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DOES TIME REVEAL PHYSICS' UNDER DETERMINISM?

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ABSTRACT

Entropy and absolute temperature, both involved in Carnot's cycle, imply that time and social constructivism of thermodynamic processes produce sufficient support for reconciling the threefold time emergence: (i) time as a 1D manifold, (ii) the asymmetric thermodynamic, and (iii) the evolutionary asymmetric time. Is time whether emerging from entropy as reality with three different faces or does it mean that we have to manage three different realities emerging from heat transformation? We put forward three steps. Firstly, we start from a triad of time. Secondly, we make room for social constructivism to examine how this time triad concept involves a threefold emergence of temporal reality. In the third step we articulate the deep role of scientific observation and the under determination of any physical theory to give answer on mentioned contradictions and paradoxes by putting forward a new uncertainty relation based on entropy and absolute temperature.

INTRODUCTION

Time, entropy and absolute temperature

The renewed focus to the nature of time in recent scientific literature is basically linked to the attempt to fulfil the ultimate dream of every physicist, namely an unified theory of physics that explains all natural phenomena. Recently, however, Rull (2012) published a critical overview of three methodological ways to formulate the theory of everything using essentialism, determinism and reductionism. He concluded that neither of them provided a good basis for a unified theory of everything. Moreover, the attempt to reduce all possible natural phenomena and processes to physical laws failed in particularly in the scope of explaining DNA-replication, metabolism and evolution to more complex emergence of live, called `the arrow of evolutionary time´. Rull referred to Hawking and Mlodinow (2010) to enforce his claims for a mosaic of pragmatic theories. Both authors restrict their critical comments about a unified theory of physics since they defend a reductionism by denying other basic sciences but physics. From every mosaic, however, a synthetic view emerges. Therefore, they mention a double perspective. On one hand there is the classical science that is based on the belief that an external world exists with defined properties and independent of the observer. On the other hand, they refer to the famous but contested psychologist Timothy Leary (1982) who claimed that one's concept of reality can depend on the mind of the perceiver. They escape from this dichotomy by adopting the epistemological perspective. As such, they make room for van Fraassen ´s constructive empiricism (1980). Constructive empiricism produces an adequate scientific model to explain phenomena. In a nutshell: there is no theory independent concept of the reality or all it depends on the adopted model. At the end, models must show some convergence in order to perceive order out of the mosaic of models. According to Rull, time is the appropriate physical concept to produce convergence of models avoiding apparent

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paradoxes between the different models. Therefore, Rull is a good pupil of Einstein who said that he just made a step forward in developing relativity after reconceptualising time. Unfortunately, Rull's claims join rather the post-positivistic view with respect to space and time. This means that the concept of time is adapted to the best scientific theory according to the given process. Rull's claims are submitted on the critical comment of Huggett in his review of Harvey Brown's and Robert DiSalle's provocative monographs about understanding space and time in terms of dynamical laws governing matter and force (2009). Huggets starts from the basic principle that the features of space-time are understood to be features of the dynamic laws.

We support Huggets'core idea but this claim implies a secondary importance of space-time in search of a physical theory of everything, provided there is any. On the other hand the more substantal role of dynamical laws is faced to some contradictions and paradoxes. How to reconcile the time symmetry of the Newtonian laws with the time asymmetry of the second law of thermodynamics? How to reconcile the latter with the continuous growth of negentropy in the Darwinian evolution to more complex biotic systems? And finally, after starting from the dynamic basic laws how to avoid the before mentioned Hawking and Mlodinow's reductionism? That is why we challenge those contradictions and paradoxes by shedding light on phenomenological emergence of time as duration in any experimental corroboration of phenomena ruled by dynamical laws.

Moreover, not only any observation but particularly the unit of time duration is by definition directly connected to concepts such as absolute Kelvin temperature and in consequence indirectly to entropy. Indeed, time duration is implicitely included by a Carnot cycle determining the motive power of heat after isothermal heat absorption from a furnace and isothermal heat emission to a sink. Absolute temperature T = m/J, where *m* is the universal Carnot's function in case of an infinitesimal temperature gardient and *J* is the mechanical equivalent of a unit of heat in isothermal processes subjected by a body of ideal gas. Thermo dynamical entropy S represents the part of the internal energy not transformable into mechanical work (Truesdell, pp. 95-102).

These thermo dynamical concepts are smartly connected to the basic dynamics of any many-particle system by Boltzmann's statistical approach. Here, absolute temperature T represents system's energy per degree of freedom and entropy is a measure of system's disorder (Penrose 2010, p.12). First we start from a triad time: as a one dimensional manifold, as asymmetric thermo dynamical dissipation to chaos and eventually as evolution to more complexity. In the second step leaving any form of essentialism, reductionism and determinism we make room for social constructivism to examine how this triad time concept involves a threefold emergence of temporal reality. In the third step, we articulate the deep role of scientific observation and the under determination of any physical theory to give answer on mentioned contradictions and paradoxes by putting forward a new uncertainty relation.

Three times 'Time' in the scope of natural sciences

Time as a one dimensional manifold

According to Newton's Philosophiae Naturalis Principia Mathematica, space-time results in a parametric time notion running along an ordered 1D manifold and an a priori ordered 3D space. We adopt Huggett's comment on DiSalle's rejection of Newton's metaphysical views regarding absolute space and time. To the contrary, spatial trajectories during a temporal interval are governed by dynamical laws and nor they are the result of relative mapping onto the absolute space (a positivistic view), neither the absolute Newtonian space is required to explain the respective trajectories (a substantive view to which Rull's claims eventually lead). Metaphysical elements slipped inside two added features characterizing the Newtonian space-time. Firstly, Newton introduced a space-time twin: the existence of an absolute zero defining absolute order in time and space. Absolute zero deeply roots essence or non-essence. It starts the realization of essence to existence without being involved or affected itself. In consequence, it refers to the Aristotelian 'Prime Mover' (Rynasicwicz, 2008), Vigo (1966), Futch (2002, I and II), McDonough (2006).

This warrants a completely reversible time evolution. Secondly, this Absolute Unaffected Observer implies the claim of an absolute external observation to isolate the examined dimensionless bodies at any instant of time. Furthermore, time does not appear in the observation of the reality as a 1D manifold, but as a denumerable ensemble of events from any experimental scientific setting. A homeomorphism, however, is required to map the ensemble of events onto the 1D temporal parameter (Grünbaum, 1973; Bunge, 1967). This time parameter is endowed by a topology that implies continuity, simultaneity, an asymmetric order relation (Grünbaum, 1973, pp. 180-206), and a metric (Bunge, 1967, pp. 93-98). In reality, time just emerges as duration, connecting two events that are supposed to belong to the same phenomenon. It is possible to define simultaneity and betweenness of events governed by Newtonian dynamical laws and forces provided two new conditions are imposed on the ensemble of observed events: k-connectivity and the principle of causation (Grünbaum, 1973, pp188-193).

Given an ensemble E containing all events evolving from the observed phenomenon P after detection by an instrument G. The constancy of the process is guaranteed by the conservation of G and P, at least during the measurement. After some observations the ensemble E contains the denumerable set of events $\{E_1, E_2, E_3, ..., E_n\}$.

As mentioned before, we adopt the condition of k-connectivity on the ensemble E from Grünbaum. This means that for any event E_i, there exist a quadruplet of events E_1, E_2, E_i, E_k, abbreviated as $n(E_1, E_2, E_i, E_k)$, where the actuality of E_1 and E_2 evolves necessarily from the actuality of E_i or E_k (i.e. is inclusive). The connectivity implies that there exist two non-empty sets of events I en K so that for every E_i of I and every E_k of K, there exists a quadruplet n. It is remarkable to notice that k-connectivity does not imply a closed set of events $\{E_i\}$. How to find out that the actuality of E_1 and E_2 are implied by the actuality of E_i and E_k? Therefore we adopt some notions of

probability theory, tacitly implying the principle of causation. That means that (with $\wedge$ = logical "and"; $\vee$ = logical "or"; | is the conditional event "given"; $\neg$ is the logical negation "not"; $\in$ is an element of):

$P(E_1. \wedge .E_2|E_i. \vee .E_k) = 1$, and
$P(E_1. \wedge .E_2|\neg E_i. \vee .E_k) = P(E_1. \wedge .E_2|\neg E_i. \wedge .\neg E_k) = P(E_1| \neg E_i. \wedge .\neg E_k) \times P(E_2|\neg E_i. \wedge .\neg E_k)$

Moreover:

$P(E_1. \wedge .E_2|E_i) >>> P(E_1) \times P(E_2) \times P(E_i)$, or
$P(E_1. \wedge .E_2|E_k) >>> P(E_1) \times P(E_2) \times P(E_k)$

So we can define an event E_i between E_1 and E_2, if and only if there exist an event E_k, all k-connected so that
$n(E_1, E_i, E_2, E_k). \wedge .\neg n(E_1, E_k, E_2, E_k)$

Moreover, provided there is an event E_v of V and an event E_w of W so that there exist a n-quadruplet $n(E_2,E_v,E_1,E_w)$, and
$n(E_2, E_v, E_1, E_w). \wedge .\neg n(E_2, E_w, E_1, E_w)$

We say that the set E is cyclic.

The reformulation of Einstein's general theory of relativity in terms of electromagnetic equations produced the famous de Witt-Wheeler equation governing a timeless universe (1973). Furthermore, Barbour cited in his monograph ´The End of Time´ (1999) this remarkable quote of Dirac: "… This result has led me to doubt how fundamental the four-dimensional requirement in physics is …*"* (1963). Indeed, in the scope of the de Witt-Wheeler formalism, all physical states are directly related to one another and time becomes redundant. But what about the cosmic microwave background or 'CMB', discovered by Penzias and Wilson, that produced a frequency spectrum showing agreement with the Planck spectrum of black bodies? The latter refers to radiation in thermal equilibrium condition while the Universe is in full expansion after the Big Bang. Penrose mentioned even that the universe 379000 years after the Big Bang is in state of maximum entropy while the further expansion is completely adiabatic and in consequence reversible (2010, p. 69-71). We counter Pensrose's claim with the arguments that concepts of heat power and the Carnot cycle connected concepts of absolute temperature and entropy can only be conceived if the universe is broken in several pieces like our Milky Way. Furthermore, time emerges from timelessness within a particular broken piece such as our solar system from which an observer identifies inside his own world the relative motion of the worlds from without.

The thermodynamic asymmetry of time or ' pTa'

More recently Davies (2010) remarked that the asymmetric time structure is not a property of the 1D time manifold but appears rather as a property of physical states though the dynamical equations are symmetric for time reversal. While molecular dynamics is governed by basic mechanical laws that are invariant for time reversal, irreversible processes are straightforward phenomena and so is time anisotropy and time asymmetry. All are tightly connected to entropy grow in the scope of thermodynamics. The time asymmetry is reduced to the second law of thermodynamics that implies an eternal grow of entropy, a worthless form of energy and a standard for the stage of chaos. Rull (2012) called this kind of asymmetry or formally 'pTa' that ends with the dead of the Universe. Time and space are tightly connected because simultaneity of events implies a space-like translation mapping both events on the same place (Poincaré 1982, p.329). The analogue operation, mapping two different events on the same place by a temporal translation operator is completely out of the question by lack of symmetry. Indeed events cannot return to the past but they can just evolve in the future (Reichenbach, 1956, pp. 20-24) though the dynamic equations permit time reversal. Entropy as physical reduction of asymmetric time is equivalent to the Kelvin-Planck thermodynamic theory in which any cyclic heating measure contains a positive absorption measure and a negative emission measure while the whole cycle measure is never positive. Furthermore, the cornerstone of this equivalence is based on a separation theorema within the phase-space of all physical states compatible with the macro condition of the physical system, provided the appropriate topological conditions are fulfilled (Truesdell, 1983, pp 123-140).

For a better understanding we adopt a phenomelogical conception of time by reducing the discussion about time to a ensembles of events evolving from experimental observation. Given a combined system composed of a physical instrument G', and its energy recipient G". This combined system G detects a physical phenomenon P and collects the data in an ensemble E. To get the set of events E there is need for a measurement procedure. Any measurement procedure is a cyclic process starting from and ending with the experimental setting. This can be the simple experimental construction of Galilee with a water tank to measure the duration of the free motion of objects falling down from the leaning Pisa Tower or a sophisticated DNA disentanglement. We note that collecting and representing experimental data is always an irreversible process, if not it should be impossible to examine the results afterwards. In addition there is always transfer of energy and in consequence a Kelvin-Planck thermodynamic theory is involved.

The measurement procedure put additional topological conditions on the space of states Z and corresponding processes P. Let Z be the set of states and P the set of corresponding processes governing the object under consideration. A state z of Z is the attribute of a material point while the whole objects is attributed by the condition C. Z is endowed by a compact Haussdorf topology so that for any state z there is a homeomorphism that mapped the state z on a product-space of R of which the time variety is one component. The states belong to some subset of Z and we define an S-algebra on Z. In order to connect the physical condition and process to experimental data we define finite regular Borel measures M(Z) endowed with a vector space structure. Furthermore, the Borel measures on Z have a compact Hausdorff topology. All pairs (v,w) representing respectively condition and process belong to a closed convex cone clP so that for a given linear functional F mapping the elements v and w of the set M(Z) on R then become:

$F\{(1-t)v + t.w\} = (1-t)\, F(v) + t.\, F(w),\ t \in [0,1]$

Positive Borel measures M+(Z) corresponds to energy absorption, negative Borel measures to energy emission, M-(Z). For any absorption of energy on a subset V ∈Z there is also an emission on a subset V' ∈Z. There is a double energy transfer: from G to P and within G from G" to G'. Besides, material points suffer from external forces evolving from processes p of P. Any material point of the system Z is characterized by the pair {m(z), p(z)}.

The measurement procedure, however, is submitted to a cyclic process after reset. Any cyclic process implies that the final and starting condition of the system, respectively m_f and m_i are identical. We define the variation Δm, as:

$\Delta m = m_f - m_i$ and $\Delta m(Z) = 0$

For a mechanical system however $\Delta m(z) = 0$ for all z of Z.

All m(z) are extensive quantities, which imply the space-like character of m, while this is not necessary for the p(z). However any p(z) acts on a state z and the duration of this action influence the further evolution of the whole physical system. Furthermore, we suppose that any measurement operation is linear so that the addition of two measurements makes also part of the sets of results and so does also a scaled copy of the first process. In consequence, the set of processes is topologically a closed convex cone. Given the mentioned topology of the space of states of process P the Kelvin-Planck thermodynamic theory is a necessary and sufficient condition for the Clausius-Duhem inequality representing the second law of thermodynamics (Truesdell, 1983, p. 132-134). The proof is based on the separation theorem of Hahn-Banach that admit a hyperplane within the locally convex Hausdorff vector space, separating the closed set from the compact set so that there exist a functional 1/T and –dH so that:

$$\frac{dQ}{T} \leq dH \text{ , on the closed side (1)}$$

However, it implies a more interesting consequence: at the separation hyperplane the entropy is zero and in consequence the system has a condition characterized with a low entropy state. Thus,

$$\frac{dQ}{T} > dH \text{ , on the compact side (2)}$$

The latter corresponds with the branch off's firstly mentioned by Reichenbach (1956, p. 113-143) and afterwards by Grúnbaum (1973, pp 257 -259), though Reichenbach and Grúnbaum identified the system Z with all sets of states in the whole universe. The above analysis, however, is completely commensurable with the claims of Hollinger and Zenzen (1985, pp 107- 147). Hollinger and Zenzen identify the cutt-off by an external perturbation that enforces evolutions with entropy growth after a state of recent equilibrium. The entropy increase of galactic systems after gravitation arose, as Penrose claimed (2010, p. 74) is also a consequence of the cutt-off by mentioned hyperplane that isolates particular galaxies from the compact early universe.

Attempts were made (Prigogine, 1980, 1986) to reduce the asymmetry of time to a micro-entropy density operator in order to breakdown the Newtonian time reversibility. Unfortunately, all were based on the ad hoc assumption of the intervention of a Kelvin-Planck thermodynamic theory on macro-scale such as Reichenbach's mark method (1956, 32-42) (Verstraeten, 1991).

The evolutionary asymmetry of time ' eTa'

There is also the evolutionary arrow of time, called ´eTA´ that governs the evolution from the primitive to the more complex forms of live. Since live contains cyclic processes both in its ontology as well as in its genealogy like analogy in structure and homology in function, the eTA emerging from these systems far from thermodynamic equilibrium is not identical to the pTA. Formally the cyclic processes can also represented by an ensemble of events E. After some observations the ensemble E contains the denumerable set of events $\{E_1, E_2, \ldots, E_n\}$, called a gen-identical chain. We adopt the concept of gen-identity from Reichenbach (1956) and Grünbaum (1973, p.28) to define a chain of events connected by at least one observable property. Furthermore, this property represents a stable structure or organism (Denbigh, 1989, p. 512). As Craig Callender (2012) proposes the idea of time as emerging from fundamental levels of matter: as temperature emerges as a standard for micro agitation of molecules constraint in a container; as time in biotic systems emerges as evolution to more complex organic forms of life. But what is most fundamental: time that appears only implicit in Carnot's formulation of thermodynamics or the negentropy as life is characterized by two properties (i) self-survival and (ii) self-reproducibility?

The mechanism of both are rather analogue for all forms of animal life as well as for vegetation. Metabolic cyclic processes govern the patterns of survival, reproduction is a cyclic dual process from one generation to another. However, also a irreversible temporal evolution towards more complex structures emerges. Irreversible evolution evolves from a successful random combination of two cyclic processes: analogue functions and homologue structures. The first organizes the behaviour of the living organism as responses to environmental stimulus, the latter adapts the structure to environmental needs. Consequently, time emerges from living organism completely in contradiction to the Newtonian time from the Prime Mover Observation and the Thermodynamic time from the second hand observer as well. Indeed, evolutionary time is not symmetric neither time arrow points to more chaos. Moreover, all processes of the living organism cannot be simply reduced to cause-consequence processes since the are all embedded in a web of positive and negative feedback processes in order to sustain the organism. Recently Callaway (2012) suggested that all these cyclic processes are governed by enzymes mopping up toxic peroxides according to a circadian clock. However, once a tipping point is reached, incidental disequilibrium cannot be balanced by a proper feedback mechanism. How to reconcile this irreversible emerging time with the symmetry of the external observations and the asymmetric dissipation of thermodynamic systems?

A tentative remark concerns the reality of this threefold emergence of time

How can a threefold emergence of time in natural sciences produces a new step-stone to a theory of everything? The determinism of Newtonian mechanics is out of the question due to its incompatibility with randomness and stochastic processes. Unfortunately, reductionism cannot explain the self-reproductive power of living organism by selective expression of some part of the information stored in the DNA-helices. Is essentialism the last life jacket of the scientist to reach the ultimate theory? But, what about the essentialism of time when time emerges in natural sciences as three different incompatible essences? Despite the order relation within the sets of observable no evidence is given for the essence of time neither for time order, arrow of time and time anisotropy. Indeed at the one hand time is corruptive, at the other it is creative, and in a third way it is an eternal return of 'now' and in the field theoretical approach of Einstein's generalized relativity time is completely redundant. To reconcile this triad nature of time the pitfall of the post-positivistic claims adopted by Rull (2012) is tempting, but Rull passed over the essential role of the relation between the physical process and the observation of events. Therefore we adopt we Hacking's social constructivism (1999, pp 6-12).

Social constructivism and physics

Social constructivism queries the sphere of inevitability, which is typically the claim of positive sciences. It puts restrictions on the natural essence of physical processes and on the determinism of the underlying governing physical laws. Hacking (1999, chapter 1) and especially Kukla (2000, chapter 2) emphasized that constructivism in positive sciences is not a matter of semantics. It is a matter of establishing ontological pluralism. Consequently, time as creation, evolution and parameter are different realities according to the social construction they belong to. Constructivism is not just an epistemological perspective such as constructive empiricism, yet constructivism is a constructive action to discover scientific facts. However, the adopted social constructivism does not make room for any radical constructivistic claim that scientific facts are but the result of constructions accepted by at least the scientific community. Neither we adopt some constructivistic views that such facts just emerge in one or another social context and so we escape from Leary's psychological assertions. With Khalifa (2010) we prefer an social constructivism that attributes to the epistemic-social aims of sciences.

Is the threefold paradoxical appearance of time due to the the hypothetical 'Prime Mover', the 'Secondary Hand Observer' provoking the breakdown of the Universe in low entropic branches evoluating further according to Clausius-Duhem inequality, or to the genidentity of biotic evolving life? Or did Newton and afterwards all scientists start from the appropriate meta-physical assumptions about matter under terms concerning the emergence of the respective events? These assumptions start with the experimental set-up, they are involved in the a priori proposed topology of space and time coordinates and in the topology of the fasespace of al conditions and processes. For instance Galilei measured time with falling water drops out of a hole in a water tank. Thus, time is a measure of state change of the leaking water tank. Galileo assigned the process independency and represented becoming on a 1D time-manifold. He linked gravitation to super facial tension of liquid matter to examine kinetics of point masses. However, measuring time is only feasible if the reference contains sufficient constant elements when isolating the varying physical parameter with time. Moreover, representing the spatial physical state of point masses in terms of parabolic trajectory to linear time implies the assumption of an ordered 4D time-space. Hacking emphasized that this experimental set-up could be completely constructed differently. However, different social constructions would involve different concepts of time and space. In addition, the constructive essence of time with its threefold emergence in the mosaic of science plays a significant role in order to produce a mosaic as a real synthesis of different stones representing all gamma of scientific realities. Moreover, constructivism implies a new uncertainty relation. Indeed, constructive activity needs corroborating reproducible facts to provide positive support for any construction. The latter are more or less probable according to the respective social constructive activity. This produces an new uncertainty. The latter is not situated on the level of the essence of isolated particles, yet on the level of the existential scientific research. Consequently, uncertainty is not the result of a indeterminism but is involved by physics' underdeterminism.

Consequences of social constructivism for time's reality

Newtonian meta-physical social constructions

Though Galileo did not consider his experimental set-up as a social construction in which 'social' participation of the observer is involved, his conception of space and time is summarized by two socially accepted characteristics: (i) Time is an uniform flood of states; (ii) Space is a continuum enclosing all motion. More precisely Galileo's time is a process of events, which implies both progressing in a spatial sense as continuation in time. In consequence, his time concept leads to an infinite regression. Newton avoided this elliptic pitfall by postulating an external observer on the one hand and the causation principle accompanied by an absolute zero of space and time on the other hand. So Newton constructed his social accepted Newtonian space-time. Moreover the above construction of the Newtonian space and time implies also a time order before masses and interconnecting forces are filling up the empty Newtonian 4D-container, provided the k-connectedness of all processes is tacitly accepted. In consequence times' reality emerge as a nude physical parameter, redundant in the elecromagnetic field formalism.

Thermodynamic constructions

What are the implications if a human 'second hand' observer, called scientist, intentionally involved within systems and becomes a system itself, but nevertheless presupposing the Newtonian construction of space and time? By determining the initial and boundary conditions he/she isolates a particular macro-system, to which many microstates of Newtonian dimensionless masses are compatible. Unfortunately, avoiding

further meta-physical constructions by reducing natural randomness as a result of the non-commutating time operator and the mechanical Langrangian, as Prigogine (1980, 1986) claimed, presupposed another social assumption: irreversibility on macro-scale (Verstraeten, 1991). Truesdell (1983), however, argued within the Newtonian concept of space and time the equivalence of a Kelvin-Planck theory and the existence of an entropy and temperature manifold. The cornerstone of the equivalence is the Hahn-Banach separation-theorem, provided the time-space reaches the Hausdorff topology. To conclude: once physical systems are established by the second hand observer, topology, separation theorems and measuring theory involve a reality of time implying entropy production, randomness, dissipation, entropy increase or more disorder and eventually an arrow of time.

Creation and evolution

According to the suggested constructivism by Hacking and Kukla we leave the Newtonian space-time conception and we adopt the Leibnizian conception. In the Leibnizian world there is no room for randomness since there is no extended observer who localizes the different events as separated points of time, according to an ordered time axis. On the contrary the constructive Leibniz' view holds a relative temporal and spatial origin. A relative zero means that the essence of 'being' stands against non-essence. One world is determined through the co-existence of contingent systems. A world exists of co-existing order relationships of one manifold with all possible relations. Reality is not just one actual existing world but all possible (potential) worlds. Those worlds only exist if the internal spatial-temporal structure produces a world that does not expand. Any world possesses an intrinsic compensation system to prevent its own destruction. Time emerges as cyclic sustainable processes. The regulating internal hardware is a resultant of feedback and response between internal diachronic spatial construction and the internal synchronic feedback between the shaped space and the temporal hardware.

The latter construct a one gen-identical chain of internal spacelike interactions. Time's reality within the Leibnizian concept emerges as chain's life time defined with respect to former events, gen-identical to the actual and the forthcoming. Besides the intrinsic cyclic time evolution, the latter geometric evolution establishes a linear 'eigen'- evolution when this evolution leads to a more complex and efficient self-organization of the respective world. Singularities within the Leibnizian gen-identical chain result into qualitative evolution of the chain and are produced by incidental interactions between the active edge of the Leibnizian world and the information embedded in the respective gen-identical chains. In living organisms interactions between de DNA-helices, the different RNA- structures and the processes on the surface of the cell membranes produce creative evolution. The more corresponding states, the more possible mutual interactions, the more opportunity for evolution. The latter is the appropriate answer to changes in the surroundings. Some authors like Penrose suggested that the creation of negentropy by biotic systems is a consequence of the relatively low entropy state of the Sun (2010, pp. 77-79). Therefore he refers to the Boltzmann's formulation of entropy that depends on the number of involved photons. The emitted solar photons are high frequency particles, the emitted infra red particles low frequency particles. As the former are high energetic and the latter low energetic, first law of thermodynamics makes that the by Earth received energy must be equal to the emitted and in consequence more photons are returning to the dark sky. The whole picture is a prototype of social constructvism on the scale of our solar system in order to make room for entropy growth of the universe, and for the biotic evolution as well. However, Penrose denied the fact that he conceives the solar system in terms of Boltzmann's statistical approach while the Newtonian space-time, Boltzmann's phase space and the global production of biotic negentropy are all involved. The latter, however, must be conceived in terms of driving out of heat power by biosystems Z not appearing in Newtonian spacetime but producing Leibnizian space-time.

Physics' reality: the trinity of time, entropy and temperature

Does the social constructive approach of the threefold time emergence make room for a more fundamental role of entropy and absolute temperature? The point is that time only appears implicitely in phenomena wherein heat power equilibrium as well as non-equilibrium transformations are involved. Moreover, the cyclic Kelvin-Planck thermodynamics produce events by implying a hyperplane separating observable macrostates from compact process. The event of intervention by the second hand agent from without, where the ensemble of states transforms its compact topology for a Hausdorff topology, however, does not follow from any physical law. This under-determinism of physics implies uncertainty about the transformation from reversible adiabatic thermal processes into an irreversible evolution. Hence, entropy is not just a measure of chaos but makes room for observability. Indeed, the more microstates compatible to the macrostate represented by some observable, the more probable the event of observation, the less the uncertainty of the topology transformation and eventually the more evidence for asymmetric time evolution.

In addition we claim that *pTa* and *eTa* are not contradictory or paradoxal neither. What is more, evolution to more complex biotic systems follows from petrified residues of life, in complete thermal equilibrium with the environment after branch off of a thermal non-equilibrium biotic state. That is completely in correspondence with *pTa* or the asymmetric time producing entropy. In the living biotic state, however, the conditions for the Banach-Hanh theorem are not fulfilled since the cyclic thermal processes do not match the Kelvin-Planck cyclic processes. Indeed, the biotic cyclic processes build up the living system and avoid corruption. We conclude: entropy growth decline the temporal duration of observation, entropy decrease or growth of negentropy increases it. Besides, absolute temperature is inversely proportional to heat absorbed or emitted during the above entropy or negentropy productions. The lower the absolute temperature, the more heat absorption in order to increase the possible number of events of observation and vice versa. And what about the consequences of the social constructive approach of physics' reality for time? First, is time emerging a reality with three different faces or do we have to manage three different realities?

The former suggestion is rather odd since a (secondary) agent is either an interacting or neutral (Prime Mover) observer within the same reality. But any agent can interact with one world and passively watch another, provided both worlds are completely different worlds. Hence, any Leibnizian world is compatible with the respective Newtonian world. The uniqueness of the latter should be very improbable. Indeed, a coherent watch of all Leibnizian agents would be required. Consequently, there would be one central source to provoke a coherent action of all Leibnizian agents. This alternative 'Good Lord' is completely incompatible with the fact that there are no interactions between the Leibnizian worlds. This argument implies the non-uniqueness of the Newtonian world and the breakdown of a unique universal entropic reduction of irreversibility. In consequence, it implies the refutation of any physical reduction of a unique and universal arrow of time.

Secondly, on Earth there is the exit of Newtonian time when this ecologic system is considered as one indivisible Leibnizian world, called Gaia. However, for any couple of Leibnizian and respective Newtonian world, there exists a threefold emergence of time reality (Verstraeten & Verstraeten, 2013). Eventually, the uncertainty event of intervention from without challenges natural sciences with a new cat-of Schrödinger-like story or the Galileo-paradox: Is times' reality emerging timelessness of the universe, the chaos after intervention from without or the complexity by creative cyclic heat power transformation? Anyhow, the threefold emergence of Time's reality enclosures physics under-determinism by revealing uncertainty about heat power transport within an Newtonian spacetime container or a branch off in a Leibnizian spacetime constructed by cyclic heat transport.

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