria(n) measures is the longest it takes Maria to arrive at the correct solution for any collection of n cities. No human being does well according to this strict criterion. We do not always see the absolute shortest path between the n cities; we often identify a route which is close to correct, but not quite there. And we sometimes miss the mark entirely. We are not very good at solving the Traveling Salesman Problem, in the sense that there are instances of the problem for which we get the answer wrong or take a long time to get to the answer. But we are good at it in the sense that most of the time we get reasonably close to the right answer, pretty fast. There are two different notions of proficiency involved here.

The simplest way to solve the Traveling Salesman problem is to list all the possible paths between the cities, then compare all the lengths to see which one is the shortest. The problem is that there are just too many paths. For instance, if there are 5 cities, then there are 12 paths. If there are 10 cities, then there are 9!/2 = 181440 paths. If there are, say, 80 cities, then there are more paths than there are electrons in the universe. Using this method, the number of steps required to solve the Traveling Salesman problem increases very fast as the size of the problem increases. So, given a large Traveling Salesman problem, even if computable, it might be better to apply erratic intuition than to use a computer to investigate every possible path (with no strategies there are not enough bits on the Universe to solve for the best.

For the Statistical Paradigm, this is a reformulation of the Maxwell Demon Paradox given by the Szilard Engine: supposing a very slow -“adiabatic” change- in a single particle in a box, Landauer states that computing information do not cost entropy, but erasing to deliver full accuracy with limited memory and process speed, does. This is a consequence of idealization for a low n number of particles: with not few but such a number of cities, n, that permutations grow to factorial on the problem, we will never be slow enough to change a system of many agents with full information because c is not infinite. Idealization put the focus on erasing, but reality remember us that computers are limited. The limit of process speed and memory is for exploring all permutations, that do not cost anything for the single particle of the “ideal model”, but do cost a lot if there are many and cost more money that all of the world if many is a bit more than that. Computing and not erasing, spends efficiency as it is limited in time to explore all trajectories for the best. Computability is the absolute fence of the space of options that remember every interaction, but time to take a decision breaks the information availability and crossing the border, even if it is computable, as information is lost in the process, we get Chaos.

Suppose you run a bank, and you have three loan officers working for you. Officer A is very methodic and meticulous. He investigates every case with the precision of a master detective, and he never makes a mistake. He never loans anyone more than they can afford. Everyone he approves pays back their loans, and everyone he turns down for a loan would not have paid it back anyway. The only problem is that he often takes a long time to determine his answer. Officer B, on the other hand, works entirely by intuition. He simply looks a person over, talks to them about golf or music or the weather, and then makes his decision on the spot. He rejects some people who deserve loans, and he gives some people more or less money than they can afford to pay back. He gives loans to a few questionable characters who have neither the ability nor the inclination to pay the bank back. Suppose that, although you really need both, you have been ordered to cut back expenses by firing one of your loan officers. Which one should go? At first you might think "Officer B, of course",… if the number of customers is low. But what if you have a lot of money to lend and a great many people demanding loans? Then A might be a poor choice, after all, B will serve a lot more customers each month. Even though there are some cases where A is much better than B, and there are many cases where A is a little better than B, the time factor may tip the balance in B's favor.

A real bank executive would find someone who is both: fast and accurate (only in two dimensions, which forbid the options for chaos, much more if we consider more capabilities). No one has yet found an algorithm which finds the exact shortest path every time much faster than the simple method given above. Second Law say that such algorithm will never be discovered even if there is not a limitation of time. The Traveling Salesman problem and hundreds of other important problems have been shown to be "NP-complete", which means essentially that if there is a reasonably fast algorithm for solving any one of them, then there is a reasonably fast algorithm for solving all of them. That build a bridge between Entropy and Gödel's Incompleteness Theorem: that there's no way to prove that they do, and there's no way to prove that they don't. PAC algorithm is Probably Approximately Correct: the better enough, not the best; and we use very commonly those methodologies in numerical approaches.

Decoherent microstate is a commutative set of correlations, no chaotic, decoupled and so ideally reversible and completely efficient. One can reach the same description from a minimum of bits, out of trace, but usually, as time for decisions is finite, the number of questions will not be the optimal, just the more effective branch to get the answer in a limited time -PAC-, so any decision will include an Inefficiency of Incompleteness of the Analytical Solution vs the PAC. Different ways to answer means different “copies” or “branches” to reach to the same non-complete description by each microstate of bits. Central Limit Theorem states that the set of microstates of questions follows a Normal Distribution. The most redundant set of bits of the environment to describe a set of questions or Branch, will not be complete, though the optimal number of bits

which define the size of the “copy” it is a rare microstate, and the average out of decoherence, is not the optimal path of questions. Randomly if one have n bits to questions, the more redundant number of relevant answers, will never be also n, but less.

The probability of a correlation depends on the distance and the information that yields on its observables is equal to the information that the environment takes when they interact, only if it does it according to the most efficient question trajectory. It is unlikely to perform a set of interactions that do not consume memory and though, have no consequences in the efficiency. The Non-Cloning Theorem states that every interaction is a contamination if it is not reversible and leave a non-zero commutator. Next interaction will be on another different system, but if symmetry is a property in all of the variables of the system, the sum of the inefficiencies in the transfer of memory in the correlations may be compensated and the overall commutator will add zero.

There is not a counter that organize every single particle of a system to interact once with another system. There will be particles that randomly never get to be correlated and others that can participate again in a transfer of information in other interactions of the same measurement (probability with repetition). Each interaction does not discard the particles that have absorbed information from the system and this produces a non-zero commutator, which means inevitably an arrow on time. (The problem of the observer is the problem of asymmetrically contaminating the states of an isolated system). The interaction between hamiltonians that commute or whose commutators compensate because its symmetry, does not disturb the observables. Commutators are therefore the way to measure pollution -non-linearity- in the correlation between systems, (for example, observer and observed). So, asymmetry can be a local property of a system (i.e. environment or bath) or a correlation between systems of different sizes and/or structure (information).

Non-zero commutator, describe contamination, or distance to the orthogonality, or the sum of the energy losses, or the entropy, or the information losses because the local-time limitation to explore slow enough all possibilities. A contaminated systems interaction between more than a small number of elements (the typical Three-Body Problem), may drive to a cheaper description relying on patterns, because the non-isolation of its particles promotes a description of chaos, not available from the description of its agents. Correlation gives partial information of the system in many branches of the other system (i.e. environment), that together contain all the redundant information, that if it is added it is repeated, but it is incomplete in each microstate of information, and because it is divided it is not a linear relation. In a billiard game a white ball correlate with a triangle formed by ten colored balls, and when they crash the resulting system has split the information between all of them. If a complex system (like an “apparatus” or an “observer”) has internal interaction between its own particles (“noise”), a correlation will tend to be chaotic, and the information given will be spread and shared, summing more copies of the correlation than one, in no-identical versions because each one may not be complete in a finite amount of time.

If we want to know how many fish there are in a pond, what species they are from, how much they weigh, what ages, ... we will need statistical methods: fish, mark and return it to the water. The probability of catching it again estimate how many there are. But when introducing structure -rod and expertise-, fishes have modified its behavior because although it has a narrow fish memory, it has the memento that it hurt when it bites the hook and changes the probability that it will bite again. Each trial will be an incomplete copy of the system of fishes in a pod. The fishing methods that consume less memory, less invasive and traumatic for the fish, will be more robust and in less number of trials they will obtain the result with the same margin of error. The states of an isolated system have a probability, but also a fragility, resiliency or anti-resistance, which is the tendency to change to a state of greater entropy, which contains more quantity of randomness, which is less information.

If there is scarcity and reality is a single one and options are many, the Evolution Law is not an option, and if several branches and copies compete and collaborate to persist over time, they will end up selecting those that are quickest to define an interaction between systems, environment or apparatus, faster by having fewer doubts. But all states are not equiprobable, so more resistant is more redundant, with more incomplete copies produced in their interactions. Greater progeny. The more redundant, and more progeny, more objectivity, because different devices will arrive at the same pattern, being precisely the most abundant (according to a normal distribution, in which the majority is the average). Microstates compete and collaborate, the more reliable microstates in each interaction will be more redundant, the natural selection for any “observer” will always be the most redundant set of microstates. The more resilience, the best option to persist and/or reproduce as much similar as possible. "For a finite-size system to persist in time (to live), it must evolve in such a way that it provides easier access to the imposed (global) currents that flow through it."

Was the universe born from random or was it the whim of a thug God? Maybe a Creator is just an observer who breaks a symmetry through his correlation and certainly SHe is not Perfect. Only a single and alone Sisyphus will have no chance of pursuit eternally his punishment and even encountering other Sisyphus who sustains its punishment eternally, their correlation will produce commutators that will compensate. Whenever a different size of another punished small gods or local inhomogeneity enters the Hell, there will be interaction, competition for space-time and though roughness, loses and inefficiency. With a small non-linear disturbance, some torus will be deformed and others will be destroyed. With no external add of energy and symmetry break, they will be balanced, and then the relations between local concentrations may join discrete vortexes far from resonance: those that have a ratio of frequencies near irrationality.

In reality, with enough number of cities, there is not time enough to compute all trajectories and systems evolve between non-equilibria macrostates. Entropy is just the distance between this reality to its idealization. Ideally Sisyphus evolve from equilibrium to equilibrium, but an overflow can force a pass through a dissipative microstate, out of equilibrium, because the limitation in space, time and scale, 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 Sisyphus carrying water in the landscape of local hills and valleys, who have established relations of mutual help, but not between identical agents, 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. Diversity introduces options and the scarcity of available realities and time, selection. With the desertification resulting from overgrazing, the camels succeeded the cart and the wheels in the Near East, the future returned to the past by not the same path. Nothing force to advance to the better with no scarcity, but irreversibility make changes that makes the flow cost in energy different in probability, depending of the trajectory 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 -scarcity of space or limits in a box- or time -c is the limit of causality-, no dissipation to irreversibility, nothing happens although the ergodicity: many decisions equally probable, will compensate mutually. Interferences between them compensate in a sum-zero if the symmetry is maintained, because there is enough space and time for selecting the best between all options, but if there is scarcity of computability, local asymmetry and interaction may have a Liapounov Sensitivity. Goertzel distinguish between structural sensitivity and sensitivity to the initial conditions, so a system evolving with small-big values, will converge to a pattern.

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 stochastic options occur in scarcity. Even then, interaction between similar compensate over enough space and time, but an interaction between different hierarchies, may introduce a decompensation, an asymmetry because the different languages of state variables of each system. 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 auto-similarity but no progressivity.

When induction is replaced by analogy for better forecasting, properly next to a crisis or scale jump, there has to be a recurrence with a short return time (because Poincarè Theorem, the history repeat once and again, but the characteristic time is affected for a constant powered with the very big number of agents of the system, the loop can be longer than the Universe live itself). Kac's Lemma for stationary ergodic processes states that for a quite low precision, a high attractor dimension -typically more than let's say ten or less-, neglects recurrence. So, even in around a discontinuity, near the phase change or a catastrophe, is possible to find auto-similarity, limiting the accuracy for the scope of analogy. We like most induction and it gives us more and better information, but when it fails, it does not work at all, the alternative is analogy, which use to be much worse and tricky, we do not like to lose scope and knowledge, while it is better than inductivity, nothing at all or randomness.

Why from a random flat distribution becomes some local diversity? Time means diversity between microstates, then evolution. Why linear regime evolves to complexity? Maybe there is another way that anybody had think about, but the idea in the whole History to solve the breaking of a symmetry to start, is either an observer of a different scale or a spontaneous phase transition on the evolution of a critical parameter that promotes a disorder-to-order growth of hierarchy at the price of a symmetry. Maybe it was just a rotation: Abo-Shaeer reported in 2001 the emergence of a pattern in a vortex lattice due to the rotation of a Bose-Einstein condensate, using the optical dipole force exerted by a blue-defined laser. We do not know what was before the Universe was so hot,…

The system needs evolution, so time dependency, or It or Him must observe Our System (fixing the boundaries by observation, the system decides an emergent shape, like it can be seen in any Bènard-type experiment with different containers and sizes), called Reality, with limitation in the availability of space-time: finitude. Some call that concept: God, Pantheism, Anthropic Principle, or in the lowest sense, just a Big Bang, a Cosmological Constant as an external input of energy, a Phase Transition because a critical parameter, a Naked White Hole or the birth from a wormhole of a bigger Universe. God may only needed to twist a bath. In any case randomness or interaction and so, no-isolation of our reality as a homogeneous and isotropic bath.

Once a complex observer exchange information with a bath, -our reality-, information about its complexity is given to the bath and also the other way back. Because its complex relation between its own agents, different partial copies of our reality configuration modifies the observer information with redundancy and that defines the asymmetries introduced for it in our bath. A perturbation may decay again to a distribution with any mean and infinite typical deviation, but any permanent asymmetry may diverge because promotes a Natural Selection between configurations, to solve the problem of Energy Conservation with the Continuity, and the asymmetry creates diversification, and though locality.

Let's imagine a pool table with a white ball hitting with a twelve-triangle balls. As the Three Body Problem, each event will produce a different hamiltonian because the interaction between the

colored balls themselves. As the Central Theorem states, the distribution of configurations will tend to a Normal Distribution of final positions on the table and that includes white ball as a single particle system of a lower hierarchy. There will be irreversibility and unpredictability, but not locality: normal distribution remains smooth and its deviation will be still infinite. Something else is needed to produce a cascade of local solutions for the Conservation&Continuity, which could maybe be the asymmetry between the growth of space vs the growth of time. The expansion of the early Universe may produce availability of space and scarcity of time and the configuration for managing the energy and flow conservation, creates a cell structure in the CMB, than will seed local galaxies.

The Kolmogorov waterfall spectrum describes an energy input from homogeneous initial and isotropic conditions, the cascade of energetic structure of the turbulences. By reinforcing the relation in irrational layers between elements competing to occupy the same space-time-scale, from a completely smooth system, the amount of input energy defines the scale of the primary turbulence expanding along its axis and compressing in its perpendicular, to another output scale in a "rough" dissipation when the viscosity slows down and destroys them. Energy injected on a scale dissipates at smaller scales and breaks locally some scale symmetry. If there is local diversity there will be some kind of repetition born from higher scales, there will be periodicity and therefore there will be difference between rational and irrational resonant solutions, creating discrete layers. Is an energy overflow enough to break the symmetry? "*Large spirals generate small spirals, which feed off their speed. Small spirals generate smaller spirals. Thus, until viscosity* "(L.F. Richardson).

Why reality prefers rational relation and eigenstates? The any-mean and infinite-deviation distribution is perturbated by the Observer of another hierarchy with information which provides some structure in exchange of the information given to the observer, decaying in cascade as local spatial diversity if there is an asymmetry in its evolution. If there is not any other interaction, the flat distribution will be modified and though from out of equilibrium will come back to the any-mean and infinite-deviation, even trough turbulence or smoothly. If there are interactions before reaching the equilibrium and/or the information given by the complex system offers some memory and rules (rules are stable interaction between memories) and/or the interaction promote a distribution with higher order cumulants (asymmetries in its shape), the altered distribution will have the option to cascade in local equilibria.

Homeostatic solution is not better or worse than either a turbulence or smooth evolution, to solve the Conservation&Continuity dilemma, but as P. Bak states: self-organization tends to be typically near the Criticality. ¿Why reality feels so comfortable near Criticality in such a dangerous sites of the phase space? The minimum investment of energy into a solution in a configuration for flow conservation, the better benefit essaying with nearest neighborhood of microstates. The system would never prefer to go far away to look for some improvement if it can find it nearer. It is just a well known economic law: after a novelty with high profits, margins will decrease as other microstates near the new one, will try to get as well the business. Stable markets means low margin and high risk with many changes of companies offering the same. Homeostasis is just a more efficient near-turbulence management of the some values of flow, due to the stability of the solution given by the structure -memory+rules-, of some phases of its evolution. So, with time enough to essay, efficiency will be selected between different levels of self-organization between rough turbulence and smooth decay as a Lyapounov function or better slope in the trajectory space, from the perturbated distribution to the equilibrium distribution.

If the trajectory essayed as more efficient is near-turbulence with some amount of memory and rules, -the better solution proposed of low investment to high profit-, cascade could split the perturbation in local smaller distribution solution, which tends to recover symmetry and though a local normal distributions, with null cumulants higher than two. From all structured normal

microstates sharing the same slope, with more time the second cumulant will also tends by selection to zero: lower and lower typical deviation of the better efficiency microstates will cumulate on the local means. Discretization will be then a consequence of having enough time to select better and better solutions, ideally reaching the best way to solve the conservation+continuity.

The more time lineally happens, the more exponentially relations has to be engaged on the algorithm that translate the description of the history of every agent of the collective, to the state variables of the system. So, because the information flow, c, is limited and because the different taxes of growing -derivatives of time and description of complexity in the relations-, computability of the algorithm may be overload by the speed of the time itself, that cannot wait for all holistic information to be computed to take the next step. We can call that change of phase on information flow: “from the best to the better”; and this could be a bridge with Special Relativity.

As either economists (Pareto’s equilibrium, “*Inefficient outcomes are to be expected when there is not perfect information*”) or psychologists (Gregorio Marañon), states, “*The psychic imbalance in moderate limits, is necessary to the man who, in another case, would be an absurd and unproductive being*”, non-equilibrium is the necessary condition for dynamics. Neither turbulence or equilibrium are the way to the better: we need some amount of eccentricity and balance between temperaments to have a healthy mind and learn from the environment, not “turbulence paranoia” as not “boring linearity”. In the 70’s the attempts to modelling galaxy formation rely either in the large-scale vortical primordial turbulence cascade for a structured system, or in a laminar adiabatic Jeans Instability frame. The application to cosmology, because the smoothness of the CMB, promote the perturbation beyond Jeans Wavelength in a collision less gas (very low pressure), as the trigger to evolve from an instable homogeneity to an Expansion/Contraction locally homeostatic distribution (structured in galaxies, stars,...). So, there is a quantity of perturbation, fluctuation, “observation”, interaction or even information given to the system,… eccentricity (kurtosis and higher moments), that transform a flat distribution into a local set of normal distributions, in which there will be a local process of nulling the cumulants around rational relations of means -which complete set are called eigenstates-. Not too low, not too high.

For locality emergence, the white ball of the metaphor may lose a symmetry between the over availability of space and limitation of time to find the best solution, maybe because it is not a perfect sphere, or it is inelastic and evolves, even the hit may produce some kind of rotational effect or tear the system itself. So, depending of the evolution or randomness of Jeans Wavelength as critical parameter for a phase transition, or interaction between systems of different hierarchy, the perturbation over their distributions of energy, will converge again to a flat homogeneous or diverge to a set of normal distributions with null second moment (with some asymmetry and/or over availability and no time enough). If spontaneously or the higher system -observer- has modified the Reality for a longer than needed to recover smoothly the homogeneity, because a local better structured solutions may be selected because some information has been exchanged with the virgin system, then the systems will select proposal on accurate time availability, to find a better solution to manage the flow to get the equilibrium. As Bejan Constructual Theorem states, as times grows the water will drain with better channels and more optimized rivers, despite the generic tendency of the landscape to be eroded, while the Systems persists out of the equilibrium either in energy and its flow.

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 all,... to macroscopic levels, and even to encompass the whole Universe. When we do not mind more than the initial vs final state variables conservation and flow, we refer to the gauge symmetry.

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 persistent random walks (with inertial higher probability for induction then for a change), 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. Scarcity, local inhomogeneity and asymmetry and/or the observation correlation from a bigger scale system, introduces random walks of the energy in time and diversity. 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... as 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 discreetly 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 into irreversibility if a solution of a relation is a discontinuity at some derivative level. If not, with unlimited space and time availability, any isolated and symmetric Complex System will tend to have all potential energy as kinetic and 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. Then it is possible to find local gauge equilibrium in the flow of energy, as islands between the sea of randomness or in the hell of turbulence: homeostasis.

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). His 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 Hamiltonian evolution from potential energy 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 (or for quantum mechanics a superposed state), 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 Zaratrustra's point of view (systems interacting from another bigger scale), the rhythm of several Sisyphus playing in tune, if there is no mechanism of self-organization of rhythm among them, breaks the harmony, but nature is wise and chaos do not conserve gauge and remembers up to a stochastic 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, but structured harmonized sounds (which contains a certain amount of energy described as information): 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 (from equilibrium to equilibrium). 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-synchronization emerges as the patterns of the better solution of flowing are the most abundant microstates, and they can offer a composite symphony, but for reaching this as soon as possible, before the time limitation of essays make a worst choose, 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. The quantity of structure needed to offer a local pattern to drain the energy flow in a given time will be selected in the optimal site between the best and the quickest.

Even the turbulence has a limit for stabilize cycles in local homeostasis, 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: non-hair means to cut and clean. The ashes are inefficiencies in the trajectories increasing its length and therefore means also more 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, they will find its way to equilibrium.

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 (another kind of kinetic work), enthalpy or friction energy in various orders of magnitude of flow exchange in a diverse time rate with the environment, irrationality rest 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 investment in structure for the efficiency flow to another scale. What is smooth at some scale may not be so 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). Each slice of a river has drops of different histories, but every slice shares the same pattern. 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 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 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. The best for every single citizen is not the best for society, but with structure, information and rules, we find a better way in less time to reach each better life as possible, as if we leave it to the jungle law.

Because the Constructual Law, which could be considered a corollary of Natural Selection applied to flows, the reality prefers patterns of rational values and eigenstates, better than irrational ashes and superposed states. 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 of the Causality Principle, the first random decision also recommends a state function, which if there is no energy invested in structure, 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’t 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 because the limitations for making a choose and the causality, produce errors... or at least not optimal decisions.

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 cant 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. If the system has invested in memory, 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 a theory, the less will be the entropy, unless the more inefficiency accumulates when we assume that it behaves well, but in reality there is a local irregularity, a "whim", a "break" or a "leap": a zero-derivative in any level.

The most traveled trajectories from one energy state to another, will be somewhere between an optimum in efficiency and the cost in errors of forecasting, but they will not 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 attempts 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. In mathematical terms, to arrive to the equilibrium with infinite time for relaxation will imply a differential equation with an exponential solution, but if the process cannot wait, that means a power law, which grows faster for the cost of discretization. The higher dimensionality to generalize a linearization, exponentially grows the computational resources, which are limited by the speed of light itself.

A complicated system may be completely described by a linearization which requires less computability resources than the best theoretical Turing Machine processing at speed of light (for example a function that in some derivative degree gets a constant or a loop, like trigonometric). A complex system its described by a limited dimensionality or locality linearization approach and its description is thought not complete. In some degree the reality itself neglects in its process description dimensions or terms in the Taylor polynomial though speed of information transfer is limited. Computability is a real limitation for real processes, not only for their simulations.

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 in the hamiltonian evolution of conversion from 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, rational and conservative, which is the more random roads that lead to the same length-, 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 or a complete “well behaved” trajectory, which may be confidently extrapolated, but to go from one state to another through an intermediate decision subject to chance, reversibility requires not chance and not “bad behave”. 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, but that is not a problem with enough experiments. The question is if the chance combines with an asymmetry in some “cumulant”. All trajectories will contain the level of chance as a 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.

Chance will make a better choose in the same lapse time available for a decision, as the better theory of extrapolation will produce the investment of energy in structure. If the cost in structure is higher than benefits, it will not be selected as an option to reality. The more thoughtful and informed decisions, with more variables, the more optimized paths... as technocratic managers know, do not reach the best strategies. 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 expenses. As “good” broker, Natural Selection does not have patience and does not choose the entrepreneur who succeeds with the best product with no limitation in its development, but the one who succeeds with less information: the optimum will not be the path of minimum energy, but the opportunistic path which supposes the "bad-behaved" and has chance or intuition. Natural Selection is incompatible with Information Conservation Principle. Easy decisions are conservative, in a “well-behaved” and constructive basis, -good performance at minimum effort-, but “black swans” exists and best managers find an optimum between the available information and the right decision, assuming errors between probability and action in a no idealized well-behaved reality. We can calculate easy the trajectory of a cannonball with two variables, but the many bodies problem is disproportionately complicated. A.Turing: “*An infallible computer can’t be intelligent*”, it needs imperfection, forgetfulness, random, loose of information… limits in its computability.

The equilibrium is a Gaussian distribution of the microstates, whose mean -first moment- is not the most optimal and its variance -second moment- is symmetric: it is just a gap between the incoming flow and the outgoing flow -third moment, null -. If the change in the flow from the environment to the system and vice versa is not zero, the statistical distribution is not Gaussian and the time arrow appears as kurtosis. "*It is very difficult to make predictions, especially if they are about the future*" (N. Böhr). Microstates test other very close perturbated microstates, which survive only if they are more efficient than the energy difference that separates them, but discontinuity 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 enough pressure of scarcity of options of reality. This is what we call stationary state. Let us suppose several microstates with the same length 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 Poincarè showed us that it was impossible to have that security, (maybe

he realized then that he was reformulating the concept of Entropy).

To know if extrapolation fits with reality, we must test, but when we check, time has gone. If there is a random walk persistent, indeterminate, chaotic, complex or aperiodic, it is only possible to know the path of least length when arrived and we cannot 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. In the Groundhog Day, they repeat thousands of times the same day until reaching the optimal: entropy is the distance of efficiency from the first to the last day of the film. 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 which gets less and 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: auto-similarity evolution (Universality, called in ecology “convergence evolution”), or the optimal pattern between the better and the most expensive.

The most probable length walk or probable 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 -structure- built by previous storms. In the abundance of realities that allow all possible options, oblivion is completely random: ideal gas (non interacting and not distinguishable 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… and more memory do not linearly produce better theories for extrapolation (a company that invest all its benefits in talent or in I+D, may or may not be more competitive than another that invest less: the winner will be the one which invest the optimal resources amount).

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 to normality 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… but investing in memory means not to drink and then, why to go the bar? 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.

Maybe we interact with a Flatland World and because our observation we broke some asymmetries

creating a society. 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 degree 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 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: the information of each agent state is substituted by a collective pattern state.

Beyond the deterministic apriorism, scientific consensus of those times 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. 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, infinity 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.

Because the virial theorem, we can measure the lost potential on reconfiguration of structure 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 average amount of random decisions to define structure 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 players will solve the cube in a limited amount of time. ¿In how many movements will the best player solve the cube in, lets say, one minute?

Another analog perspective has the algorithm Kolmogorov-Chaitin-Solomonoff Complexity: "*the size of the shortest computer program that can generate a complete description of the system*"… but if it is complete, then, it may not be consistent. 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 for the more fundamental understanding.

The entropy as information loss is not new, but it is not often related to the investment of energy in increasing efficiency in a limited amount of time through structure, which means conversion from units of energy invested in structure, to units of memory lost in the process because the difference between the average and the optimal in a continuum process (in a phase change memory losses will be bigger). In the 29 L. Szilard and C. Shannon published their interpretation of the Maxwell demon 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 $I_N = -k_B \Sigma p_i lg(p_i)$, 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". We delayed more than 50 years to verify the R.W. Landauer minimum information and heat/temperature loss, ($1K = 0.95697\ 10^{-23}$ joules/bit, which if we refer to the Avogadro number, is 0.17352 bits/molecule).

Energy investment through memory in structure vary with continuity while the explored microstates are neighbors. But sometimes the systems use randomly the surprise, or probability when exploring a non-consecutive microstate so far away that it cant know the path between them (or know what is behind a door). If the benefit is clear, the system change will be selected because the scarcity of realities and we call that a phase change. With a phase change forgetfulness means not fossilization but evanescence, the information is not conserved, and information conservation is a Principle for other branches of physics, comfortable with its determinism and continuity of "well behaved" evolutions, so with no changes in this topic, never will be reconciled under a same mathematical umbrella with indetermination and chaos.

If we incorporate the detail losses, the energy investment in environment modifications and in alternative essays, the oblivion and delete expenses, the inefficiency of the mostly path respect the optimum way to get to the same place, 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 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 cant 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. After a perturbation of a system, if there is some kind of asymmetry (between the sizes of

correlators, i.e. between system and environment or system and observer) with unlimited time the systems will travel back to equilibrium or evolve to local new equilibria, but with time limitations the possibilities are to get the new local equilibria through a non optimal but enough trajectory of decisions, or if overloading, change of phase to other options.

Any new proposal of bureaucracy in the flow of energy requires an investment of own energy, maybe deviates from excesses, from other projects or even it is imported from the outside (than the system will not be isolated). 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 cant 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 to occupy, 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 structure and memory as friction or enthalpy, H, to go one step further: the investment in making a hole, does not have 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 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, emergence. Limitation in time for reaching new equilibria may not permit all local subsystems to find the better solution for new circumstances after correlation, or even to find the equilibrium, and force the local systems to evolve from non-equilibrium to non-equilibrium. Another way of creating order by Universality: convergence of patterns.

Each change of hierarchy or phase consumes or yields energy discretely, breaking the continuity prejudice and so determinism: the phase change between solid and liquid or between liquid and gas, invests energy and information in digging random channels in far away configurations, 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 benefits with the expenses, because the change of phase itself costs energy derived to new bureaucracies. The memory is erased and substituted by a new set of state variables, that may not have to be understandable for the agents that originated the system.

J. Barrow and F. Tipler describe the process capability as linearly dependent on the temperature of the system, and while locally energy is concentrated, entropy and dissipation will increase. A measurement of an observer is the collapse of uncertainty in information: quantifies and keeps a copy without immediate need to erase. Erasing a hard drive may be necessary with the limited availability of space and we need that resource to continue writing. Reality is finite and if information and detail are lost, entropy cant be an absolute value because it depends on the "memory" and the "pixellation" of the observer. More than this, a string of bits is random if it is incompressible (the optimal set of questions yes/no that defines completely a microstate): if it does not contain patterns that allow its description with fewer questions; but there may be hidden patterns in chaos, and there may be obvious patterns in randomness. Reality is not quasistatic and the dynamics sometimes evolve through non-conservative paths between non-equilibria states. The increase in disorder does not always define the quantity of macrostates, and entropy or distance to

the optimal path of decisions, can be increased with a better organization (crystallization), which implies oblivion of the agent states when been substituted by the new collective pattern states... Symptoms that the Entropy Law itself was falsely stated as a primary law, and there are more fundamental laws to look for.

In the development of positive reasoning, we have found irreversibility, irregularity, information investment, asymmetry, efficiency and randomness,... egalitarianism and solidarity, but for the moment, neither disorder nor exponentiality in the benefit,... or virial behave. The increase in energy may not have a multiplier effect in the "aggregate demand" = investment + savings + consumption, -or increase in heat = entropy+exergy+temperature-, since there is no risk exploring the neighborhood. So, the energy losses invested in the exploration of faraway configuration alternatives, may not be a loss but a risky business and the oblivion of memory of a change of state, from the state of every single agent to the state of the collective pattern, would be just a benefit investment for the best… and the game still sum zero.

Entropy is the heat invested in savings for the future, in structure for efficiency and in forgetting structure for a risky change: there will be apparent energy losses if there are interactions in space coordinates of position -viscosity-, changing interactions in time coordinates -delete- or changing in scale coordinates -detail-. 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 expensive 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 charges of force, -non-hair theorem-, at the price that the information beyond is erased from our perspective as observers (complex systems correlating with it). A gas can be described by pressure, volume and temperature, at the price that we cannot know the kinetics of its particles. A company report to their investors is not a detailed list of every single incoming and outcoming movement in the accounting, but a Balance of “State Variables”,... 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, but an error essay is an investment in a business or in an academic investigation. 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 excess of disorder and systems are selected by the scarcity of space and time in a single reality, to be the better solution considering the limitations.

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 conservative modes, 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. Natural Selection of Markets will choose the better distribution between investments and expenses, and rarely will be the best option but the most repeated.

In stability any minority innovation that improves the efficiency of energy flow, constitutes a solution overwhelmed by the macrostates (in equilibria, a better configuration cannot 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 feedback into a resonant phase. Thus, the random decisions that make a space-time path irreversible, can with the scale recover the reversibility, from smooth collective new elements to 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 of induction in the scale of the elements of the system: 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, but they are just structure. 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… and the same happens with the structure of the landscape.

Infiltration, retention, evapotranspiration, rainfall, run off,... are processes with different periodicity, and being conversion of potential energy into kinetic energy dynamic residues, can be either removed or invested, entering 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 because its position in a growing market-; 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 transition between non-equilibrium, 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: creates a commutator. 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 of having more energy invested in structure, knowledge and talent. Because 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 stationary, finding a new equilibrium. There must be stars everywhere.

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 be selected with auto-similarity to solve a local turbulence to homeostasis, and if Strong Cosmological Principle -also to scale-,...

A viral phenomenon, a plague, an explosion. 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 Threshold Event (H. Morowitz), the market "crack", a drop that full fills the glass… 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 (which is not anything else that the non-successful essays, or the distance between average better solution to the optimal, needed for success of the collective because the causality means that we do not know which of our decisions will be the best). 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 a Bejan sense, to naturally select the better flow-promoting the stress to take the risk of a new configuration, a novelty in dynamics, coming from random unrelated systems correlation linked to another scale, non-periodically and irreducibly. It is a much more expensive option than the continuous improvement, because many more combinations must be tested and discarded, losing quality in energy and information, but with more risk, better benefits. 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, inductive and decohered, so with a huge waste of lost rest in errors, more complexity and ideal new system in a upper scale. Collapse, just alike entropy, is only possible if there is a collective behavior that leads to the transformation of a probability into reality. It is only recognized as is once it has happened and only achieves with 100% security in the new path to take or dump, who bets the day after the match. The more disparate are the alternative destinies of reality, -"with less fitness"-, the closer you are to the phase change.

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… with a complete random distribution of any average but infinite second cumulant. 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, because there is energy conservation if there is a zero-sum, all the rest energy is invested in structure, but not every investment has been selected.

Local concentration of the flow over the drain capacity of the turbulence, eventually produces emergence of new management configurations (digging, moving stones,…), 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 invested, 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 in being perpetuated by natural selection, 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 changed and because energy do not disappear, became a benefit assuming the cost of the risk. 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,... while the rest of the Universe continues to dilute in greater volume, uniformity and randomness.

As long as the evolution remain 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 fine 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.

Induction is a tool limited for smooth and computable processes. It use to work until it does not. Economists and climatologists are very good inducing what is next gathering the past, but eventually there is a crisis. 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 or induction of a smooth function, and the plans we decided for the day after tomorrow become irreal and reality will not wait for you and go back to ask: which way to take for the better family day? The information has been lost and decision has to be taken in a limited time while there is not all information needed to decide about one path or another, so that reversibility is lost and, as we do not know for sure what is beyond, in some decision we will lose 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 maybe because it 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, not with the optimal option. God is maybe Great but not an Architect, while reality is not optimized.

The Constructual Principle, -of minimum effort for the better flow, with enough but not every 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 stationay 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 Algorithm 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 not always continuous and smooth, sometimes is rough.

Even not being the best, the length of the better 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 investment of energy in errors (which apparently do not success by its own, but on the overall consideration of the essays, soon or late, its energy will flow again in some selected configuration for being preserved or reproduced), on 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 local rough and asymmetric 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, both quantities may be conserved 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 the different entropies overlap? Do they leave holes in between?

So, Entropy can be defined in many ways because it is not fundamental but a consequence of Causality, Conservation 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". 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 investment in 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 compresibilities; 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, roughness, black swan probability,… 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 both his different legs: from accumulation of randomness and oblivion, in the inertial extrapolations from the past to the future in each system, whether they are hydrological, computational, 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 extrapolated door. You cant always be right in all decisions, but if there is not a choose, is not possible to fail, but times goes on.

Reality is not inertial, nor smooth, nor drives between equilibria, nor obeys Cauchy, nor it is always "well behaved", it is not continuous, not deterministic and cannot always be described in stable evolution equations (well posed and strongly hyperbolic)… usually reality is weakly hyperbolic (not fully determined by differential equations) and occasionally it may be ultra-hyperbolic (unpredictable because the divergent behave of the equation, even “explosively” or “inflationary”). The orography and the rainfall, 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 soft behavior of the system, both arrive at a quasi-equilibrium dynamics, with parsimonious and causal evolution between balances, predictable and calm, which in extraordinary events becomes more casual than causal. In the local interaction of orography and pluviometry, environment and energy flow, part is diverted to the modification of the environment, whose information is altered occupying the previous information, for which the previous configuration of the environment is deleted. 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).

The incoming energy in the system which does not leave or holds, but accumulates and got stuck, produces imbalance in value that means nothing to the Hamiltonian and increase entropy, if you do not know the distance between equilibrium and bifurcation in which the scale is changed, as an impatient solution -without giving time to the option- to the solution due to turbulence or divergence evolution. It happens with measuring the balance, what happened when measuring the bias: with enough variables and in good behavior, statistically we can go to a normal distribution of cumulants, but case by case, locally, emergency to emergency, each statistic will be a son from his father and mother, intelligible though not foreseeable, indeterminate "a priori" according to a probability when a black swan happens or the overflows promote turbulences; then, because the time availability, the evolution happen to be from no-equilibrium to no-equilibrium. The Buridan Jackass never know if his option will be the best path, like any stressed systems near to the collapse knows exactly its distance to the phase change (it can be estimated by probability but never be completely sure).

The distance to equilibrium may be estimated quantitatively by Jorzynski's Theorem, through irreversible work: how asymmetric is the distribution of work among the agents of the system; or, in other words, how poorly defined it is, or how far its distribution goes far away from the central moments average value. The full amount of water of a rain may take a very long time to fully return

to the sea, maybe some drops fossilize in a cave on a stalactite and delay millions of years its way back, so never a system will close his state to cycle again as a wheel. The work invested in removing a system from equilibrium is returned to the environment during its relaxation in the form of heat completely only if the work is a closed value, but since the work is not a state variable, -a "gauge" symmetry -, but a process whose statistical value we take as a system variable, its "cumulants" of order greater than 1 (those that are not average, but their nuances such as deviation, skewness, kurtosis, ... dispel), respond to asymmetries that are irreversibly lost. When completely described by definition with average and dispersion, a normal distribution of work will dissipate according to its standard deviation, the more the greater its squared dispersion. The more asymmetric in more degrees of the expanded polynomial of its characterization, the more irreversible.

If the distribution of the work that causes the imbalance is not known or is entertained in a potential fossilized situation, a soliton or homeostatic local configurations, another more graphic way of description can be the candidate functions of Lyapounov, -words by minimum, maximum functions, inflection functions, ...-, that define a space of level curves converging to zones of stable or unstable equilibrium, locally attractive. A function of Lyapounov with a negative derivative will be attractive for destabilized situations; as well as positive values will spit out these configurations in a random way, offering ruptures of reversibility when encountering singularities.

Because it is a more common situation, the disorder does not belong to the definition of Entropy. While it is majority, "strictu sensu" entropy has nothing to do with disorder, but a number of possible and equivalent solutions to the conservation of energy and flow at the same time: it is more common that there are more seemingly disordered than ordered solutions, but sometimes this is not so. In an isothermal system, the principle of maximum entropy becomes the principle of minimum free energy. In 1949 Onsaguer proposed the transition mechanism of liquid crystals. More accessible volume for each particle leads to less entropy, which can happen in a crystallized arrangement with respect to a fluid disorder. Simulating the distribution of hard balls in a closed space -like oranges in a box- in 1957 Alder and Wainwright published numerical models in which "orderly" solutions were more than "disordered" solutions when they occupied more than 50% of the volume. Since 1986, the chemistry of liquid crystals and colloidal solutions, play to add certain polymers that adhere to the surface of the colloidal particles; and as a consequence an interaction takes place which repels the approach of two such particles and becomes so intense that it can even overcome the electrostatic attraction between them.

By raising the temperature of a system, there is more energy to drain -dissipate-, which requires higher flows and when it is not enough, better flows; and if structure do not deal with this in an homeostatic local configuration, then turbulent flows. Systems do not tend locally to disorder but to find the greatest number of solutions, modes, paths, or trajectories, in order to preserve both energy and its flow in space-time-scale with the better configuration that a limited time has given to essay. The reality is rough and it works by quantity of alternatives, instead of look for the best solution (it is quantitative, not qualitative). There may be leftovers in the drainage capacity to saturation, which disrupts them; but also surplus energy that oversaturates the system, which is reinverted in trying new drainage modes and orders them with greater entropy. The more better structure on the system, the more entropy used in a parsinomious way, not disruptive, not turbulence, not disordered,… like in mature environments and societies. By locally obtaining benefit of the order in the concentration of the energy dissipation with less random walks, the reduction of inefficiencies generate surplus that may be used in erosion, in novelty,... in R&D+i, or in tests, errors and instability, overflow, some times better than to speed turbulences of the non expertise youth.

Time do not brings randomness to the efficiency, nor the addition of local interests sum to the general interest (democracy is not a linear way to manage). The selfish interest of each agent or

local subsystem in manage its overflow may not coincide with the interest of the general system, being 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, but they will approach more with better structure. The sum of the intentions of maximizing the benefit for each individual of a market, 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). More structure do not means better structure. Complexity is concentrated locally in space (life increase expenses in structure), 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.

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 an 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. Resetting 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 a 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 maybe means emergence of auto-similarity from deeper scales. The constituent elements of a hierarchy level are reset 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 by coincidence at the level or our top capabilities to “watch” or even the subatomic particles are fractal systems? If so, what happens in between the Planck scale and de “zeptoscale”, from -23 to -43 seconds and centimeters? A full Universe of processes like ours could fulfill the order of magnitude gap in between the most basic time scale and the resonance virtual particles life scale.

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, that may reproduce auto-similarly giving the false sensation of communication between them. Similar emergent levels may speak different languages -diverse cells, understand chemical messages differently-, but they can share meanings: there are grammar, translators, codes and 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 cannot 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, deer 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 a body that lives for tens of years. Societies live for centuries... In the reduced 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 of stars. 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. They would not look for us but for their similar. 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 a foot wish for peace and love to a lung of a grey alien. Maybe there are no explorers of the galaxy at our level of complexity, 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 obeying causality laws, the emergence of novelties is a generic consequence of the local agreement between Conservation and Continuity Energy when renewals are not constructuality enough to solve the requirements for both at the same time, and turbulence is a minority between options. Homeostasis in local subsystems 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 Bènard 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 inefficiency is the waste accumulation dump where novelties are generated, so reproducing is a need to reset the error counter and vices to bring some of this energy again to the game. 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 and a clean of stories between them.

As we mix different perspectives -from saturation and unsaturation- of disorder -generating turbulence or diffusion, convection or conduction-, we also mix antagonistic concepts in equilibria: more chairs than asses promotes entropy, and more asses than chairs unbalance the system by turbulence, and in the middle point, occasionally with stationary emergence of new configuration between the relaxation evolution and turbulence flow... the system locally stabilizes on such a structure to manage conservation and continuity on causality and scarcity of time restrictions, which some times is called Life. Are stars, planets, landscapes, rivers, solitons, puddles, tornados, fires, music, concepts, languages, Internet, Gaia,… alive? They have an auto-similar pattern, but not an information heritage to transcendence a structure of managing overflow. Not enough, but if we can consider this soft definition of Life, then soft definition of Death is just the collapse of an structure (build with information, that is memory and rules), that may happen when the better and more voted configuration between all possible macrostates, is further from the system to death than the potential energy stored in opportunity… when Reality select another much better structure to follow

on managing conservation and continuity with the restrictions of the environment.

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 friction; 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? 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 (always equal to the higher benefits, but not necessarily in the same subsystem).

The equilibrium is stillness from the macrostate on the average values of those observable to its macroscale, 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 more success, the more proximity has been to a breakdown.

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,... everybody 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 preannounce the Central Theorem, proposing the "Regression toward the mean": with linearity and independence, systems tend 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 that allow a local homeostasis. Thermodynamic equilibrium vs

homeostatic equilibrium. The stabilization of the energy conservation and flow -homeostasis- is the dynamic equilibrium of the system against the variability of the flow; lives if it has an structure and dies when it surrenders, because the stationary state costs more energy than a solution of less 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 mature, the marginal benefit is reduced until the launching of a new business, that never succeed if there is not novelty in demand of the environment. 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 upper scaled 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,...-. Eigenvalues are preferred in a correlation because its resilience and that is way they populate more microstates than superposed states in an observation process. 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 ever fit with revolutionaries expectations and each will be self-similar to others, but never a novelty may be well known before the bifurcation. Every sudden rupture of the temporal symmetry proceeds from the bifurcation and amplification of an instability, from linear, through proportional, multilinear, exponential and even viral. From a critical value of energy, the collapse and the unpredictable novelty, occasionally convergent towards some attractor, are progressed without any remedy... "auto-similarly" again and again, until in one of the jumps the hand slips or does not grasp the next branch and dies.

In the chaos, every order seems to vanish as patterns appear on another scale if the system has high Goertzel structural sensitivity: apparent randomness and self-similarity are two faces of the same gold coin, although in the KAM context, the Golden Ratio is the ratio between periods of forcing and greater stability. Chance fits the boundary between ultra-hyperbolic divergent hypersensitivity and convergent forgetfulness of the initial conditions. Hypersensitive may be an over achievable 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 and for our understandability inside a black box. Information does not blow out, just it evolves in structure at another scale rebalancing the risk benefits with the flop essays. Random chaos is something else: not even the small gods who share our dimensionality remember the way back 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.

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 equilibrium 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 no-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 inaccessible information, hypersensitivity may arise chaos that seems irreversibility being only incapacity; however from, oblivion the spontaneous order may also appears trough auto-similarity: the structure made with energy investments... the successful and the unsuccessful. 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 geodesic 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 and no Universe with local asymmetries would be possible, 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. Does it means that we live in a less than 6D Universe because more than that will always be fully random, with no local opportunities to develop?

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 there is no way to forecast the score. 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 environment being this another system, an observer or even the outside world.

If life is just a structured macrostate selected democratically to homeostatically manage the energy and flow conservation; 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 preferred 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 termite nest without need of architects or blueprints, nor sending them information.

Because that need of knowing about the environment to adapt and have better options to be selected by reality, increasing the investment in structure, a system will tend to be divided into specialized behaviors of local subsystems that will evolve increasingly independent from each other and developing a more and more complex holistic, 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 complex 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 remains in those silences.

In statistics the average nothing means without variance or for some purposes, 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 cannot 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, but energy has been translated from memory to rules. Reality do not preserve information, but energy, and the energy invested in information and rules is conserved. 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, while age and accumulate vices and mistakes, while not all credits are returned, while not everyone is good, or bad, while we do not always fulfill expectations, while we cant go backwards to life and decide again with no error, while 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 dynamics in which the motion of the particles of a system is decoherent and extrapolated. 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 and Continuity Conservation with Causality restrictions; and disorder increase is though a consequence of deeper reasons. And by the way, Life is the same but in a local stabilized structure between the lazy evolution exploring near states with no risk, and the over turbulence flow.

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 reset emergent and non-saturated system: "ab initio" systems in which the addition of individual actions produce a collective behavior 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 limits 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 (there is no time to manage the overflow with an structure that may split the energy in homeostasis). If it is done by conduction or radiation, it would be slower

than the rate of accumulation and would collapse or eventually emerge new local 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 if some subsystem is still rebalancing and the distance to the equilibrium could be sized by a net flow.

Rescuing a previous metaphor, imagine again the inhabitant of Flatland, living in a world of two spatial dimensions, to which reality offers several doors to decide his trajectory. They are closed and he cant 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 Eye, but the flatlanders do not. Each choice confronts our mouse to another decision between closed doors that for him are the same, but options of the environment are not symmetric and 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’s 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 arrow of time, 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, continuous, with no surprises, no black swans, or the selected will rarely be the microstate trajectory of 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.

With Conservation, Continuity and Causality Laws, it can be described the evolution of a few variables deterministic system, through differential equations that includes conservation of equilibrium, energy and its derivative. Why stop there? Why not consider the system to conserve the second derivative, or the third,...? Why not keep the second derivative, or the third, ...? We implicitly limit the paradigm of Statistical Mechanics to 3 laws because we assume normal distributions, which by definition have a fixed average and variable standard deviation, but the rest of the "cumulants" null. In a non-normal distribution model, three conservation laws would not be enough, but all those that completely describe the whole.

The mathematical description approximates the behavior of Reality, and any theory may agree the constructual optimum between utility and cost: for a gas in equilibrium, considering its three state variables, it is enough with the three laws of thermodynamics, since the system does not has the universality class -dimensionality- that allows chaos, which let us to forecast in the comfortable environment of reversibility. As the system gains complexity in its dynamics, differential equations must incorporate independent variables if there is no equilibrium (one of them cant be cleared and expressed as an analytic relation of others), and therefore add new differential equation; they must incorporate even more if reality presents turbulence, because this will restrict the way of evolving in its continuity, and will require modifying the continuity modification. More if the system presents self-organization around local critical points, as they will appear in chaos… and so.

In a meticulous dynamic description of a non-linear, turbulent, out of equilibrium, chaotic and locally self-ordered system, laws should include, more than Causality and Conservation, not only Derivative or Continuity Conservation per unit area, but also the derivative of the derivative, and the derivative of the derivative of the derivative,... until it reaches zero or a "complex variable" loop. If Three Laws are usually useful enough, it is because we do not need more, given the exceptional conditions of normal distributions. There are not three laws, but as much as according to the statistical distribution of the agents that make up the system. When considering more tend to appear behaviors very difficult to model, such as the locality of non-derivable points (change from laminar phase to hysteresis or vice versa) and non-linear exponentiality. The utility, as it happens in QM, determines the model: with “n” variables, we will need a similar number of conditions expressed in differential equations, to aspire to some solution.

Apparently nothing new to redefine what “identically” mathematically means by equivalent modes of expression through language,... but consider the mathematical definition of Entropy as overall inefficiency in a random walk dependent on natural selection over the solutions, investment for structure to be selected as the better way to manage flow, and interaction between different scale systems as "friction", with limitations in the availability of information because time, establishes another brick on the 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 because there is not infinite time to essay all microstates in a single reality, formally with the limitation proportional to the typical deviation of the statistical distribution of the energy states respect to the perfection… the Coase’s distance from equilibrium is standard deviation. In homeostasis the local subsystem 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.

Entropy has several similar and equivalent definitions with identical formalisms, so with such a perspective dependent conceptualization, the objective is here to skip the Entropy from fundamental Principles of the Statistical Mechanics. The proposal is another similar and compatible way to define Entropy (not just as disorder, not just as limitation on the availability of memory, as inefficiency,… but as a direct statistical consequence of diversity, over availabilities and limitations), with identical formalisms because relies on the same microstate distribution paradigm, but from another set of enunciates.

There are many ways to enunciate the Three Laws (or the Three Limitations), and some of them are shared by other ecology and economy laws, such as: "No free lunch" or "Into equilibrium there is always a zero-sum game"; "We do not remember the future" or "We can't try again and again to improve the same decision and never reach" or "Effect never before cause" or "What done is done"; and "We are confined in the limits of our reality" or "We are not angels" or "The observer can't be out of the observed system". An identical formalism validates this perspective, as definitions include assumptions due to interpretations and may open other paths to better negotiate with other mechanics:

"Conservation of the Energy and Flow"
From equilibrium to equilibria. The system will essay proposals of configuration for both, the conservation of energy -from Noether's Theorem, that implies reversibility on time- and its flow – which implies irreversibility-. Squaring of the circle. Such a single basic requirement, conservation-causality on equilibrium is the single Law we need. If Normal Distribution, (it means physics on equilibrium) and if Continuity Idealization, (it means classical approach). The better structure for a statistical deviation accorded to the over space and limited time availability frame to reach a solution, but not the lowest typical deviation, will be selected with enough essays.

Into cross fundamental "eco" constraints, commonly accepted in the Science:

"Scarcity Laws"
There is a single reality. Microstates are proposals to be essayed in a limited amount of space, time and scale. So, the better will only be the best with no scarcity and the inefficiency is just a statistical consequence of economic and ecologic laws (Natural Selection on the market of microstates whit different structures of information and rules to manage the better but not the best, Conservation and Continuity solution). In a Normal Distribution of Energy, time limitation to find the better trajectory of decisions, will be proportional to the Typical Deviation.

"Computability"
Incompleteness, Indetermination, Irreversibility,… from Laplace all it is about what is forbidden to know, not only for us, but for reality itself. Information transfer is limited, the size of the pixels of reality is limited,… time to take decisions is limited and as idealization, C^{∞} is a useful approximation like it is perfect accuracy… and all limitation has to be accomplished. "Time speed" waits for the best only if the linear simulation of the process is cheaper than its complete description. Computability is limited in reality too.

"Causality Principle"
Through evolution of the system, the essays will be sequential. A proposal of microstate do not know its distance to the optimal solution until it has been already selected and never come back for a second chance to improve with a better (constructual) trajectory of decisions. In the n dimension space-phase called space-time, there are symmetric (spatial) and asymmetric (temporal) no-reversible, variables, which both could be collapsed on scalar

values or fundamental constants preserving the sign.

By changing the Entropy ever increasing Law, which is a measure of chance trough the quantification of the possible combinatory states, by its dual no-randomness concept: causality; there is a bridge to connect determinism relativistic mechanics with indeterministic quantum mechanics. Causality is a price for Statistical Mechanics to a common paradigm based on the also paying a price in Relativistic Mechanics as multitemporality of space-time -and thought the better trajectories on time to flow, but not the very optimal-; and paying a price in Quantum Mechanics as the emergence of periodic, chaotic, resonant,… patterns on the parameter space, in auto-similar complex systems called fermions and bosons. Then DeWitt-Wheeler universal wave function and Feynman paths may be both understood as the low energy local better trajectories, but not the very best, on a limited time speed to flow. Here we have been talking about the cheapest of the prices to pay for a common paradigm; the other to turn gravity into statistics frame, is not as expensive as can seem and it is developed in other papers (Mmetric). It is necessary a deeper QM in which particles and forces are not fundamental, -and we have availability from Plank to 10^{-15} meters of the known scales-, to build systems with the properties of particles and forces, as even the more expensive String Theory tries (it will not be that much).

A film with no surprises or a joke without fun, makes life mature but boring. A film with all its ordered frames makes sense and has little chances to be a blockbuster, but the story that abuses on breaks “deus ex-machina”, becomes foolish with time, as its entropy increases because perfection in every single decision with limited time, is not even 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 only the scrap of his failure? Why create something perfect and at the same time provoke with the expansion its degeneracy? Perfection, infinitude and memory are not God’s Talents. Are we forgotten feces and freedom our stench?

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