Can 'Theory of Everything' Be Global Theory of Consciousness? Ontology and Psychodynamics of I-observer

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ABSTRACT

The 'theory of everything' (TOE) is conceived to embrace all natural sciences Today the TOE is discussed mostly in physics. From Copenhagen interpretation to date, another discussion is widely unfolded on the role of consciousness in quantum experience and physical descriptions in general. The paper combines both the discussions and argues for a global theory of consciousness (GTC). It will be proven that the naturalistic postulate on the world's independent existence is not quite correct but requires independence of any privileged anthropic I-observer with regard to relational observer-dependent scenario. The stream $I(t)$ of consciousness is introduced by analogy with causal set modeling in quantum cosmology as a Markov chain (or a Turing machine) taken to be a set of the instant I-World states. In dynamics, the *cogito* emerges to be an unclosed loop on $I(t)$ related directly to ψ-ontology. Further, it can be naturally extended to the *perpetum cogito* mechanism that entangles the triple 'past-present-future'. In fact, it is a noncommutative algebra for physics on a boundary. I-observer moves in superposition through every current present and in 'back-position' towards the arrow of time.

Key Words: theory of everything; stream of consciousness; perpetum cogito; ψ-ontology; arrow of time; nonlocality

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1. Introduction

Although the "theory of everything" (TOE) had been historically related to philosophy of mind rather than natural science, now it is discussed mostly in physics. Articulated initially as Hilbert's sixth problem, the TOE is presupposed to be generally based upon the axioms (fundamental laws) powerful enough to deduce all observable phenomena from them. However, be the TOE conceived as a 'final theory that ends the days of a 'certain sort of science with the ancient principles' (Weinberg 1992), an ultimate mathematical theory of all logically self-consistent models-words (Tegmark 2007) or a cellular automaton ('t Hooft 2015), all these definitions can be taken in favor of the global theory of consciousness (GTC).

There are two at least quite independent reasons of why the TOE can be the GTC. The first lies entirely in the domain of natural sciences. Namely, it comes from the fact that the brain is the most complicate dynamical system taken physically. This is a naturalistic reason. The second implies quite another matter. It can be called a 'phenomenological' reason here, since it seems to be undoubted that any theory including TOE has to be none other than a phenomenological (say, logic-semantical) product of consciousness in the sense of Wigner's (1960) remark on 'the unreasonable effectiveness of mathematics in the natural sciences'. Indeed, it follows from nothing that mathematics being derived exclusively from consciousness must be adequate to the independent physical reality.

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The duality of the naturalistic and the phenomenological approaches is initially and methodologically tied to mind-matter dualism and is unalienable in our (conscious) studies of the reality. So, in classical definitions of scientific naturalism (realism), both terms of the duality presence always although, of course, in favor of matter. For example, in Smolin's formulation (Smolin 2013):

Naturalism is the view that all that exists is the natural world that is perceived with, but exists independently of, our senses or tools which extend them; naturalists also hold that science is the most reliable route to knowledge about nature.

However, Smolin instantly puts a remark that this is a good first try at a definition of what is naturalism (or realism) but its simplicity hides ambiguities and traps, and further he insists on naturalism with time irreversibility and a privileged status to each moment of time taken as 'now'. It implies physics on a boundary when a current present takes a singular position in dynamics over time passage. The main aim of this paper is to consider intently time evolution in respect to consciousness, so that an observer with essential indexicals such as 'I' and his degrees of freedom. We intend to bind I-observer (mind) to the naturalistic postulate directly.

The second aim is to impose consciousness by the naturalistic postulate upon the TOE in favor of the GTC. So, Tegmark (2007) founds the TOE on two hypotheses. He articulates naturalism as the External Reality Hypothesis: 'There exists an external physical reality completely independent of us humans', and then he goes to the main hypothesis of his work that our external physical reality is a mathematical structure. At first glance, it seems uncontestable that the universe can be modeled more or less consistently and completely only by some mathematical structure based upon the concepts of the order and relationship with no baggage. However, if the TOE is designed to embrace all natural sciences related traditionally to describing the external reality, it faces instantly three, at least, problems.

Firstly, our external reality and internal reality can be scarcely separated from each other with a residue. Something may remain there. It is a subject of the widely discussed in philosophy of mind 'hard problem' and 'qualia' (Nagel 2012). Secondly, being such conceived, the TOE should explain everything including itself as a mathematical structure. This seems to ignore the question about the status of mathematics as a pure product of mind. Putting aside from mind-body duality, how much is it possible that consciousness being, say, isolated in itself might be able to derive mathematics and logic from its internal reality (its own neural syntax) beyond any empirical knowledge on the external reality? Might consciousness elaborate such concepts as 'set', 'order', 'number', 'structure', and the like in itself independently? Is it so necessary for mind – to observe the physical space before imaging a mathematical space?

After all, with regard to Gödel and Tarski incompleteness, how could the TOE being maximally formalized as a consistent mathematical theory prove its own foundations in the sense that any closed theory requires a meta-theory for avoiding paradoxes (as it is, in particular, in Relativity and Quantum mechanics taken apart). Therefore, the GTC (if assumed to be logically complete) might emerge as a strange theory whose foundations meets a paradox on the boundary of the observable reality. Meanwhile, the GTC (if taken seriously) should embrace not only natural sciences but humanities and social sciences including linguistics, logic, mathematics (as a full theory of language) as well as moral, justice, aesthetics (as a full theory of mind) in order to explain its principles.

The TOE starts with a reasonable idea that the universe is the space-time full exclusively of elementary particles which obey general laws. Naturalism in turn assumes two standpoints, namely in respect to reduction and emergence. Reductionism holds a position that the simplicity and complexity have only a quantitative difference, while all systems are governed by the same laws of physics alike. Taken radically, reductionism can go on to a provocative conclusion against free will. In this sense, reductionism itself can be phenomenologically reduced *ad absurdum* through the *cogito* (it will be considered below).

Instead, emergentism argues for qualitative distinctions among systems according to their complexity. The whole is said to be more than the sum of its parts (Anderson 1972). New properties of a system arise as it increases and extends its functionality. Thus, consciousness emerges as an epiphenomenon of the neural cells whose behaviour however cannot violate basic physical principles, in particular, such as causality. On the other hand, the Free Will theorem (Conway and Kochen 2009), based on the EPR paradox and the Kochen-Specker paradox asserts, roughly speaking, that if an experimenter (consciousness)

may have a certain freedom to make his choice, then the physical world may be non-local, that is, the particles are not determined fully by their previous history. It defies causality and a naturalistic principle about independency of the reality.

The TOE is usually viewed on a whole as a hierarchy with vertexes arranged in terms of special sciences S_i. In other words, it is a lattice whose order is conceptual logically, and $i < j$ implies that S_i underlies S_j so that the elementary entities of the 'lower' science obey the laws established in the 'upper' one. Laying simply, it is a chain with the collateral branches for subdomains and overlaps.

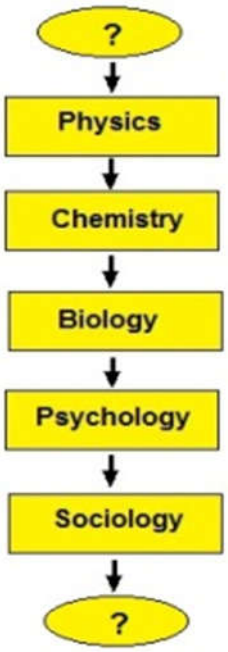

Fig. 1 Hierarchy of sciences.

Emergentism and reductionism both are agree about the general order of the hierarchy. Nevertheless, in emergentism, any stage can and must require new conceptions and its own laws, despite reductionism where, say, psychology is viewed to be applied biology that is in turn applied chemistry and so on until elementary particle physics and quantum mechanics. The TOE is traditionally designed to be the supremum S_0, while psychology and social sciences occupy the infimum of the hierarchy (Tegmark 2007, Anderson 1972). It seems to remain nothing for speculative philosophy of mind but opens a wide way to the GTC in both naturalistic and phenomenological approaches. After all, GTC can claim to be the TOE because the very origin of consciousness from the matter having no consciousness (if we exclude panpsychism and spontaneous emergence psyche in systems complex enough for it) is one of the most fundamental puzzle of scientific knowledge from ancient times.

The TOE can appear not a hierarchy of sciences but a vicious circle, where, say, physics determines biology, (neuro)-biology determines psychology and sociology, those, in turn, explain consciousness, but physics itself cannot be explained without consciousness. It has a long discussion in physics shared between the relativistic and quantum observers whose basic theories are incompatible. So, quantum mechanics itself (if taken under the GTS as TOE) exhibits quite mysterious properties involving an observer (consciousness) into the process of becoming the universe assumed in naturalism to exist independently. Being encouraged initially by Copenhagen interpretation, it caused Many-worlds (Everett 1957, DeWitt and Graham 1973) and Many-minds (Lockwood 1996, Spekkens 2007) models, Participatory Anthropic Principles (Wheeler 1977), the nonlocal reason-like Wholeness with the implicate order (Bohm 1980), Observer-dependent reality (Rovelli 1996), and other conceptions defying the naturalistic principles. It suggests that the hierarchy itself taken as a mathematical model for the TOE can be wrong. A more adequate structure may occur in the conceptual-logical order where the supremum and the infimum are bundled by consciousness. For these reasons, listed here in short, the TOE should be the GTC – whatever it might turn out eventually – as a complete or incomplete in principle theory of everything and everyone.

This paper is mainly phenomenological by applying logic to consciousness and physical observation. It is not on quantum logic though the very law of excluded middle might be challenged there in respect to both the boundary problem in mathematics and the moment problem in physics. The aim is to formalize ontology of I-observer and elaborate dynamics of his stream over time with regard to physical observation. It would be desirable to go on over foundations of mathematics and physics to the GTC. Does consciousness obtain its internal reality trough physical observation or, on the contrary, create the external reality by interaction with it?

2. Ontology of I-observer

In Descartes' thought, the *cogito* is the first uncontestable truth of consciousness. He introduces the *cogito* not only as a self-evident tautology 'I think (of myself), therefore I am' but

argues yet for it as the initial mechanism of realizing existentiality. Mind endows its mental acts – whatever they might be – with actuality and existentiality at once. Only consciousness is able to endow the world with existentiality for itself. In particular, Castaneda (1966) argues that 'I' and other personal derivatives of consciousness cannot be eliminable out of description. The 'I' plays a role of an existential indexical $\exists I$ in the world of things and ideas. Traditionally, we omit the indexical in common usage with no damage to the sense and meaning of our predications. Nevertheless, it becomes significant and ineliminable if a speaker's belief cannot be expressed in language without the essential indexicals that Perry (1993) calls *locating beliefs* about 'who, when, where one is'.

Now we intend to introduce the concept of I-observer for consciousness with respect to Perry's indexicals with their localities. For convenience, let $\Re$ be a predicate 'to be perceived' or 'to be really observable'. The latter is more preferable in modern terminology of physics. Further, by keeping the GTC in mind, we assert that any proposition on an 'atomic fact' A (in Wittgenstein's terms) or a process $F(x)$, including thus the TOE on the whole, is ontologically made in $\Re$-predication from the standpoint of some abstract consciousness (I-observer).

Surprising though it might seem, physicists striving historically to describe the objective and presumably independent reality with no consciousness were constrained by logic of the *cogito* (and 'the order of things') to introduce consciousness in physical descriptions as a relativistic and quantum observer. Just as quantum phenomena interact inevitably with a device in experience, ontology of the very reality adheres to consciousness and cannot be detached from it. The Anthropic Principle elaborated by modern physics in quantum experience (Barrow 1997) comes to the same ontological position although in other formulations.

A more famous formulation is made by Wheeler. His Participatory Anthropic Principle (PAP) based on Copenhagen interpretation of a wave-function collapse, in which just the observer brings the quantum uncertain reality down to the classical relativistic reality, runs: 'Observers are necessary to bring the universe into being' (Wheeler 1977). Who is the observer? It is consciousness. In our terms, it is 'I' in $\Re$-predication, where *ET AL.,* stands for 'to be really observable'. In fact, the only criterion of what is real for natural sciences is 'I' (with its tools and machinery) in $\Re$-predication. The universe must be perceivable and thinkable to appear in being.

Can it be some evidence in favor of the GTC that physicist, logicians, and philosophers come from quite independent ways to the same conclusions about the role of consciousness (*I*-observer)? Searle (1997), for instant, refers to Husserl's 'transcendental primacy' and says that consciousness defines the very fact of appearance, and the existence of the appearance *is* the reality. As regards the indexicals, it is embedded in physical equations implicitly. In terms of physics, any observation implies spatial-temporal coordinates (taken as the degrees of freedom) tied factually down to one or another frame of reference that is unfolded around one consciousness in its zero-point(0,0). One can say that the frame of reference with the indexicals $\exists I(0,0)$ emerges necessarily in physics as a 'measure of all things'.

While classical mechanics takes the external reality for granted, quantum mechanics is in doubt about its ontic state. From Born and Heisenberg arguing for a probabilistic interpretation to date it is in discussion about whether ψ-ontology of the wave-function is *ontic* or *epistemic* (Pusey *et al.,* 2012, Aaronson *et al.,* 2013, Leifer 2014). It is a delicate matter. The role of consciousness is excessive in the causal universe. Clearly, causality eliminates consciousness from any participation in fundamental laws. It is very desirable to us to have the laws independently of one's will. However, causality should also exclude the free will as such at once. But quantum effects do just it: they break up causality at every current present and, thus, bring consciousness back into physical descriptions.

Why is it, then, unobvious for classical mechanics including Relativity? An answer can be simple logically. Indeed, if the existential indexical $\exists I$ in $\Re$-predication is omnipresent in all physical descriptions, it means nothing for physics itself and, hence, can be omitted with no damage to the sense of the equations and physical theory as such in order to make good predictions on the reality. However, naturalism assumes this mathematical laconism seriously as an evidence for the independent external reality. This hypothesis may turn out an illusion caused by the incomplete mathematical descriptions in the sense of Einstein's 'hidden variable' that can, in Bell's words (1987), be unspeakable in quantum theory. Just the I-observer (consciousness) in time passage is not spoken out there. This 'anthropic

lacuna' in respect to the omnipresent existential indexical $\exists I\,\Re$ is technically justified in classical descriptions, however, it can happen essential not only for logic and linguistics but also for physical theory as such..

After all, the universe might exist independently (why not?), but such inaccessible existence is nothing for consciousness. By rephrasing Wheeler's PAP in a more delicate way, Yurchenko (2016) concludes: consciousness brings the universe into being such as it is necessary for consciousness itself in order to be. 'I' becomes a center of existentiality in which the world is absolutely immersed. In this sense, the only reality having sense and meaning for us is consciousness. No it? No ontology. No reality. No universe.

Thus, we come to the conclusion that naturalism is factually based on two theses, and the second one is like the relativistic principle on the frames of reference.

1. the world is physically independent of consciousness;
2. the only criterion of what is the real is observation accessible to every consciousness with no privileged observer.

So, Smolin calls naturalism 'an ethical commitment' by referring to a 'rational argument from public evidence' (2006). Now, by providing the existential indexical $\exists I$ with the coordinates t and x_i we should supply any physical equation with this universal preamble in disposition of the 'anthropic observers' in $\Re$-predication.

The Naturalistic Postulate

$\forall I(t, x_i)\mathcal{R}: < the\ world >$

The objective reality must be open to observation for all consciousness alike.

It is absolutely though implicitly approved by natural sciences as the only criterion of the objective reality. The outcome of an experiment should not be dependent of an experimenter. The experimenter can be everyone. It is much more than 'an ethical commitment'. Factually, it implies the necessary role of consciousness as such but not the absence of it at all as it might seem to one who lays the world's independence simply by thesis 1. It is unknown and will never be known of what is the universe to be beyond observation. A real thing may, possibly, exist anywhere as a 'thing-in-itself', but what is the reality as an ontic state with no consciousness? What mind is questioned to prove the world's being? No consciousness? Scientific naturalistic is, thus, universal quantification of I-observer by $\Re$-predication. The objective reality is believed to be the same one for all I-observer at every point (t, x_i). In mathematical terms, it means that the fundamental laws and physical theories are invariant under I-observation.

In particular, illusions and imaginary entities are not real. So, one having a hallucination would be entirely justified in one's phenomenological right to include it in $\Re$-predication. But the private evidence does not hold the Naturalistic Postulate. One's experience must be testable by any consciousness to satisfy our scientific criterion of what is real. Just the universalism (at least, theoretical) of observation is the only criterion underplaying our belief in the universe' being.

In natural sciences, thus, the universal preamble $\forall I(t, x_i)\mathcal{R}$ to the physical descriptions is obligatory but traditionally ignored like a book's title that was accidently forgotten. Nothing is seemingly lost in the very book telling the same story but the absence of author's title may be essential. We rise this question in regard to ψ-ontology in quantum mechanics. Who was the author of this tale and what did he want to tell us just about? Possibly, this information might radically clarify the context of the book. Take a simple thought experiment by adding the phenomenological indexical $\exists IT$ and preamble $\forall I(t, x_i)\mathcal{R}$ to any arbitrary formula in mathematics (logic) and physics (economics, psychology, sociology, and so on) respectively. It can cause a strange affect in one's mind as if an 'extended' sentence might exhibit some emergent property that the classical original equation did not exhibit.

Let us consider the following propositions,

$$\forall I(t, x_i)\mathcal{R}: ds^2 = -c^2t^2 + dx^2 + dy^2 + dz^2 \equiv g_{\mu\nu}x^\mu x^\nu$$

$$\forall I(t, x_i)\mathcal{R}: i\hbar\frac{\partial\psi}{\partial t} = H\psi$$

The first sentence is the Minkowski metric elaborated phenomenologically in respect to all relativistic I-observers by implying, roughly speaking, Lorentz invariance of their descriptions to each other. The second sentence is the Schrödinger equation implying Copenhagen interpretation made from the standpoint of every quantum I-observer in applying to the wave function that, in Heisenberg's words, 'represents no longer the behaviour of the particle but rather

our knowledge of this behaviour' (1958). These examples show that *I*-observer with his *cogito* as the mechanism of 'I-World' existence will be implicitly present in any description of the reality.

Yet, the concept of *I*-observer emerges manifestly in many minds models that refer to consciousness more explicitly. These models imply the universal preamble $\forall I(t, x_i)$ and claim to combine Naturalistic postulate with many worlds interpretations by corresponding every *I*-observer apart to a world with regard to ψ-ontology (Albert and Loewer 1988, Lockwood 1996). Such a formulation might be lightly converted into a scenario where two or more I-observers (minds) could attribute different states for the same physical system (Fuchs 2010). In more appropriate way to this paper, it can be reduced to the scenario when the unique I-observer could obtain a different outcome for the same quantum system in identical initial conditions but at a different moment of time, as if the quantum system might be in free will like this I-observer.

$$\exists! \, I(t)\mathcal{R}\colon |\psi\rangle \neq \exists! \, I(t + \Delta t)\mathcal{R}\colon |\psi\rangle$$

It is not said in favor of the Free Will theorem by a simple reason that it explains nothing in the essence of the problem. The aim is to find an explanation for such 'quantum freedom'. The notation above on a quantum experiment looks quite incredible. Of course, it is not a correct presentation regarding the usual order of things, since the 'quantum freedom' is essentially based on nonlocality between two space-like points, whereas a classical interval Δt is indifferent to it.. It will be considered intently below in part 3 on psychodynamics of I-observer in time.

However, it raises one question in respect to the role of the *cogito* in psychodynamics. How does consciousness make up the real for itself without referring to a common evidence? A break between the thinkable and the real starts with the first mental act of a consciousness. Is consciousness itself a thinkable and/or real phenomenon? We believe that consciousness is real. Why? Who is an observer of this consciousness? It is consciousness itself. Thus, this (individual) consciousness cannot be real in the sense of the Naturalistic Postulate (8). In other words, the only I-observer for every consciousness is this I-observer. My consciousness is real, your consciousness is only my (scientific!) assumption.

We shall emphasize this key moment with respect to the *cogito* and a question of the kind 'Why are we so sure about that we have consciousness and free will unlike a Turing machine and/or a cellular automaton ('t Hooft 2015)? Only self-identification trough the cogito can atone for my strong (and entirely particular) belief that consciousness is available as a real phenomenon inherent to me, and only the Naturalistic postulate allows me to assume it in respect to other people.

What if this absolutely subjective argument is not well enough to satisfy the scientific criteria? What physical experiment prepared in a classical fashion might prove that someone is a conscious being? Obviously, the only quality separating consciousness from a thing is free will. How can then the free will be tested objectively?

3 Psychodynamics of *I*-observer

3.1 Free will and Causality

For the moment, Cartesian 'mind-matter' dualism can be translated from a philosophical plane into physical one in terms of natural science to the question about the free will. Is the free will an illusion or is there some physical mechanism allowing to insert free will into the causal world? In other words, is the brain like a machine or can consciousness be locally free of the past? Traditionally, by saying 'free will' people imply the ability of consciousness to freely choose its own actions. In this wide formulation it seems undoubted. People govern their activities and are, at least, psychologically able to change them. It challenges causality that, in turn, rises a question about the nature of time.

Indeed, if the future would be predetermined absolutely, this should deprive consciousness of any choice. In physical terms, time taken as a dynamical variable of human behaviour becomes illusory in pre-established determinism and can be reduced to an usual degree of freedom in regard to any physical body. It leads to timeless naturalism which proponents – in Smolin's remark – believe also in the full computability of the nature (for a moment, it should mean that the TOE might be complete despite Gödel-Post theorems) and strong artificial intelligence, yet they favor the many worlds interpretation of quantum mechanics with anthropic multi-verse cosmologies (Smolin 2013).

The latter seems illogical in respect to timeless naturalism that holds time only as an illusion assumed for our convenience to make

mathematical descriptions on the causal world with no time. The free will cannot take a place in the timeless universe. Illusory time entails illusory free will. On the other hand, the proponents' assumption on anthropic multi-verse can be understood in respect to the undoubted fact of our human presence in one, at least, universe. However, such a benefaction is like a remedy that cures the disease by annihilating the patient. It is not rational – to refute a belief (in free will) with the help of another belief yet more expensive (in the timeless nature and anthropic multi-verse for granted).

Therefore, the concept 'free will' is in discussion among physicists. 't Hooft (2007) argues for a more precise formulation that does not clash with determinism and leads to different conclusions concerning causality and locality in quantum mechanics. He states by referring to the 'unconstrained initial state' condition:

If we would have been deprived of the possibility to freely choose our initial states, we would never be able to rely on our model; we would not know whether our model makes sense at all. In short, we must demand that our model gives credible scenarios for a universe for any choice of the initial conditions! [...] It is not the free will to modify the present without affecting the past, but it is the freedom to choose the initial state, regardless its past, to check what would happen in the future.

Certainly, the possibility to choose the present independently of the past is omnipotence rather than free will in an usual human sense. Thus, 't Hooft emphasizes a cognitive aspect of the free will. Let us unfold this aspect in conformity with the subject of this paper. Indeed, the only ultimate predestination of natural science is the ability to predict the future from the initial conditions in the past. If consciousness might be able to know the future beforehand, any natural science, firstly, physics, would be excessive. Consciousness would be omniscient as such. In reality, consciousness knows its past, but the future is open for cognition as well as for activity freely, however, within the limits given by causality and human rationality based on knowledge obtained from the past experience. Just it is free will assuming yet all aspects of social sciences and philosophy of mind.

Further, free will is psychologically and neurophysiologically based upon the ability of consciousness to keep its mental states (saving information on physical causal events in the external reality) in memory to make more or less regular predictions not so much in a scientific sense as mainly in everyday life at every step towards its future. Just the free will imbedded in consciousness allows us, firstly, to do this step in general, secondly, to make it more or less reasonable, and, thirdly, to prepare initials conditions for a scientific experiment. It is a crucial point to this research. In a simple fact, *the only universe we know is a universe in our past.*

We observe, study, and describe only the past universe. It is the reality of classical mechanics and Relativity, whereas a current present happens instable in the realm of quantum mechanics. The future will emerge open at every present moment of our being. Time is said to wait nobody, and consciousness constrained to be in incessant motion over time obtains this classical reality by collapsing the present (initial conditions) from the future (final conditions). It is retro-causality. But by looking into the past I-observer sees a classical picture where the causal order as such is saved. Metaphorically speaking, the future is a 'dark time'. There is a cognitive 'event horizon' in front of consciousness at every current present. I-observer prescribes the reality to be in the future by inverting the past around a current present taken at an instant rest like a center of temporal symmetry where causality must hold transitivity with no damage. Thus, I-observer can insert his free will in the universe just at this center of symmetry where causality takes an instant pause. This current present, 'now' taken seriously, is the only point where consciousness can change the order ote things – not despite causality but in order to prepare initials conditions for the desirable future.

Hence, the quest on the *ontic-epistemic* status of the wavefunction in ψ-ontology may be reduced (or rather raised at a more fundamental level) to the quest on ontology of time passage. Namely, is the temporal event horizon arising spontaneously in front of consciousness at every current present *ontic* or *epistemic*? In other words, is time real or illusory? Does the universe exist really only at a present moment as, say, a quantum state, or is consciousness only a traveller localized at a current present across the eternality in the timeless universe?

3.2 Time and I-observer

While 't Hooft (2007) argues for the deterministic definitions of free will, Smolin (2013) tends to refer to 'qualia', a philosophical concept taken in opposition to the idea that consciousness is no me than a machine that, obviously, excludes free will

in favor of a computation fully. Is consciousness endowed with the ability to choose freely the initial state for itself? Note, if the answer is 'yes' and if we will tie the universalizing *I*-observer to the world in our descriptions instead of the independent self-sufficient reality with no observer, then the Free Will theorem (Conway and Kochen 2009) saying that the physical (quantum) systems are free like consciousness, has to emerge *per se*. It challenges causality. Hence, if causality cannot be disproved, we must specify precisely what free will to the initial states is locally in time. Time is challenged now. Indeed, non-locality assumed to the universe abolishes time together with causality at once. Therefore, we need to treat free will carefully with the regard to the initial states. Exactly, how are the initial states fixed in a current present. What is the present?

So, Smolin (2013) refer to the Wheeler-DeWitt equation where time vanishes from descriptions of quantum cosmology and to Barbour's (2000) instantaneous pluralism of moments, according to which what exists is a vast collection of moments, which exist all together timelessly, and then he states

Temporal naturalism asserts that the presently present moment has a special status. But it also admits that there were moments in the past and will be other moments in the future. But all these other moments will have or have had that same special status with respect to observers at those times. Hence any special status claimed for now must apply to all moments.

It must be noted that Smolin corrects this statement at once in the next paragraph with respect to temporal (obviously, not modal) logic by saying that no statements about the future have truth values. It is an ambiguous matter. In Prior's tense logic (1967), for example, it is taken under transitivity property that any true sentence on an event (say, on the fall of Rome in 476 CE) will remain the same for the future. Of course, such a statement would be speakable there in regard to the past, but we are making a true (!) prediction now just about the future. Will it be true that consciousness is based on the fundamental laws, and therefore, I-observer (if any) must holds the same special status for a current present for all times? It raises many questions on semantics of language and the truth theory, however, it is not in the scope of this paper.

What is essential is that it may be taken for one more evidence that our classical (firstly, mathematical) logic had been naturally elaborated from the standpoint of *I*-observer at a current present as a 'I-World" state. Though time can be introduced into mathematical equations like other variables, the very mathematical logic laid into foundations of mathematics in respect to the notions such as 'set', 'order', 'part and whole' renders the 'eternal truths' and, therefore, can be taken untimely. Consider the equations:

$$\forall I(t)\mathcal{R}\colon a^2 + b^2 = c^2$$

$$\forall I(t)\mathcal{R}\colon F(t) = m\frac{dv}{dt}$$

The first proposition implies Pythagorean theorem and refers to the numbers that seems to require Platonic universals where time is irrelevant to the truth evaluation. The second one is a physical law (true sentence) for all I-observer at all times. Hence, a temporal variable may be excessive in the preamble (and the preamble itself too!), but t cannot be removed from the law without damage to its sense. Unlike mathematics that, in Tegmark's thought, is a baggage-free description for the TOE, physical descriptions should factually contain time twice: a temporal variable for the dynamical modeling and universal (anthropic) time for*!*-observer whose predication it is. Just the universality allows to omit this time in physical descriptions as well.

It should not be a surprise that physical theories appear to be invariant under time reversal. Possibly, it is one of the reasons why the strategy '*Tempus nihil est*' takes place in physical discussions (Anderson 2011). At all times, mathematics and natural sciences historically strived to banish (subjective) consciousness from logical and physical consistent descriptions to elicit 'pure' scientific knowledge about the objective reality presumed to be independent of consciousness but cognizable for consciousness at the same time. It is a controversial aim. As stated above, this 'pure' knowledge is factually elicited not by banishing consciousness but by universalizing *I*-observer. Consciousness with anthropic time stand in a position of the hidden variables in physical descriptions (prepared mathematically). The cognizable reality is anthropic primordially.

Let $e(\tau)$ be some physical event in real time τ, and let $x(t)$ be in $\Re$-predication on this event made by I-observer in his anthropic time t. Then we can dynamically tie the external reality to the I-observer according to the Naturalistic postulate,

$$e(\tau) \Leftrightarrow \exists I(t)\mathcal{R}\colon x(t)$$

Factually, it is a definition for the 'I-World' state at every moment of time. Further, by assuming (very reasonable) $\tau \equiv t$, we have time twice, so that one of them can be neglected as it is traditionally in physical descriptions. Should it be the former or the latter? What time is more adequate to a global theory taken as a TOE to explain everything including consciousness? So, Rovelli suggests in his relational approach to quantum theory (1996):

I propose to reinterpret every contingent statement about nature ("the electron has spin up", "the atom is in the so and so excited state", the "spring is compressed", "the chair is here and not there") as elliptic expressions for relational assertions ("the electron has spin up with respect to the Stern Gerlac apparatus" ... "the chair is here and not there with respect to my eyes", and so on). A general physical theory is a theory about the state that physical systems have, relative to each other.

Consciousness (brain) is a physical system that takes a central role to its environment. Finally, we can define,

The Relational Postulate

$$e(t) \Leftrightarrow \mathrm{I} - \mathrm{World}(t)$$

Any physical event requires an observer, and appearance of the I-World state is this event.

More generally it means that no consciousness can exist beyond the world, and no world can exist beyond consciousness. The universe with no I-observer might have or have not the events by itself, but it is unprovable in principle. According to a phenomenology and cognate gestalt psychology, consciousness is always the consciousness of something. Consciousness, however, does not exist separately from the external reality to hold 'something' apart from itself. It must hold both the external and internal reality in I-World state having lost neither itself nor the world. I-observer is a Wheeler's participant of the universe, so that every mental act $x(t)$ is realization of some I-World state obtained by grasping the reality as an event $e(t)$ at a moment of anthropic time *t*.

3.3 Stream of consciousness

This part is based on three conceptual theses:

1. The only universe consciousness observes is a universe in the past;
2. At every moment of time consciousness grasps both the external and internal reality together as a 'I-World' mental state having lost neither itself nor the world;
3. *I*-observer moves over time with the back towards the future.

Further, the model presented in this part follows the approach elaborated in (Yurchenko 2016) and holds also that:

(i) consciousness is a physical (multifunctional) process obeying causality;
(ii) consciousness is a discrete stream of the mental states alternated over time passage;
(iii) every mental state is an act of grasping the I-World state holding a wholeness of the internal and external reality.

In many minds models the mental states are often associated with the brain states evolving in a stochastic way to one of the two final brain states $|\Phi_{\pm}\rangle$ with the Born probabilities. The quantum system never collapses, and no mind is in the superposition (Albert and Loewer 1988, Lockwood 1996). It is not the way of this paper. Instead, the stream $I(t)$ of consciousness is taken by analogy with the causal set approach in quantum gravity (Sorkin) as a discrete well-ordered set $I = (x_i, <), i \geq 1$, where x_i is a mental act of consciousness. It is irreflexive, transitive, and acyclical in respect to causality with no closed loops $x_i < x_{i+1} < \cdots < x_i$.

Another equivalent description of the stream in temporal presentation is a chain of I-World states,

$$I(t) = \{I(0), I(0 + \delta t), \ldots\}$$

Where $I(0)$ is the initial I-World state, and δt is some minimal interval between two states. To date the lower boundary of temporal discrimination is detected experimentally within $\delta t \sim 100 - 750\, ms$ (Buonomano 2009). In other words, while the mental states $I(t)$ are assumed to be instant, the mental acts x_i take just the interval δt to prepare these states.

Thus, the stream of consciousness is a chain with the natural temporal order from the birth-moment t_0 of *I*-observer to a current present. We will combine both the mathematical descriptions for convenience (if it does not make a mess).

$$I(t) = \bigcup_{i=1}^{\infty} x_i(t) = \{x_1(t_0), x_2(t_0 + \delta t), \ldots\}$$

Or, equivalently,

$$I(t) = \bigcup_{i=0}^{\infty} I_i = \{I_0, I_1, I_2, \ldots\}$$

Where a mental act x_i takes an interval δt to realize a corresponding I-World state from the previous one,

$$x_i(I_{i-1}) = I_i$$

In other words, the $I(t)$ is a Markov chain. It makes consciousness like a Turing machine. In this presentation, $I(t)$ is like a tape of a Turing machine on which symbols (images) are written down in order to be consequently executed by the machine. An essential distinction is that a tape imitates the machine's 'reality' to which its algorithm has to be applied, whereas in this model I-observer does not implement real actions but only perceives things and events. Every I-World state I_i thus conforms to an instant position of $I(t)$ in dynamics over time by acts x_i consistently. Consciousness perceives a duration between states, but cannot holds time itself. Instead, by preserving in memory the order of the states I_i assigned to the events $e(t)$, I-observer acquires the phenomenological notions such as time, space, causality. Elusiveness of time may be one more psychological reason for timeless naturalism.

This model is restricted to observation and does not take into consideration the activities of consciousness in the external reality. Moreover, it holds causality but free will seems to be impossible there. A machine is able to compute its own next state by the previous one, but it cannot freely choose the initial state conditions in 't Hooft's definition (2007). Free will might be assumed there through the *cogito* as a self-identification mechanism solely (see below). In fact, not consciousness but self-consciousness is presented there. Why then is it to be a well approximation? The model catches the mainstream of consciousness that cannot be free of itself. 'Pure' consciousness is no more than a philosophical phantom. Consciousness and the external reality are unalienable in 'I-World' state at all moments.

Further, though the mental states are assigned to be at an instant rest (associated conventionally to a inertial frame of reference), it must be incompatible with the halt of $I(t)$, since the cessation of a brain's activities is its death by a well-known clinical definition. How might consciousness resolve this contradiction for itself to survive this 'mortal' instant present? It is not quest to physics properly, rather to theory of consciousness. On the other hand, it the TOE is presupposed to be pro-physical, it can be challenged there in respect to the GTC.

In Descartes' thought, consciousness can discover its own being only through the *cogito*. Thus, consciousness can prove its own existence in the *cogito* solely. 'I am if I think (making I-World state)'. It is a classical self-reference in logic. Thus, consciousness acquires itself as I-World state trough a mental act of self-identification with respect to the world. This act is a physical process with time. Hence, consciousness can refer to itself over time passage only by shifting towards the future so that the reference itself falls into the past mental state. The cogito mechanism is thus an unclosed loop in the stream $I(t)$ of consciousness.

The stream of consciousness can be well presented with a monotonically increasing line in a phase space $I \times t$, where t is physical time, and I is an axis of all mental acts and I-World states. Thus, the arrow of time t contains the life-time of a consciousness, whereas I consists of its life-history. Note, $I(t)$ cannot decrease and make causal loops because of time irreversibility, it cannot be even stopped in time, since it is a halt of $I(t)$ and its death neurophysiologically. Consciousness must go on over time to be alive. Every moment of t is a point of no return for consciousness. What is then a reminiscence? It is a reflexive mental act of $I(t)$ to its life-history in the past.

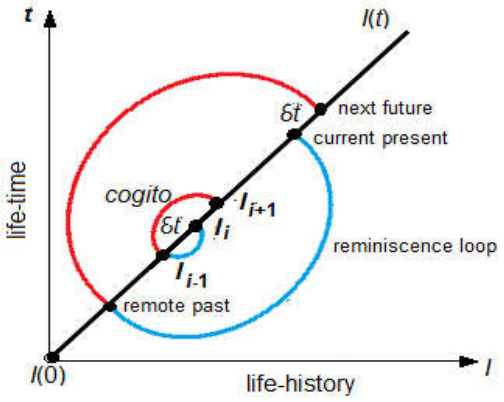

Fig 2. The stream of consciousness in psychodynamics

Nevertheless, $I(t)$ is a cause-like set rather than causal one. Therefore, I-observer always can be reminded of its past at the present due to free will. Just this ability allows I-observer to choose initials conditions mentally and then prepare them really by going to the future.. However, it does not presuppose a temporal loop, since in the reality any reminiscence requires time. Going mentally into the past, consciousness moves really to the future. Consciousness needs, at least, one

'quantum' δt to relive the old events in memory whenever they take place in its life-history – be it yesterday or long time ago. Thus, reminiscence is an unclosed loop from $I(t)$ through $I(t-\Delta t)$ to $I(t+\delta t)$.

Undoubtedly, consciousness in reminiscence refers to itself at some I-World state but not to some physical thing or event as such. Accordingly to the Relational postulate, it is impossible in principle to refer to the reality beyond I-observer. Thus, any reminiscence is an internal self-reference that is not articulated into the world as something in $\Re$ -predication. But the *cogito* is a self-reference also. What is then the *cogito*? It is the shortest reminiscence. Hence, in the reverse analogy, any reminiscence uses the expansible *cogito*. Theoretically, I-observer can be reminded of any mental state I_i in its past by means of the *cogito* and existential indexical in *T*-predication (not $\Re$ -predication) to rethink of it.

What is consciousness with no knowledge about the past? What is free will if this knowledge is blocked? It is a passive register of events. It can be taken for an appropriate formulation of the free will.

The Free Will postulate

$$\forall I(t)T\colon \forall i,j(j<i)x_{i+1}(I_j,\delta t)=I_{i+1}$$

Every I-observer has the freedom to initiate the next I-World state into the future by choosing the past ones.

It satisfies the 't Hooft's restriction (2007) on free will with respect to causality. On the other hand, it is much more than a machine's behaviour. Thus, a cognitive aspect of free will must be psychologically imposed in the GTC upon the consciousness' ability to retrospection. Consciousness is undoubtedly endowed with free will through the *cogito* mechanism. Though consciousness is constrained by time passage and causality, it is able from a state I_i to choose the next position I_{i+1} in the future by causal shifting over time and by free collapsing the previous I-World state I_{i-1} into the past. Thus the reality is determined behind I-observer in the past always, whereas a current present is uncertain and the future will be open for experience.

3.4 Perpetum cogito

It seems to be in our common belief that consciousness must hold itself at any moment with no break, from the primordial state I_0 at its birth-moment until the death even neural disorder does not deprive consciousness of self. Possibly, by deleting self – whatever it might be ultimately – we would find nothing beside a machine.

Further, while irreflexivity provides $I(t)$ with a pseudo-loop in the *cogito* (Fig.1), transitivity shifts I-observer toward time passage and thereby develops the *cogito* into the *perpetum cogito*. Consciousness can loss itself only in a halt of the stream $I(t)$. While alive and in action over time, I-observer realizes himself in I-World state at any moment t by the *perpetum cogito* to grasp the future and save the past with no break of $I(t)$. The very consciousness passes through the triple 'past-present-future' in superposition.

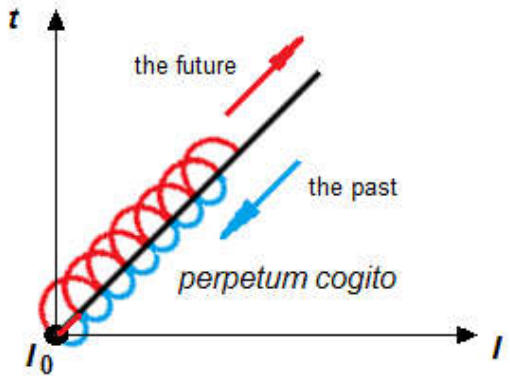

Fig. 3. The *perpetum cogito* in time evolution

The stream $I(t)=(x_i,<)$ has been above treated as an irreflexive, transitive chain of the mental acts x_i applied to consciousness (brain). Let g be an operator associated with x_i which application to $I(t)$ is an instant I-World state I_i of $I(t)$. Assume also for simplicity that all mental acts x_i can be unified to one and the same operator g taken in iteration over time evolution.

Then we have a cyclical noncommutative group $G=\{g^n\},\ n\in\mathbb{N}$, such that[1]

$$\begin{cases} g^0=1=I_0 \\ g(I_0)=x_1(0+\delta t)=I_1 \\ g^n(I_0)=x_n(0+n\delta t)=I_n \end{cases}$$

Anticommutativity follows immediately from it.

$$g^{n-1}g^n\neq g^n g^{n-1}$$

Thus, the commutator (Poisson bracket) spontaneously throws out a new mental act x_{i+1} (like an action quantum $i\hbar$ emerging in the uncertainty principle) that generates the next I-World state I_{i+1} in the nearest future,

$$[g^{n-1}g^n]=g^{n+1}$$

[1] Rather, G is a monoid or even a syntactic monoid with string concatenation in neural syntax of the brain.

No reminiscence can cause the real time reversal or its halt. On the other hand, by transferring any loop into the future, the *perpetum cogito* mechanism (PCM) escapes a 'mortal' break-point in $I(t)$ and thereby holds transitivity on $G = \{g^n\}$ over time passage. It endows consciousness with both qualities of the reality – discreteness and continuity.

The elusiveness of a moment consists in the fact that consciousness can fix a current present only from the future and only as its past. In other words, the very consciousness is entangled in the PCM between the past and future, and I-observer stays factually in a superposition by going over every current present. As the PCM ties the triple 'past-present-future' together, we will denote it as a triple-bundle $[g^3]$ related conceptually to the commutator (Poisson bracket). On the other hand, $[g^3]$ can be taken as a phase group for every current present and be considered with regard to nonlocality (Coecke *et al.,* 2011). For this moment, it is important that the triple-bundle is imbedded in the PCM on which the Free Will postulate is based.

Let the identity element $g^0 = 1$ of G be

$$g^0 \equiv I_0 = Self$$

In other words, it means that consciousness is bound to its Self through PCM forever from the birth-moment until the death. Thus, the PCM is an universal principle for every consciousness as a vital necessity. Now by combining the Naturalistic postulate (NP) with the PCM we have, laying simply,

NP + PCM

$$\forall I(t \pm \delta t,)\mathcal{R}\colon \langle the\ reality \rangle \mathrm{E}$$

Every I-observer obtains I-World state at a current present in the superposition.

In particular, for I-observer in a quantum experiment on an event $e(t)$, the concatenation of the Relational postulate (RP) and the triple-bundle entails

RP + $[g^3]$

$$\exists I(t \pm \delta t)\mathcal{R}\colon e(t) \Rightarrow [g^3]|\psi\rangle$$

In some appropriate way in can be reduced (or raised) to both Heisenberg and Schrödinger formulations of quantum mechanics. The Free Will theorem follows spontaneously from the ontic-epistemic equivalence.

It is traditionally suggested that quantum theory predicts that objects can be in more than one place at the same time. The emphasis is put on the space, on `here' and `there', but not on time. Are this non-local quantum effects caused by time evolution? Can just the term 'simultaneity' be at stake there? It is not said in a relativistic sense putting two I-observers to the same physical process in Lorentz transformations. Instead, it is said in challenging a common belief that the physical events are instant within the process, i.e. local in time taken for □. Physics at a point, however, causes many difficulties in physical descriptions. Historically, it goes back to Zeno paradoxes. It challenges the foundations of mathematics, firstly, the continuum with respect to the separability, Cantor uncountability, the boundary problem and so on. However, it requires another paper.

4 Conclusion

Obviously, being conceived to embrace all natural sciences the TOE should take causality for a fundamental principle. Hence, it should disprove not only the role of consciousness but the free will yet. In contrast, the GTC will hold free will and argue for the existential primacy of consciousness. In this sense, the GTC challenges the TOE to deny free will. Analogically, the TOE challenges the GTC to deny causality. Thus, the GTC should explain local violation of causality at a current present as it is observed in quantum mechanics. In short, the proof on a break of locality consists of two parts:

(i) superposition of consciousness;
(ii) primacy of consciousness over the causal reality at a current present

The *perpetum cogito* mechanism endows consciousness with both phenomena, at first sight, incompatible – causality and free will. In the cogito consciousness is able to return into the past by moving to the future toward the arrow of time. Moreover, as showed above, consciousness can and must be only in such a 'back-position' to the arrow of time, as if it (brain) moves with the 'back' towards the future. Consciousness cannot see the future, it has only the past. The future remains open at every current present.

In other words, consciousness collapses the reality (wave function) down through the perpetum cogito mechanism in order to obtain a mental I-World state that is necessary for it to be alive. In terms of GTC, the very question whether the quantum states are ontic or epistemic might be viewed as excessive. Neither reality, nor consciousness cannot be eliminated from the Naturalistic postulate. Ontology of the external reality is nothing beyond the existential indexical $\nexists I$.

What does one mean factually by saying about the 'independent reality'? It means no more than the fact that the reality is not depended on any observer. More exactly, there is no privileged I-observer in which $\Re$-predication the universe comes to be. The existence of the universe is invariant under every *I*-observer in all its observations over time passage (through the perpetum cogito). In other words, there is the following logical chain. While the TOE is inferred from two hypotheses (i) on the external reality completely independent of consciousness and (ii) on mathematical structure of the universe [2], the former viewed as Naturalism (Smolin 2013) is a consequence of what can be called an 'ontological diffeomorphism' between *I*-observers, whereas the latter requires to explain what is mathematics itself. Might it be elaborated without free will of consciousness?

Further, the Relational postulate posits that the reality is that what is in I-observation. In other words, there are no pure ontic quantum states independent of consciousness, ontic is epistemic in I-World state. While the nearest past is in being, the nearest future is in becoming, but the present is null. Every current present is elusive in principle. This elusiveness can be fixed only from the future when this present moment is in the past factually. Any observation is made into the past . The only universe that we have and know is the universe in the past. The future is open through an uncertain present. Speaking in mathematical terms, a current present rises the boundary problem in respect to the continuum □ taken as t. The very law of excluded middle fails at the boundary of $\Re$-predication (observation in time). A current present is just the middle. It is enough to infer quantum effects such as superposition, wavefunction collapse, nonlocality, and the like.

I-observer closes the past by a wavefunction collapse with obtaining the stable state (epistemic and ontic alike) for himself and the reality equivalently. Of course, we are not in a right to assert that it is necessary for the universe, but it is a vital necessity for consciousness, since it needs the collapse in order to avoid a halt and thereby step over the present. In this sense, a current present is for consciousness a 'mortal equilibrium' between the past and the future.

Let us combine relativistic and quantum descriptions to one I-observer. Relativity takes the reality globally in a large scale. A local present is presented there with a point of intersection of two light cones. Factually, a local present is light-like in the Minkowski space where the metric becomes degenerated.. Just this (singular) present is taken under observation in quantum mechanics.

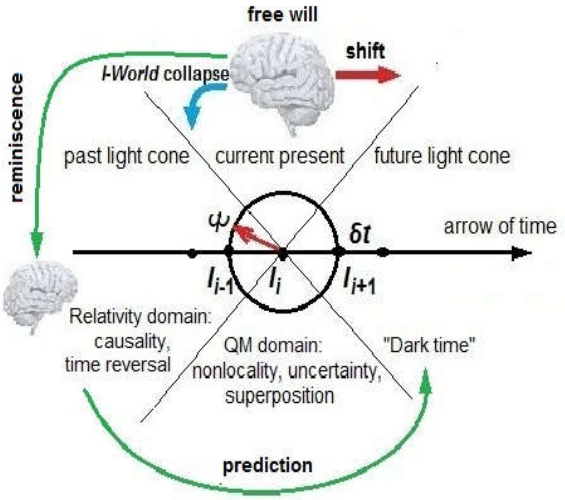

Fig. 4 I-observer at a current present of the Minkowski space0time

The I-observer (brain) moves with the 'back' towards the future in superposition by entangling the triple 'past-present-future' through the perpetum cogito mechanism. The stream $I(t)$ cannot be localized at a current present as I-World state. Hence, according to the Relational postulate, no event $e(t)$ can be localized there too. Though the universe is certainly local and causal in the past, it is still in becoming for every current present. Not time as such but its evolution is at stake there. It is typically discussed in terms of the pure quantum states (if presumed) with overlapping distributions and ontic indifference (Spekkens 2007, Hardy 2013). Now we can conclude that these pure quantum states overlap with the very temporal 'event horizon' on which 'dark time' supervenes perpetually. The reality will become local from the nearest future in the past (light cone) by collapsing a non-local present. Thus, consciousness has the local causal universe in its past always. It is the realm of classical mechanics and Relativity.

Strictly speaking, there is no real universe in the past, there is only its history written in consciousness by means of I-World states. When we say 'the universe' we say much more than it might be really (with no consciousness). The universe we have is essentially anthropic. In this sense, the GTC should not consider the universe taken in Relativity in continuous dynamics over space-time as, say, $U(t,x,y,z)$, on the whole but in the partition U/t like Wheeler's 3-geometries or t-strata with respect to nowhere-null

hypersurfaces. In other words, the GTC should argue for physics on a boundary.

A radical idea than can be inferred there for physics is that the universe $U(t,x,y,z)$ presupposed to be in t-foliation cannot be localized instantly as a quantum state $U_i(x,y,z)$, at any one t-stratum solely but is extended over the strata. In other words, any body in the reality, every its particle holds time not only as a degree of freedom for motion like spatial dynamical coordinates, it has yet 'proper time' (not life-time) as its own temporal size like a natural size occupied in the space. For physics on a boundary, it means that no body, even no particle can be localized as a point in one t-stratum. Instead, each of them is expanded over time. It might explain self-interference of a particle in a double-split experiment when spatial and temporal sizes correlate at a quantum level. Moreover, Lorentz transformations might be also related to these proper parameters of a body not to space-time as such.

Though consciousness moves in 'back-position' to 'dark time' into the future, it is able to mentally observe the past from the past yet more removed by reminiscence along the arrow of time as if it would be the future for which the past was already collapsed. Consciousness realizes time reversal mentally in itself to obtain knowledge about the reality established in the causal order and therein elaborate its own behaviour in the real future due to free will. But the real inversion of time is not possible at all. It should at least be mortal for consciousness. I-observer (brain) is impossible under time reversal. However, consciousness could not exist in spite of what the universe is really. Hence, time must be real and irreversible.

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