The Threefold Emergence of Time unravels Physics´ Reality

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Abstract

Time as the key to a theory of everything became recently a renewed topic in scientific literature. Social constructivism applied to physics abandons the inevitable essentials of nature. It adopts uncertainty in the scope of the existential activity of scientific research. We have enlightened the deep role of social constructivism of the predetermined Newtonian time and space notions in natural sciences. Despite its incompatibility with determinism governing the Newtonian mechanics, randomness and entropy are inevitable when negative localized energy is transformed into spatially dissipative heat. In sharp contrast to the Newtonian notion, social constructivism makes room for the temporal twin of cyclic conservation and pseudo-linearly structural evolution both reconciling mechanical order and thermodynamic chaos in Leibnizian space-time. In the broad scope of natural sciences this triad nature of time produces a multiple reality and gives appropriate answers on virtual physical paradoxes.

Keywords: Newtonian and Leibnizian world, cyclic, dissipative and evolutionary time, multiple reality

1. Time and the theory of everything

For centuries scientists have strived for the ultimate theory of everything. Recently, Rull (2012) concluded that neither of three methodological ways - essentialism, determinism and reductionism - provided a good basis for a unified Physics. Determinism is out of the question due to its incompatibility with randomness and stochastic processes. Reductionism cannot explain the self-reproductive power of organisms. Even essentialism is no option because physicists disagree about the real nature of physical concepts like space and time.

To avoid apparent paradoxes Rull (2012) adopted van Fraassen´s constructive empiricism (van Fraassen, 1980) of different models and promoted time as the appropriate physical concept that drives the convergence to perceive order out of the mosaic of models (Hawking and Mlodinow, 2012). However, according to Hacking's constructivism (Hacking, 1999), widely called social constructivism, essentialism does not imply deterministically and unavoidably physical facts as is assumed in classical sciences. Particularly different essences of space and time create different realities.

Here we criticize uniqueness of reality and search for the multiple nature of time. The Newtonian and Leibnizian concepts of space and time and the way time emerges in different physical theories are our step stones. We will not conclude with a theory of everything, but with a multiple reality concisely brought together by the threefold emergence of time.

2. The emergence of Time as constructive drive

What about the query about time? At face value, the opinion about the real nature of time varies from non-existing to a "phenomenological way of something more fundamental".

The famous de Witt-Wheeler equation, i.e. the reformulation of Einstein's general theory of relativity in terms of electromagnetic equations, even governs a timeless universe (1973). Barbour (1999) cited this remarkable quote of Dirac (1963): "… This result has led me to doubt how fundamental the four-dimensional requirement in physics is …". Indeed, all physical states are directly related to one another and time becomes redundant. Time emerges from timelessness if the universe is broken in several pieces like our Milky Way and particularly our solar system from which an observer identifies inside his own world the relative motion of the worlds from without.

Craig Callender (2012) proposes the idea of time as emerging from fundamental levels of matter, like temperature emerges as a standard for micro agitation of molecules constraint in a container. Furthered, time is connected to a metric space by concepts as duration independently from any observer. The most controversial time property is the arrow of time that points from past to future. This asymmetry is not a property of time but rather a property of physical states (2010), though the basic equations of mechanics do not make room for this asymmetry. This is because its determinism does not imply randomness of micro states compatible with the actual macro state.

There are two types of asymmetric time flows. Firstly, there is the thermodynamic arrow of time. 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. This arrow of time is based on stochastic and probabilistic elements that are unified in Boltzmann's Stosszahlansatz: the most probable microstate reconcilable with the macro state of the thermodynamic system is the actual one. Secondly, there is the evolutionary arrow of time, called ´eTA´ that governs the evolution from primitive to the more complex organisms. Since organisms contain cyclic processes both in its ontology as well as in its genealogy like analogy in structure and homology in function, the eTA that emerges from these systems far from thermodynamic equilibrium is not identical to the pTA. Contrary to the dissipative arrow of time of a chaotic future eTA is driven by cyclic biochemical processes towards to more complex ordered self organizing independent systems.

We remark a threefold emergence of time: a parameter time, an asymmetric dissipative time and an asymmetric evolutionary time (Fig 1). How can social constructivism transform this threefold emergence of time to unravel physics´ reality?

3. Social constructivism and physics

Social constructivism starts from the postulation of the a priori existence of reality that permits human action in order to get scientific knowledge. It 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. Constructivism is not just an epistemological perspective such as constructive empiricism, yet constructivism claims ontological status. In the constructive framework nature of all real things precedes any theory about the reality. Constructivism starts from the postulate that reality makes room for constructive human action to discover scientific facts, the basic necessary boundary conditions of any theory. So constructivism in positive sciences is not a matter of semantics (Kubla, 2000). It is a matter of establishing ontological pluralism. Consequently, creation, evolution and nature itself are different realities according to the social construction they belong to.

Any experimental set-up is the result of a social construction and one of the first cases can be attributed to the first experimental physicist Galileo. He 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 the observation by a linear time parameter. He linked gravitation to super facial tension of liquid matter to examine kinetics of point masses. Measuring time however 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 a-priori ordered 4D time-space.

Hacking (1999) emphasized that experimental set-ups could be completely constructed differently. Different social constructions, however, would involve different concepts of time and space. And so does the origin of time and space. Constructivism implies uncertainty about the considered reality. 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 and the respective reality allows former activity. Consequently, social constructivism implies uncertainty, not situated on the level of the essence of isolated particles,

yet on the level of the existential scientific research. Particularly, either the observer is isolated from space and time (Newtonian) or participates to space and time (Leibnizian).

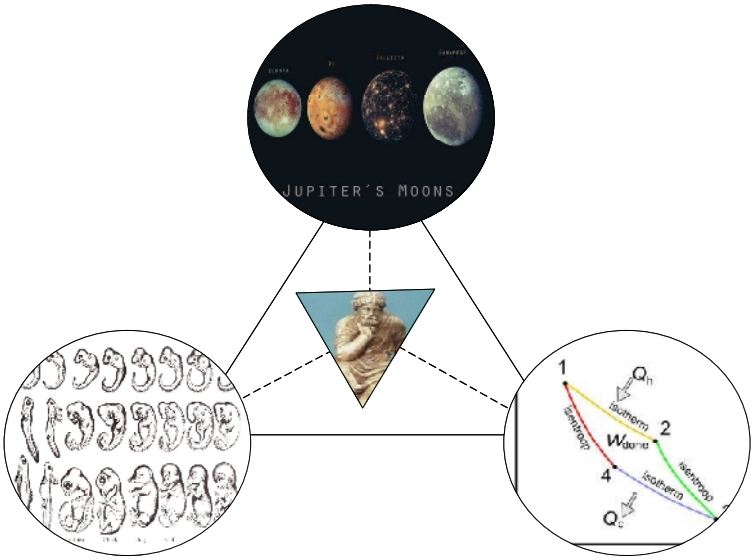

Figure 1. Threefold emergence of time and the step stones to a multiple reality versus a theory of everything: One time to order, one time for chaos, one time for evolution.

Aristotle in the middle of the triangle represents a threefold observer in a dual reality. As an Absolute Unaffected Observer, he characterizes time by absolute order in time and space (´First Cause/Prime mover´) just like Galileo observing the Jupiter's moons. As second hand observer, he represents the thermodynamic arrow of time implying an eternal grow of entropy, here represented with a phase diagram (Carnot machine) in the same absolute order. However, he participates in the cyclic organic processes where time is the variation in space within the constraints of the conservation laws that end with the irreversible birth of a new organic entity. Eventually, he represents organic grow according to the absolute time order when Haeckel's principle - the ontogenesis proceeds according to phylogenesis - is extrapolated to the evolutionary arrow of time. As Absolute or pseudo Absolute Observer Aristotle adopts the Newtonian conception of absolute space-time, as participating observer he makes room for the Leibnizian concept of relative space and time.

4. Reversible Newtonian Time emerging from the metric ordered continuous space

Galileo, preceding Newton, did not consider his experimental set-up as a social construction in which 'social' participation of the observer is involved (see paragraph 3). His conception of space and time is summarized by two characteristics: (i) Time is a uniform flood of states, and (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 and strictly ordered from cause to effect. In consequence his time concept leads to an infinite regression. In contrast to Galileo, Newton avoided this elliptic pitfall.

According to Newton's Philosophiae Naturalis Principia Mathematica, space-time results in a parametric time notion running along an a-priori ordered 1D manifold and an a priori ordered 3D space. Newton introduced a space-time twin: the existence of an absolute zero defining absolute order in time and space and an Absolute Unaffected Observer, tacitly assumed as the ´First Cause´. Indeed, a homogeneous reference system exists wherein both time and space are prearranged before physical or other systems are involved. Furthermore, the Newtonian time-space concept claims the possibility of an absolute external observation to isolate the examined dimensionless bodies in any instant of time. Newtonian mechanics rules out all possible initial and boundary conditions assuming universality of the time-space frame. Deterministically, the actual physical state of any macro or micro system is not the most probable but the only possible state allowed by the mechanical laws and the appropriate initial and boundary conditions.

Questionable is that the Newtonian mechanics did not formulate any criteria for defining this absolute order in time and space. Both Newtonian escapes are not physically, but rather metaphysically connected as the absolute zero refers to the Aristotelian 'Prime Mover'(Rynasiewicz, 2008; Futch, 2002; Mcdonough, 2008).

5. Thermodynamic Arrow of Time emerging from a separating topology in the Newtonian space-time

What are the implications if a human 'second hand' observer, called scientist, is intentionally involved within systems and becomes a system itself? By determining the initial and boundary conditions, the scientist isolates a particular macro system to which many microstates of Newtonian dimensionless masses are compatible. Two possibilities emerge. Firstly, there is no need for the Newtonian social construction and thus the paradox between 'Prime Mover' mechanics and 'Second hand' human observer evolves into the pragmatic thermodynamic or statistical approach. Secondly, the Newtonian social construction is complemented by natural micro randomness. The former pays the price for loss of information by introducing dissipation of energy and entropy as the measure of chaos. Prigogine's (1980) attempts to give micro-fundaments to randomness as a complement of the Newtonian construction are in vain. It tacitly implies irreversibility and entropy increase on macro scale eventually extrapolated to the micro scale (Verstraeten, 1991). Moreover, both social constructed concepts deny the determinism and reversibility of the Newtonian time-space although both visions result from a social construction that forces physics to be stuck in the Newtonian concept of reversible time on the micro level. Adopting topologic concepts in the scope of thermodynamics provides a third way out of the above paradox.

Truesdell (1983) argued the existence of an entropy and temperature manifold as a consequence of the Hahn-Banach separation-theorem, provided the time-space reaches the Hausdorff topology. The former separation-theorem executes the isolation of physical systems, the latter topology provides the appropriate algebraic structure of ensembles within the Newtonian space-time. Though any isolated system in the Newtonian space-time is cyclic following the Poincaré's recurrent theorem (Poincaré, 1913), the recurrence time doubles when the environmental boundary condition reaches a critical value according to Feigenbaum (1978). The more improbable the 6N-dimensional system, the smaller the threshold value of the infinitesimal changes of the environment. Neither Hahn-Banach theorem, nor the compact ensembles are consequences of mechanical determinism of the a-priori ordered Newtonian space-time.

Hence, once a physical system is isolated according to the Hahn-Banach separation theorem the 6N- dimensional Phase Space representation violates the mechanical determinism of the 4D Newtonian space-time. Thus, once physical systems are established by the second hand observer, topology, separation theorems and measuring theory involve entropy production, randomness, dissipation, more disorder and eventually an arrow of time.

6. The Leibnizian temporal twin emerging from self consistent an reproducing systems

Time emerges as evolution to more complex organic forms of life. Life is characterized by two properties: self survival and self reproducibility. These two mechanisms are rather analogue for all forms of organisms. Metabolic cyclic processes govern the patterns of survival, reproduction is a cyclic process from one generation to the other. However, also an 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 organisms as responses to environmental stimulus, the latter adapts the structure to environmental needs. Consequently time emerges from organisms completely in contradiction to both the Newtonian time from the Prime Mover Observation as well as the Thermodynamic time from the second hand observer. Indeed, evolutionary time is not symmetric nor asymmetric pointing to more chaos. Moreover, all processes of the living organism cannot simply be reduced to cause-consequence processes since they are all embedded in a web of positive and negative feedback processes assisting the organism to sustain.

Recently, Callaway (2012) suggested that all these cyclic processes are governed by enzymes mopping up toxic peroxides according to a circadian clock. Once a tipping point reached however, an incidental disequilibrium cannot be balanced by a proper feedback mechanism. Hence, how to reconcile this irreversible emerging time with the symmetry of the External observations and the asymmetric dissipation of thermodynamic systems? According to the suggested social constructivism (Hacking, 1999; Kubla, 2000) we quit the Newtonian space-time conception in favour for the Leibnizian conception.

According to the Leibnizian observer, the water tank and the falling body (paragraph 3) do not proceed in an a priori ordered space-time (see paragraph 4), but they construct space by mutual interactions. As a consequence Leibniz' view holds a relative temporal and spatial origin. A relative zero means that the essence of 'being' stands against

absence of ´being´. One world is determined through the co-existence of contingent systems. A world exists of co-existing order of 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 destruction of its world. The structure of the edge of worlds gives feedback to the hardware of that world driving the geometric evolution. 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. The bounds of a multiple-world is regulated with the internal hardware and 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.

This ontological pluralistic vision is strongly inspired to the level of molecules composing the DNA-helices. Insights in the selective expressing of genes were gained when more attention was given to electromagnetic currents in the spatially non homogeneous cellular wall. This spatial heterogeneity, synchronic with cell nucleus interactions, rules the evolution of organisms. Due to the splendid isolation of the Leibnizian worlds, they all have an additional long life recurrence time that recover their existential conservation. This Leibnizian long life recurrence time is not defined with respect to an independent observer as is the case in Newtonian time-space, but with respect to former and the latter events, provided all events are gen-identical to the actual, the passed and the coming. Gen-identity means that all events of a particular Leinizian world have one natural property in common so that it can be considered as a whole. Consequently, the respective Leibnizian world is one gen-identical chain whose events cannot be mutually separated. Indeed, when it becomes possible to define a gen-identical chain governed by a Haussdorff-topology, the Hahn-Banach theorem implies an entropy density function, temperature and dissipation and the whole process is represented by a Newtonian time-space.

The Leibnizian gen-identical chain implies a geometric structure of time-space. Similar to Ohm's mechanics any geometric structure making part of the gen-identical chain that produces the Leibnizian space corresponds to a kinetic state. Some geometric structures appear more frequently than others. Hence, some kinetic states are more probable than others. Though any state is the consequence of another kinetic state, and different states imply different former states, their appearance depends on the corresponding geometric structure within the chain. Leibnizian time is nothing else than the variation in space of a relative observation, such as Barbour's time-capsule, within the constraints of the conservation laws of the Leibnizian space that imply that the ontogenesis proceeds according to phylogenesis. This conservation laws represent the geometric regularities of the Leibnizian chain. Singularities result into qualitative evolution of the chain and are produced by tide interactions between the active edge of the Leibnizian world and the information embedded in the respective gen-identical chains. In the framework of organism this is traduced to interactions between de DNA-helices, the different RNA- structures and the processes on the surface of the cell membranes. The more corresponding states, the more possible mutual interactions, and the more opportunity for evolution. The latter is the appropriate answer to changes in the environment.

Observing organisms, however, are faced to a double conception of space and time. Though evolution is manifested within the Leibnizian world of organisms by the reproduction, the historical evolution from the simple corals to complex mammals is observed by the second hand observer. It is the scientist who links the fossil petrified residues of organisms to Haeckel's principle that phylogenesis finally ends into ontogenesis. Eventually the scientist presents all data according to time evolution ordered on the Newtonian time parameter axis. Hence, the apparent paradox between the thermodynamic evolution to chaos and the evolutionary arrow of time to more complex order results from the a priori reality corresponding to the respective social construction.

Consequently, different possible worlds have their own spatial-temporal structure. The latter implies that Leibnizian time switches from a state of affairs or as simultaneously manifested configurations in the shape of tracks to interrelation within one world besides others.

7. From a threefold emergence of Time to a threefold essence of Time

A threefold human action produces a threefold emergence of time. Within the Newtonian space-time the action can happen outside the whole reality or outside a separable part of the reality. The Newtonian time emerges from a ordered continuous space as the way how an external observation is structured according to the widely accepted but too simple assumption that cause precedes effect (see paragraph 4). However, once the observer adopts a topology on the Newtonian space linking continuity to mass, and once the observer adopts a separation action on mass, the

observation is structured according to the thermodynamic arrow of time (see paragraph 5).

Both emergences are the two sides of the same social construction based on a separability of an outside respectively inside observer and a scientific object. On the contrary, Leibnizian time appears as variations of physical states in correspondence with the governing conservation law (see paragraph 5). These are the physical consequences of the particular geometric structure in some parts of the chain. The appropriate essence of time is lifetime out of thermodynamic equilibrium and is the result of a social construction based on the inseparability of observer and object. It results into a time twin, a cyclic conservative time supporting a creating pseudo-linear life-time.

8. Back to a single or multiple reality

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 agent is either an interacting or neutral 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, only 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' or 'Prime Mover' 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. However, for any couple of Leibnizian and respective Newtonian world, there exists a threefold emergence of time. This conclusion implies the exit of Newtonian time on Earth when this ecologic system is considered as one indivisible Leibnizian world, called Gaia. Galileo observed Gaia when he accomplished his investigation of Earth gravitation, but he watched the accompanying Newtonian world when he admired Jupiter's moons (Figure 1).

The same reality paradox appears in describing catastrophic shifts in ecosystems (Scheffer et al., 2001). Some ecosystems are cycling around two attractive equilibriums when external pressure overcomes the proper resilience. The cyclic evolution runs according to a hysteresis loop. The cyclic time is the internal cyclic Leibnizian clock, the scientific representation, however, is formulated in terms of the Newtonian time parameter. Another example of the paradox appears in case of emergence of infectious diseases (Antia et al., 2003). Ecological pressure producing an initial insufficient pathogen's basic reproductive number, can promote a rise of the average number of secondary infections due to pathogen transmission and mutation (evolution). The concatenation of infections evolving into subsequent disease emergence are the Leibnizian events of the gen-identical chain that branches off when the average number of secondary infections reaches the critical value and the epidemic spread is described in terms of Newtonian time and space. Another reality paradox is encountered in the recent critical article of Claudio Mazolla about Jean Paul van Bendegem´s claims about discrete time (Mazolla, 2013). Van Bendegem (2011) pretends that if time is discrete, then space must at least looks discrete. His arguments are based on assumed correspondences between motion of bodies and the constructed geometry on the subsequent positions of the moving bodies. However, according to Mazolla (2013) these correspondences are based on unwarranted assumptions about the epistemic power of the hypothetical observer of motion. In the scope of constructivism it is not a matter of discrete or continuous space-time, it is a matter of constructing a world that makes room for discrete, respectively continuous and mixed discrete-continuous space-time. The genidentical chains of the Leibnizian world make room for discrete space and time, but the hypothetical observer gives the Leibnizian and the Newtonian world equal chances. As insider of the Leibnizian world, he observes varying Leibnizian bodies as a denumerable set of events and the respective space is based on discrete spacelike bodies. As outsider, he observes motion within the a priori continuous Newtonian space-time. In consequence, it is not the question how space looks at least discrete since space can be Leibnizian discrete but Newtonian continuous.

Finally, we emphasize the possibility for many couples of Newtonian-Leibnizian worlds. Any other celestial body that contains self-organizing evolving complexities can be a Leibnizian world accompanied by the respective Newtonian world. Hence, the already mentioned uncertainty appears: either a Newtonian world with an a-priori ordered parameter space-time or a Leibnizian world with a twofold temporal representation, cyclic and pseudo-linear. Eventually, we challenge science with a physics´ reality paradox: Is the first modern scientist constructing Gaia of acting co-existing beings or the Newtonian world of the 'Prime Mover'? Physics is suffering from underdeterminism to give the a priori answer. Social constructivism transforms the apparent contradiction between symmetric and asymmetric time in the frame of the Newtonian construction and avoids the paradox between the

dissipative and evolutionary arrow of time. Any observer participating to an evaluating Leibnizian world doubles the reality when observing a Newtonian world from without but is faced to corruption and a dissipative arrow of time when focused to a system separated from the virgin Newtonian world.

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