About Language, Self Reference and Everything

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Abstract

The ontology of TGD inspired theory of consciousness consist of the trinity formed by objective realities represented by configuration space spinor fields, subjective realities defined by quantum jump sequences between quantum histories (selves), and geometrical objects (res extensa) represented by spacetime surfaces. The infinite-dimensional configuration space of 3-surfaces is believed to be determined completely by the requirement that it allows Ka hler geometry free of infinities: infinite-dimensional ontology is fixed by self consistency. Quantum histories (configuration space spinor fields, solutions of field equations) are not only representations for objective realities but identical with them: painting is the landscape so that there is no theory-reality dualism at this level. Quantum histories can be also identified as inhabitants of the Platonic realm of ideas.

p-Adic nondetermism and the nondeterminism of the basic variational principle defining configuration space geometry correspond to the nondeterminisms of cognition and language. These nondeterminisms make it possible to represent, not only the quantal aspects of quantum states, but also quantum jumps sequences defining selves as spacetime regions. This explains the self-referentiality of consciousness meaning that it is possible to become conscious of being conscious about something. One ends up to a view about mathematics in which one must distinguish between mathematical ideas at the level of quantum histories and quantum jump sequences (that which is), and their cognitive and linguistic representations at spacetime level: the latter ones can never be faithful so that in this sense the map is not the territory.

1   Introduction

The arguments of this section relate to the relationship between consciousness, language and mathematics and are almost as such from an email correspondence relating to the relationship between consciousness and language in the group formed by Otto Nieuwen- huizen, Goro Kato, Uri Fidelman, and others. I have preserved the first person I tend to believe... form of representation. I am grateful for participants of group for providing new views about my own ideas.

Anyone trying to theorize mathematically about consciousness, sooner or later encounters the problems how to understand mathematics and language in the framework of the theory that one is defending. While trying to communicate ideas one encounters the prob- lem what the real communication, sharing of experience, really is according to the own theory of consciousness (or whether a real communication is possible at all). All theories should be internally consistent and coherent and in the case of consciousness theory this looks an almost insurmountable looking challenge. It is possible to be conscious about being conscious about something. Or more precisely, it is possible to become conscious about being conscious about something. How this self-referential property of consciousness can be understood mathematically? Somehow it seems that that the formulation of the theory should trascend the inherent limitations of language and practical mathematics. This kind of transcendence seems impossible in fixed axiomatic framework and the naive brain as a determistic computer view certainly does not give hopes of meeting this challenge.

While consciousness theorizing, one becomes also conscious about the Cartesian duality implied by the widely held implicit belief that reality and the theory about reality are fundamentally different things. As well as from the almost automatically held belief that there is single unique reality creating so many problems when one tries to understand free will and intention.

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This article is slightly updated variant of an article published as online article at my home page. What has been updated are references to TGD but no changes in content has been made. The basic background in TGD inspired theory of consciousness can be found in [1]. It should be added I do not full heartedly agree with all the statements made in the article.

2 Ontologizing

I introduce the ontological background before discussing the basic challenges of language and self reference.

2.1 Mathematical existence as physical existence

I believe that mathematical concepts and structures are much more than constructs of our mind. Doing mathematics is basically perceiving mathematical ideas and building symbolic representations about these perceptions (by definition perception means enormous filtering of information]. I believe that there is a realm of Platonic ideas about which these perceptions give kind of sensory information: perhaps cognition might be regarded as sensory perception of ideas.

This mathematical existence must be consistent with what we believe are laws of physics and I find it difficult to tolerate any duality between theory and reality. Thus I believe that these basical mathematical ideas must be representations for possible physical realities. This means that mathematical theory (solution of field equations) about reality is the reality. There are of course infinite number of possible realities identified as solutions of field equations. Painting is the landscape, one might say. I will later demonstrate that this does not conflict with the map is not the territory idea. Buddhist would perhaps assign the label that which is with these mathematical existences, but now in plural:those which are.

Being quantum physicist, I identify this mathematical existence as being basically defined as infinite-dimensional geometry of the configuration space of 3-dimensional surfaces in certain 8-dimensional space. My conjecture is that this geometry is more or less uniquely fixed by the mere existence requirement for Riemann connection and other geometric structures. The mere absence of infinities implies huge symmetries fixing the geometry essentially uniquely (more than half century of frustrations with the infinities of quantum field theory have taught one lesson: infinite-dimensional geometric existence is indeed probably unique). Consistency fixes infinite-dimensional ontology. Configuration space is thus the nondynamical arena of quantum dynamics. The solutions of Schrödinger equation are replaced by classical configuration space spinor fields and represent what might be called objective realities, or following Heisenberg, Platonic ideas. There is no quantization at this level, at configuration space level physics is completely classical, linear, and local.

Configuration space geometry and configuration space spinor fields necessarily transcend the finite-dimensional and finite mathematics and thus also language since all finite-dimensional representations mean necessarily an enormous loss of information. This is what transcendence means in TGD universe.

Finite-dimensional geometry is essential aspect of configuration space geometry. In order to realize four-dimensional general coordinate in the space of three-dimensional surfaces, the definition of the configuration space geometry must assign to each 3-surface a unique 4-surface representing classical time evolution, the classical physics, associated with that 3-surface. Classical physics is necessarily an exact part of quantum physics, rather than approximation. It is good to notice already now that all physical experiments involve a mapping of quantum phenomena to those of classical physics. This representability of quantum physics as classical physics is something very deep and crucial also for language and cognition.

2.2 What is subjective existence?

Mathematical/physical existences as such are not conscious: solutions of field equations are Zombies. In my personal universe the basic element of the subjective, conscious existence is moment of conscious-

ness identified as quantum jump between two physical existences/quantum histories/solutions of field equations/Platonic ideas. Subjective time corresponds to this sequence of quantum jumps and must be distinguished from the geometric time of physicists (spacetime coordinate): there is of course connection between these times but I will not go to it here. Subjective existence means continual re-creation: the objective reality is replaced by a new, in statistical sense more complex and intelligent, reality in each quantum jump.

Quantum jump is not enough: the notion of self is also needed. Self is autonomous system in quantum sense which means ability to remain unentangled between subsequent quantum jumps. Self has also historical dimension: it can remember its earlier experiences. This is achieved if the conscious experience of self corresponds to a statistical average over the experiences of quantum jumps occurred during the lifetime of self. Self has subselves which it experiences as mental images. Subsubselves associated with given subself give rise to kind of average mental image. An important, relatively new, idea about self relates to the sharing of mental images. When two subselves of self fuse, a more complex mental image is generated. For instance, right and left visual fields are mental images which usually fuse to give stereo vision. Also subselves of separate selves can fuse and this gives rise to more complex stereoconsciousess: this fused subself is experienced by both selves as similar mental image. Not only remote mental interactions, but all genuine communications, involve this fusion of mental images and it makes possible generation of social structures. Consciousness is not so private than we have learned to think. This sharing and fusing of mental images involves getting and giving: it is impossible to communicate without allowing the transformation of the message.

2.3   Mathematical existence is represented classically at spacetime level

The basic postulate which has served as a guideline in the construction of quantum TGD and TGD inspired theory of consciousness is that there is a correspondence between the quantum physics at infinite-dimensional configuration space level and spacetime physics. All quantum aspects must have correlates at the level of spacetime topology: quantum numbers, quantum entanglement, quantum jumps,... must have these spacetime correlates. This postulate is implicitly made also in standard quantum physics and every experiment involves the assumption about quantum$\rightarrow$ classical mapping.

What I going to propose that these spacetime representations are also what practicing mathematician constructs when the talks and writes and cognizes. In cognition and languaging the transcendental infinite-dimensional Platonic that which is is mapped to 4-dimensional existence.

3   Challenges

At this stage it is good to introduce the challenges which the proposed framework must encounter.

3.1   How to understand language?

Physical existence, subjective existence, and existence at spacetime level are separate ontological levels. Configuration space spinor fields (quantum histories) represent physical existences and subjective existence consists of selves defined by the sequences of quantum jumps between quantum histories. The first difficult question: How it is possible to represent anything about consciousness, subjective existence at the level of physical existence? How single quantum history can represent a sequence of quantum jumps between quantum histories?

The second difficult question: The contents of consciousness of self should be representable symbolically at spacetime level, as a love poem or a web article about consciousness, say. The pages of book, the words I speak, provide a representation about the con- tents of consciousness of self translated to the geometry and topology of the manysheeted spacetime. How the miracle of language is possible, how

it is possible to achieve a mapping from the transcendental that which is level defined by the infinite-dimensional geometric and subjective existences to the existence at the finite-dimensional spacetime level?

3.2   How to understand self-referentiality?

There is also the problem of self-referentiality. I have the ability of *becoming* conscious about being conscious of something. When I am cognitively conscious about something, somehow a spacetime representation about my state of consciousness results. Then I become conscious about the presence of this spacetime representation and I have thought about thought. Somehow the spacetime region representing though symbolically induces a sequence of quantum jumps, subself, mental image giving meaning to this symbolic representation.

4   Meeting the challenges

4.1   Three kinds of existences and three kinds of non-determinisms

As has become clear, TGD allows a trinity of existences: objective existence (quantum histories), subjective existence (consciousness), and finite-dimensional geometric existence (dynamical spacetime surfaces). The key to the understanding of language and self-referentiality turns out to be non- determinism. TGD allows three kinds of non-determinisms.

1. There is non-determinism associated with the quantum jumps. Moment of con- sciousness replaces the old quantum history with a new one. This non-determinism is also present in standard quantum theory but leads to paradoxes: quantum state as quantum history resolves these paradoxes.

2. The variational principle assigning to a given 3-surface X^3 a four-surface $X^4(X^3)$ (at which general coordinate transformations act as gauge symmetries) is non-deterministic. A good example is provided by a soapfilm: it can happen that given frame (wire) can span several soapfilms of minimum area. To fix the solution uniquely, one must allow additional fictive frames through which the soap film passes.

   In TGD a given spacelike 3-surface (frame of soap film) can span infinite number of absolute minima of the action (spacetime surfaces $\leftrightarrow$ soap films). One must generalize the notion of 3-surface by allowing sequences of spacelike 3-surfaces with timelike separations. These collections of soap film frames, sequences of snapshots about classical history, bring strongly in mind sequence of quantum jumps between quantum histories and it will turn out that they indeed represent symbolically (languaging!) sequences of quantum jumps, contents of consciousness of selves.

3. In TGD framework it is natural, and even necessary, to generalize the notion of spacetime geometry. Besides real numbers there is infinite number of number fields resem- bling reals, so called p-adic number fields. Spacetime decomposes in a well defined sense to real and p-adic regions and in p-adic regions p-adic counterparts of field equations are satisfied.

  The very special feature of the p-adic differential equations is that they are inherently non-deterministic. Integration constants have vanishing derivatives by definition. In real context intengration constans are indeed constants but not so in p-adic context. Any piecewice constant function of p-adic argument depending on its pinary cutoff (analog of desimal cutoff of real number) has vanishing derivative. This means that the solutions of field equations decompose into deterministic pieces. p-Adic reality, p-adicity, is like dream reality: piecewise realistic, one might say. This nondeterminism is very much like non-determinism of imagination and p-adic spacetime regions are indeed identified as cognitive representations, spacetime correlates of thoughts, intentions, plans. A cognitive representation at spacetime level for a sequence of quantum jumps comes into mind also now.

4.2 How do language and self-referentiality emerge?

I am now ready to propose how language and self-referentiality might be understood in TGD framework.

1. p-Adic nondeterminism makes possible to represent sequences of quantum jumps defining selves as piecewise deterministic p-adic spacetime regions. This is what intentions, thoughts, plans are at the spacetime level. There is indeed map from the infinite- dimensional that which is level to the concrete spacetime level.

   Cognition is strictly classical: self-consistency requires that in each quantum jump a complete localization in p-adic degrees of freedom occurs. There are no quantum parallel p-adic spacetimes in the final state of any quantum jump. In particular, a thought about contents of consciousness is realized as a quantum jump to a new quantum history in which spacetime surfaces in quantum superposition contain the same p-adic spacetime region representing (not faithfully!) the quantum jump sequence defining the self.

2. The classical non-determinism of the basic variational principle is present also in real physics and makes possible language. The sequences of spacelike 3-surfaces (recall the soap film analogy) are the physical correlate of language. When I talk or write, p-adic spacetime regions are somehow mapped to this kind of real spacetime regions. Perhaps by a quantum jump in which p-adic region is replaced by a real region.

   Presumably intentions are transformed to actions by the same mechanism and psychological time corresponds to the moment of geometric time defining the phase transition front at which p-adic intentions about geometric future transform to real actions and become memories about geometric past.

3. Self-referentiality emerges automatically. The generation of a p-adic spacetime region providing a cognitive repesentation about contents of consciousness of self means quantum jump in which configuration space spinor field becomes a quantum superposi- tion of spacetime surfaces, all of which contain this cognitive representation. This means that in subsequent quantum jumps self can be conscious about the presence of this cogni- tive representation: that is, has become conscious about being conscious of something.

This view means that mathematics and language provide very limited symbolic repre- sentations of that which is but iterative self reference loop makes it possible to improve the representations indefinitely. At this level the map is never the territory. Direct expe- rience of ideas is however possible. At this that which is level painting is the landscape.

4.3 What practical mathematics is?

After these preliminaries I can state what I think doing mathematics, as opposed to mathematical exis- tence, might be. Doing mathematics is perceiving mathematical ideas and communicating these percep- tions to other mathematical perceivers using language. Mathematical cognition gets only narrow glimpses about the full glory of the infinite-dimensional mathematical = physical existence. Thinking means build- ing of cognitive representations at spacetime level about contents of consciousness as p-adic spacetime regions. Languaging in turn translates these cognitive representations to symbolic representations in the material world represented by real physics. Both cognitive and linguistic representations are realized at the level of spacetime geometry and topology and these representations can never be complete. There is however iterative self-referential feedback loop which allows to indefinetely improve these representations.

4.4 Further comments about mathematics and consciousness

The following comments are based on the response of Uri Fidelman [2, 3]: the core of this argument were objections against the existence of Platonic realm of mathematical ideas. Uris argument was originally

against Penroses platonism and I wish to point out that my platonism differs from that of Penrose. I use also the opportunity to interpret the paradoxes discussed in Uris arguments in TGD framework.

4.5   Comparison with Penrose

My impression is that Penrose believes that state function collapse is reducible to a deter- mistic but non-computable time evolution and that a proper theory of quantum gravity allows this kind of reduction. I do not share this belief. I believe that quantum jump (U process is analogous to Schrödinger time evolution of infinite duration + state function reduction+ state preparation) is genuinely non-deterministic and subjective time development is the sequence of qjumps in which universe is re-created again and again. This together with two new non- determinisms: the nondeterminism of classical dynamics for spacetime surfaces (making possible language) and p-adic nondeterminism of cognition, means quite a deviation from Penroses intuitions.

What is Platonic in my belief system is the view that mathematical truths or ideas are something which we perceive as being true. Quantum jump makes possible instantaneous direct this is true experience, kind of Boolean quale, which is quite different from the mathematical proof.

In this framework mathematical proofs are only means of deriving further truths by mechanical symbol manipulation from the perceived truths, and restricted strongly by the requirement of representability as a spacetime region consisting of deterministic pieces representing steps in proof (or words of language).

Classical nondeterminism of the basic variational principle allows language but huge amount of information is lost in the map from that which is Platonic reality to symbol sequences represented as spacetime topology and geometry. The reduction of consciousness theory to a formal system allowing to see brain as a deterministic computer like system is out of question and I see the definition of theory as collection of algorithms as quite too narrow one. Rather, I like to see evolving universe as theory = reality becoming conscious of itself. There is no hope of complete representability of that which is at the spacetime level. Each quantum jump replaces universe=quantum history with a new one and this means a vicious circle: when universe=quantum history constructs descriptions about itself at spacetime level, it becomes more and more complex, and there is more to describe!

I believe however that it is possible to formulate also linguistically some very deep truths about consciousness and physics. Theory Of Everything undestood as some extremely general ontological statements (say the idea about uniqueness of infinite-dimensional configuration space geometry) might be possible although solving this theory (which in my belief system means coding the information about infinite-dimensional geometry of the configuration space and quantum jump sequences to the p-adic regions of spacetime) is certainly impossible. Of course, the number of deep truths is endless so that Theory Of Everything should be replaced by some less pompous phrase.

4.6   Computing and TGD Universe

In TGD framework each quantum jump involves the unitary process U represented by S-matrix. In extremely general sense U + state function reduction could be seen as analogous to a quantum computation lasting infinite time (one cannot however assign genuine Schroedinger time evolution to U). Subjective time development can be compared to a sequence of quantum computations of infinite duration. The naive estimate suggests that there are 10^{39} quantum computations of this type per one second of psychological time which are averaged at the level of conscious experience. This means that brain would be quite far from Turing machine and even quantum computer.

The philosophy behind Turing machine identifies subjective and geometric time with each other. In TGD it is in principle possible to have conscious information about entire classical history: the localization of conscious experience to single time=constant snapshot is only an idealization and already the possibility of intentions and memories (experiences giving information about geometric past *resp.* future) breaks this idealization. If Turing machine is realized at the level of spacetime geometry, it is in principle possible to have conscious information about entire infinite history of Turing machine, also about whether it halts or

not in the geometric future. This could make possible new kind of intuitive computation, usually called educated guesses and heuristic arguments.

4.7   Logical paradoxes and concept of time

I think that many logical paradoxes could be resolved if one assumes that there are two times: geometric and subjective and that the spacetime surface providing linguistic repre- sentations changes quantum jump by quantum jump. In particular, during the conscious argument leading to the logical paradox!

The objections of Uri Fidelman against the Platonic vision involve the paradoxes of the cyclic cosmology (one might think that Turing machine in cyclic cosmology might be able to know whether it has halted immediately after starting and thus be much more powerful than ordinary Turing machine). Basic paradox is that in cyclic cosmology allowing time travel one can imagine a son who murders is mother.

It is interesting to consider this paradox as resulting from identification of the identification of subjective time with geometric time, which I see only as an approximation. In TGD the counterpart of time travel would be sequence of quantum jumps changing the entire classical history quantum jump by quantum jump and inducing the shift of the spacetime region, where the contents of consciousness of time traveller are concentrated, to the geometric past. No paradoxes result since spacetime is not a fixed arena of dynamics but changes in each quantum jump. As a second example one can take the second objection of Uri Fidelman against Penroses program known as Berrys paradox.

Non-formalizable theory cannot provide a model of the physical world which includes the brains cognitive function, since such a model must be lingual, written or spoken. However, such a model implies the following paradox of Berry: Let n be the smallest number which cannot be defined by an English sentence having less than, say, a hundred letters. This number exists, since the number of all possible combinations of a hundred letters is finite. Nevertheless, it has just now been defined by a sentence comprising less than a hundred letters.

Berrys paradox could be understood when the piece of text is seen as inducing a sequence of quantum jumps in which the spacetime region at which the argument is rep- resented symbolically changes. For the initial spacetime region representing my cognitive state there is indeed smallest number n which cannot be defined by using less than one hundred words (using the English in that spacetime!). After reading the statement quan- tum history is replaced by a new, more complex one in which this this number can be defined by using less than one hundred words since a new reflective level of cognitive consciousness has emerged and is represented at spacetime level. This example encourages to think the possibility of replacing the idea of a fixed ax- iomatic system with a living and dynamically evolving system becoming conscious of new axioms from which new theorems can grow. One can consider the possibility that even the logic used is dynamical.

4.8   Dynamical logic?

What is paradoxal depends also on the logic used. The discussions with Goro Kato helped me to learn some interesting ideas about logic. One can say that in category theory logic is dynamical and defined by so called Heyting algebra which is more general than Boolean algebra, and is inherent to the category in question. Also the idea of local truth emerges: local truth is like local section of a bundle assigning to each believer a truth value in Heyting algebra. The local section need not extend to a global section (function). An intuitive picture about a local truth is provided by Z_2 (Boolean) bundle defined by Mobius band (take narrow sheet of paper and twist the first end 180 degrees and connect it with the other end). The base space of the bundle is circle which could be seen as a continuum of believers, fiber space is the finite vertical slice (say interval [0,1]). True and false can be interpreted as the upper and lower ends (0 and 1) of the slice locally. For ordinary band (or annulus) global truths are possible: the two circles representing the upper and lower boundaries of band represent global truths (true and false). For Mobius band only local truths are possible: since the boundary of Mobius band is connected (circle), the attempt to assign a definite truth value to each believer leads to the situation in which one traverses the entire

boundary of the Mobius band and both ends of each slice belong to the graph of truth function which is thus two valued. Every inhabitant of the Mobius world believes that the statement in question is both true and false. Perhaps moral rules (right/wrong) could be seen as this kind of local truths not necessary allowing globalization.

I also learned that the open sets of any topological space with real topology define Heyting algebra (the interior $r < R$ of ball is basic example of open set). The comple- ment of open set is closed and only its interior is open. Thus the union for a statement represented by a set and its negation represented by the interior of its complement do not span the entire topological space in real topology. The boundary of the complement corresponds to the third truth value. Concrete everyday example about 3-valued logic is following: think of person at the door, is he inside or outside or both inside and outside?

Interestingly, p-adic topology is compact-open so that the complement of open set is open and p-adic open set logic is inherently Boolean. The identification of p-adic spacetime sheets as cognitive representations is thus consistent with the fact that cognition is Boolean. The logic of sensory experience (real number based physics), if it respects continuity, is more naturally three-valued.

This framework would encourage to consider also the logic as dynamical. One could perhaps differentiate between the logic of sensory experience, logic of cognition, and per- haps many other logics depending on the category appropriate to the situation.

4.9   Platonism and nonstandard models of arithmetics

I find Uri Fidelmans comment about nonstandard model of arithmetics (allowing infinite numbers besides finite ones) especially interesting. The reason is that I developed year or two ago a formulation for physics as a generalized number theory. In this formulation the notion of infinite primes plays a key role. The starting point is following: p-Adic length scale hypothesis states that there is hierarchy of physically especially interreresting length scales $L_p = \sqrt{p}L$, $L \sim 10^4$Planck lengths, $p = 2, 3, 5, 7, ...$ prime. Entire universe must correspond to infinite length scale and thus to an infinite prime. Thus it would seem that it must be possible to construct a theory of infinite primes.

One can indeed do this. The simplest example of infinite prime is obtained by forming the product of all finite primes: call this number X ($X = 2 \times 3 \times 7 \times 11 \times ...$). Form the number $P = X + 1$. This number is not divisible by any finite prime as is easy to see, and is thus infinite prime. One can generalize this construction, and one finds that the process of construction for the simplest states is equivalent with second quantization of what is called a supersymmetric arithmetic quantum field theory. One can iterate the process by forming the product X_1 of primes obtained in this manner and repeat the same, and so on... The basis of physical manyparticle states represents the elementary particles, primes of the theory at the next level of the hierarchy.

Infinite primes can be actually mapped to the so called polynomial primes so that they are not totally new things. What is fantastic that infinite primes (also infinite in tegers and infinite rationals) can be mapped to spacetime surfaces (this follows from the fact that polynomials are geometric objects and their zeros define surfaces). One can see and compare infinite primes since they are represented as geometric objects! Infinity becomes something completely concrete and accessible to sensory experience and (spacetime) surfaces might perhaps be regarded as trascendental numbers! Primes correspond to elementary particles in well defined sense: elementary particle physicists are experimental number theorists!

If one allows the infinite hierarchy of infinite primes, the p-adic length scale hierarchy continues ad infinitum, and a given level of hierarchy corresponds to infinitesimals at the next level of hierarchy. Spacetime surface of infinite duration (cosmology) at given level is nothing but a tiny infinitesimal volume element at the next level of hierarchy. This raises the questions whether theorems not provable by finite number of steps might be proved by infinite number of steps at the next level of the hierarchy (represented physically as spacetime regions of arbitrarily infinite size), and whether we correspond to the lowest level in the hierarchy of consciousness and endless expansion of axiomatic system!

References

[1] M. Pitkänen. Matter, Mind, Quantum. In *TGD Inspired Theory of Consciousness*. Onlinebook. `http://tgdtheory.com/public_html/tgdconsc/tgdconsc.html#timesc`, 2006.

[2] U. Fidelman, *Cerebral asymmetry implies that a total theory of the universe and of the mind is impossible*, to appear in Symmetry: Culture and Science, 2002

[3] U. Fidelman (1999). *Gödels theorem and models of the brain: Possible hemispheric basis for Kants psychological ideas.* Journal of Mind and Behavior, 20 (1), 43-56, 1999.