Why the outcome of an event would be more predictable if it is known to occur?

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Abstract

There are experiments suggesting that the reliability of future predictions for events is better for real than for hypothetical events. This strange finding, if is real, would be an anomaly analogous to Libet's findings about active aspects of consciousness challenging the notion of free will.

In this article it is argued that it is difficult to explain the finding in the physicalistic framework, and that the allowance of free will seems only to worsen the situation since precognition of acts of free will does not make sense. In the framework of Topological Geometrodynamics (TGD) zero energy ontology (ZEO) replaces the standard ontology of quantum theory. ZEO predicts that in "big" (ordinary) state function reductions (BSFRs) the arrow of time changes and that the identification of acts of free will identified as BSFRS is not in conflict with the determinism of classical physics as an exact part of quantum TGD. Also Libet's findings can be understood.

This suggests a model for the anomaly. The experiment would have already happened as BSFR ("already" is with respect to subjective time, which should be distinguished from geometric time) for a quantum system associated with the experimenters and participants. The knowledge that the event is actual inspires unconsciously the attempt to "remember" the personal performance in the experiment instead of only imagining it and this would explain the improved future predictions.

Contents

1 Introduction

Past research in experimental psychology has brought evidence showing that certain changes in internal neurocognitive environments of human subjects can influence their predictions of near future events. In the series of experiments published in a recognized psychological Journal of Personality and Social Psychology, Armor and Sackett [J2] examined how the nature of future events influence the participants´ predictions about their future performance in different tasks.

In Study 1, half of participants were informed that they will complete a scavenger hunt task, i.e. finding particular objects at the university campus during 30 minutes, whereas the second half of participants were not informed. Thus, the expectations of participants were manipulated in terms of real versus hypothetical future events and this manipulation also causes different changes in internal neurocognitive environments in each half of participants. The participants were asked "How well will you do on the scavenger hunt?" or "How well would you do, if you were asked to complete the scavenger hunt?". After that, all the participants completed the scavenger hunt task and their predictions were compared with their real performance in this task. Strikingly, participants who did expect to complete the task predicted their own performance quite accurately. In contrast, participants who believed that the task is only a hypothetical future event showed much higher prediction-performance discrepancy, i.e. they were not able to predict their future performance accurately.

These findings were replicated also in Study 2, where another kind of task was used (a completion of test used for Graduate Record Examination). One may ask how it is possible that participants that were informed about their future life event predicted their real performance in the task better than non-informed participants. The authors of this study were quite surprised by obtaining these results and labeled them as "seemingly anomalous findings". If this finding is real it provides a difficult challenge for model builders.

In the context of Minkowski spacetime, several possible explanations can be theoretically conceptualized:

1. In classical GRT, the causal structure is the structure of light cones of the space-time metrics. As the matter-energy degrees of freedom determine the metric through Einstein's equations, the causal structure of a region of space-time is dynamical: it depends on the state of the matter energy in its past light cone. If one identifies the causality of human actions experienced as acts of free will with the deterministic causality of field equations, the ability to predict the near future is theoretically possible. This applies also to person's own behavior if it does not involve free will: if this is the case, the two causalities cannot be identified.

2. Also a general quantal explanation may be considered. Quantum measurement provides information. In the context of the above-outlined experiments, the participants who were told about the purpose of the experiment gained information. Could this action have involved state function reduction of some kind improving the ability to predict their own future? Also this option would assume that HOs are passive inspectors of their own fate and does not conform to the direct experience of having (partially) free will.

3. One can consider also an explanation in terms of precognition based on future-to-past communications requiring change of the arrow of time and therefore also violation of standard thermodynamics. Precognition is classified as belonging to the field of parapsychology by materialists accepting only a single arrow of time. Also this explanation fails if one accepts free will: precognizing of own unpredictable acts of free will is impossible.

In the sequel the problems of various physicalistic explanations are discussed in more detail and the TGD based model relying on zero energy ontology (ZEO) [L7] replacing the standard ontology of quantum theory in TGD framework and solving the basic paradox of quantum measurement theory. The basic prediction is that the arrow of time changes in "big" (ordinary) states function reductions (BSFRs) but is preserved in "small" SSFRs as analogs of "weak" measurements. This forces to distinguish between geometric and subjective time.

This leads to an understanding of the findings of Libet [J3] about active aspects of consciousness challenging the reality free will: in BSFR the arrow of causality changes and the outcome of BSFR causes the neural activity rather than vice versa. Also the findings of Armor and Sackett seem

to give direct support for the physicalistic picture: the members of group A would be passive inspectors of their own future actions and therefore would have not free will. Precognition, which is not accepted in the physicalistic framework, is however required, which suggests that BSFRs transforming precognition to memory recall might be involved.

In the sequel the findings of Armor and Sackett are taken at face value and an explanation based on TGD inspired theory of consciousness relying on zero energy ontology (ZEO) allowing to get rid of the basic paradox of quantum measurement theory is proposed. There are 2 new elements essential for the explanation.

1. There is a hierarchy of magnetic bodies carrying dark matter as $h_{eff} = nh_0$ phases of ordinary matter and defining a self-hierarchy.

2. The time reversal in BSFRs makes memory recall in reversed time direction possible: these memories need not be personal and it is possible to get information about the memories of MB at a higher level of hierarchy with a reversed arrow of time after BSFR.

In the scavenger hunt BSFR at higher level would be assignable to the experiment which had already occurred with respect to subjective time at a higher level of the hierarchy in the geometric future of participants. This BSFR would be followed by a cascade of BSFRs proceeding to shorter scales in subjective future but located in the geometric past.

The subject persons who were told that that they will participate a scavenger hunt would have received non-personal memories about those abstract aspects of the scavenger hunt at higher level of hierarchy, which they could not affect by BSFRs: the number of objects found by the participant would have been this kind of aspect and already determined by a BSFR at a higher level of hierarchy. Ordinary motor action would be very similar process involving communications to lower levels of self hierarchy in the geometric past.

This explanation is akin to the earlier TGD based explanation [L1] [K6] for psychedelic experiences in which subject persons experience meeting of representatives of advanced civilizations of outer space. That these encounters could be actual telepathic contacts was proposed in a book about psychedelic induced experiences titled as "Inner paths to outer space" (`http://tinyurl.com/gnb4bp9`) written by Rick Strassman, Slawek Wojtowicz, Luis Eduardo Luna and Ede Frecska [J6]. In ZEO the arrow of time is not fixed so that instantaneous communications over arbitrarily long distances become possible by what might be called time reflection involving BSFR.

The explanation relies on sending a signal, which is reflected back as a time reversed signal (involving BSFR): this allows to circumvent the barrier caused by finite speed of light. In principle this would make signalling with arbitrarily distant civilizations possible.

2 Why the standard physics based explanation for the findings of Armor and Sackett looks implausible?

What seems clear to me is that it is very difficult to understand the findings of Armor and Sackett [J2] - if real - in the standard physics framework.

1. Standard physics excludes precognition: the thermo-dynamical arrow of time is fixed and also the quantization procedure of quantum field theory fixes the arrow of time. Creation operators create states and annihilation operators destroy them. The change of arrow of time would change the roles of these operators. Classically this corresponds to the fact that signals propagate in preferred direction only. It is difficult to see how quantum effects according to standard QM could help. State function reductions happen in standard physics only in very short scales and have no effect in macroscales. They do not make possible effective precognition.

2. The idea that the persons in group A got bored after they had found the number of objects that they had estimated to find does not work since the same should have happened in group B.

3. The experimenter effect [K4] is encountered in parapsychology experiments and also in experiments involving living subjects (testing of drugs). There are extremely successful parapsychology experimenters and often their findings cannot be replicated. Could the experimenters somehow affect the subject persons so that the outcome of the experiment is what the experimenter would regard as desired? Physicalists deny the possibility of this kind of effect so that fraud or bad experimentation remains the only explanation. The reality of Placebo effect cannot be denied and suggests that the state of mind of the patient affects the healing in conflict with the physicalistic expectations. These effects are discussed from the TGD point of view in an article [K4] prepared in the project organized by Lian Sidoroff. Experimenter effect leads to ask whether the strong belief of experimenter on the expected result could induce the result also in the experiment of Armor and Sackett. This hypothesis could be tested by replicating the experiment sufficiently many times by other experimenters.

4. The causal reference frame model of Guerin and Bruckner [J2] involves a rather speculative proposal that classical GRT could allow anomalies in which the order of events is different for different observers modelled in terms of lightcones. One can ask whether it could differ in the recent experiments between participants a in group A and participants b in group B. For persons in group A it would have been changed and they could "remember" their performance whereas the participants in B only estimated it since they did not know that effective memory recall is possible! The information would have entered as classical signals in reversed time direction to the participants in group A. Somehow the information about the participation to the actual experiment would have made possible this effective change of arrow of time.

   Classical Relativity predicts that gravitation is extremely weak interaction so that the explanation does not look plausible to me. There are however some black-hole like solutions of Einstein's equations known as Kerr-Newman metrics [B2] describing rotating objects having opposite arrows of time in near-field and far-field regions but these solutions do not seem relevant in the recent case.

   It is difficult to see how standard quantum physics could help. One must however notice that there is no generally accepted quantum theory of gravitation.

3 A model for the findings of Armor and Sackett based on the notions of magnetic body (MB) and zero energy ontology (ZEO)

TGD based explanation of the findings relies on the notions of magnetic body (MB) and zero energy ontology (ZEO).

3.1 The notion of magnetic body (MB)

The notion of classical field differes from that it classical field theories. Gauge potentials - in particular electromagnetic gauge potential - are induced from the spinor connection of imbedding space $M^4 \times CP_2$ as defining static and non-dynamical gauge potentials. Sama applies to gravitational field as deviation from flat metric of Minkowski space. The dynamics of space-time surface makes the induce gauge potentials and metric dynamical. Locally the dynamics is however extremely simple since only 4 field like variables are involved. Even approximate superposition of fields is lost and possible only for massless modes propagating in the same direction and is replaced with superposition of effects.

This extreme local simplicity is compensated by the extremely complex topology of the many-sheeted space-time distinguishing TGD from standard model plus General Relativity. Many-sheeted space-time prevailing in long length scales means that there is very large number of space-time sheets parallel in the sense that they intersecting 4-D M^4 projections. This is crucial for all applications. Any system the induced gauge fields at space-time sheets characterizing the system and since these sheets are separate for separate system, these induce fields do not interfere. One

can say that the system has field body, in particular magnetic body (MB). In gauge theories this is not the case.

How does this picture relate to ordinary field theoretic description. Particle like entity as a small 3-surface touches all space-time sheets with 4-D M^4 projection and therefore experiences the sum of induced gauge fields associated with the space-time sheets. Effects superpose and this superposition corresponds basically to a set theoretic union of space-time surface with intersection M^4 projections. In ordinary field theory this is used as justification for the assumption that fields superpose. Field theory limit of TGD is defined by replacing the many-sheeted space-time with single regions of M^4 with gauge fields and gravitational fields defined as superpositions of the induced fields.

Also brain has MB. Quite generally MB is assumed to contain dark matter identified as ordinary matter characterized by extension of rationals with dimension $h = h_{eff}/h_0 = n$ measuring algebraic complexity and having interpretation as a kind of universal IQ. Also the scales of quantum coherence increase with h_{eff}. The layers of MB characterized by the value of n form naturally a slaving hierarchy in which ordinary matter with smallest Planck constant is at the bottom and controlled by higher levels. The energies of systems increase with h_{eff} and since h_{eff} tends to be spontaneously reduced, energy feed is needed to preserve the distribution of h_{eff}: the interpretation is as metabolic energy feed.

In the TGD framework the onion-like hierarchical structures of MB of brain would correspond to brain regions. The structure of MB with levels labelled by extensions of rationals characterized partially by $n = h_{eff}/h_0$ measuring the scale of quantum coherence, would also reflect the geometric and topological structure of the brain. There is evidence that functionally similar neurons can be modelled using statistically determined hyperbolic geometry [J5]. Functionally similar neurons not necessarily near to each other physically would be near to each other in the effective hyperbolic geometry.

In TGD framework MB could realize this hyperbolic geometry quite concretely as an abstract representation of the hierarchical functional structure of brain [L10]: functionally similar neurons and also higher level structures would be connected to nearby points at MB by flux tubes. Classification experienced as putting similar things to the same box is one of the basic cognitive functions and hierarchy of MBs could realize classification geometrically: functionally similar neurons would be connected by flux tuges to points near each other at MB - they would belong to the same box.

There is an astonishing finding supporting the notion of MB. The neurons of the brain of salamander were shuffled like a pack of cards. The salamander however recovered and preserved its memories (identified as learned behaviors) [J8]. In [K5, K2] this finding was considered as a support for the view about the brain as an analog of hologram (for the idea about TGD Universe as a conscious hologram see [K1]). It is however clear that a single neuron cannot represent the information content of the entire brain. However, if memories are represented by the images of neurons at the level of MB, the shuffling of neurons has no effect on memories as indeed found. Neurons would represent the analog of RAM in computer science.

3.2 What does ZEO mean?

The TGD based explanation would be based on ZEO allowing to solve the basic paradox of quantum measurement theory. First a brief summary of ZEO [L7].

1. In ZEO quantum states are not 3-dimensional but superpositions of 4-dimensional deterministic time evolutions connecting ordinary initial 3-dimensional states. By holography they are equivalent to pairs of ordinary 3-D states identified as initial and final states of time evolution.

   Quantum jumps replace this state with a new one: a superposition of deterministic time evolutions is replaced with a new superposition. Classical determinism of individual time evolution is not violated and this solves the basic paradox of quantum measurement theory. There are two kinds of quantum jumps: ordinary ("big") state function reductions (BSFRs) changing the arrow of time and "small" state function reductions (SSFRs) (weak measurements) preserving it and giving rise to the analog of Zeno effect [L7].

2. To avoid confusion it is good to emphasize some aspects of ZEO.

   (a) ZEO does not mean that physical states in the usual 3-D sense as snapshots of time evolution would have zero energy state pairs defining zero energy states as initial and final states have same conserved quantities such as energy. Conservation implies that one can adopt the conventions that the values of conserved quantities are opposite for these states so that their sum vanishes: one can think that incoming and outgoing particles come from geometric past and future is the picture used in quantum field theories.

   (b) ZEO implies *two* times: subjective time as sequence of quantum jumps and geometric time as space-time coordinate. These times are identifiable but are strongly correlated.

3. In BSFRs the arrow of time is changed and the time evolution in the final state occurs backwards with respect to the time of the external observer. BSFRs can occur in all scales since TGD predicts a hierarchy of effective Planck constants with arbitrarily large values. There is empirical support for BSFRs.

   (a) The findings of Minev et al [L4] in atomic scale can be explained by the same mechanism [L4]. In BSFR a final zero energy state as a superposition of classical deterministic time evolutions emerges and for an observer with a standard arrow of time looks like a superposition of deterministic smooth time evolutions leading to the final state. Interestingly, once this evolution has started, it cannot be stopped unless one changes the stimulus signal inducing the evolution in which case the process does not lead to anywhere: the interpretation would be that BSFR back to the initial state occurs!

   (b) Libets' experiments about active aspects of consciousness [J3] can be understood. Subject person raises his finger and neural activity starts before the conscious decision to do so. In the physicalistic framework it is thought to lead to raising of the finger. The problem with the explanation [J1] is that the activity beginning .5 seconds earlier seems to be dissipation with a reversed arrow of time: from chaotic and disordered to ordered at around .15 seconds. ZEO explanation is that macroscopic quantum jump occurred and generated a signal proceeding backwards in time and generated neural activity and dissipated to randomness.

   (c) Earthquakes involve a strange anomaly: they are preceded by ELF radiation. One would expect that they generate ELF radiation. The identification as BSFR would explain the anomaly [L5]. In biology the reversal of the arrow of time would occur routinely and be a central element of biological self-organization, in particular self-organized quantum criticality (see [L6, L17].

3.3 Some implications of ZEO

ZEO has profound implications for understanding self-organization [L6] and self-organized quantum criticality [L17] in terms of dissipation with non-standard arrow of time looking like a generation of structures. ZEO could also allow understanding of what planned actions - like realizing the experiment under consideration - could be.

1. Second law in the standard sense does not favor - perhaps even not allow - realization of planned actions. ZEO forces a generalization of thermodynamics: dissipation with a non-standard arrow of time for a subsystem would look like self-organization and planned action and its realization.

   Could most if not all planned action be like this - induced by BSFR in the geometric future and only apparently planned? There would be however the experience of planning and realizing induced by the signals from geometric future by a higher level in the hierarchy of conscious entities predicted by TGD! In long time scales we would be realizing our fates or wishes of higher level conscious entities rather than agents with completely free will.

2. The notion of magnetic body (MB) serving as a boss of ordinary matter would be central. MB carries dark matter as $h_{eff} = nh_0$ phases of ordinary matter with n serving as a measure for algebraic complexity of extension of rationals as its dimension and defining a kind of

universal IQ. There is a hierarchy of these phases and MBs labelled by extension of rationals and the value of n.

MBs would form a hierarchy of bosses - a realization for master slave hierarchy. Ordinary matter would be at the bottom and its coherent behavior would be induced from quantum coherence at higher levels. BSFR for higher level MB would give rise to what looks like planned actions and experienced as planned action at the lower levels of hierarchy. One could speak of planned actions inducing a cascade of planned actions in shorter time scales and eventually proceeding to atomic level.

3. This interpretation is actually not new. I proposed in [L15, L16] that motor actions could correspond to BSFRs and sensory percepts to their time reversals. It took still some time to realize that sensory perceptions naturally correspond to SSFRs ("weak" measurements), and that both BSFRs and SSFRs can occur with both arrows of time. Motor action would be a cascade of BSFRs with each BSFR inducing sensory perceptions as SSFRs at lower level inducing in turn motor actions as BSFRs in shorter time and length scales. The above model is a generalization of this picture.

3.4 The model

Could one apply ZEO also to the experiment under consideration?

1. Could one think that the experiment involving BSFR had in some sense already occurred (with respect to subjective time) when the experimenters got the idea to perform the experiment as a control signal from the geometric future? Experimenters and participants would have been like neurons in the brain of participants of Libet's experiment demonstrating that neural activity precedes experience about act of free will [J3]. They did what the already occurred experiment forced them to do. They of course had a lot of free will but not at this level of hierarchy of conscious entities but in shorter time scales and this made possible the needed preparations.

2. Experimenter informed the members of group A about the arrangement of the experiment. Therefore the members of group A concentrated on a process which was actually an attempt to remember in a reversed time direction and they were successful. The participants in group B did not know that the experiment would be arranged and made only guesses.

3. The objection is that in applications to atomic systems, Libet's experiments and earthquakes, one speaks of what an outsider with the standard arrow of time observed. Now one however talks about the participants of experiments and BSFR would now affect them. Does this really make sense?

   Here the notion of MB could come in rescue. BSFR would occur at the level of a collective MB of the system involving participants and experimenters and induce the outcome of BSFR and would change the arrow of time only at this level of MB. The participants at lower levels of hierarchy would receive information from the collective MB as time reversed control and communication signals. The signals would be received if the participant tunes herself to the correct wavelength - that is performs a memory recall, which would become possible after learning that the experiment will be actually performed.

3.5 How could the higher levels of MB use the brain to realize their free will?

The proposed model assumes that the experienced long terms goals (in the recent case the goal of experimenter to perform the experiment) correspond to SFRs that have already occurred at some higher layer of MB controlling the brain.

Neuroscience supports the view that frontal lobes are responsible for long term planning and decision making. They are involved also with the self model. This suggests that the highest layers of MB control frontal lobes. There would be a hierarchy of layers of MB having frontal lobes at the bottom.

3.5.1 Model for the coupling of MB with frontal lobes in terms of cognitive entanglement

A natural assumption is that the control of biological body by MB involves entanglement. Since frontal lobes are associated with high level cognition, this entanglement could be cognitive entanglement discussed in [L12]. Cognitive entanglement is a hierarchical entanglemen between wave functions in hierarchy of sub-groups in the factorization of Galois group to a product $G_1G_2...G_n$ of sub-groups reflecting directly the representationof extension as extension of extensions of .... of rationals.

What is special is that entanglement is directed like attention and hierarchical just like for the slaving hierarchy. The entanglement between states in group algebras of G_1 and $G_2...G_n$ is directed from boss G_1 to slave $G_2..G_n$. Cognitive SFRs are cascades proceeding downwards and reducing entanglement. Negentropy Maximization Principle can however prevent the cognitive measurement cascade from proceeding down to G_n [L14] if it does not give rise to negentropy gain.

Long term goals could involve this kind of cognitive entanglement assignable to directed attention and motor actions as BSFRs at this layer of MB would produce what is experienced by the levels of the hierarchy with the standard arrow of time as a behavior with long term goals. This would produce what could be regarded as analog of precognition [L15] and identifiable as sensory perception of signals propagating to non-standard direction of time. Precognitive dreams would be an example of this.

3.5.2 What happens when frontal lobes are damaged?

This vision conforms with what happens when frontal lobes are damaged. Although intellectual abilities are not lost, long term planning is not possible and the patient loses the ability to initiate actions. Damage can also lead to idiot savant phenomenon [J4]. Although the person seems to lack conceptual thinking completely, he/she can possess miraculous looking mathematical skills [L3] [K3] or artistic gifts [L2] [L2]. In some poorly understood sense idiot savants can be extremely intelligent.

Is the character of the cognitive entanglement changed or replaced with something totally different in these situations? TGD predicts two kinds of information related to two different representations of genetic code which relate to each other like function represented by its local values to its Fourier transform as a non-local and holistic representation [L11, L13]. The local representation of the genetic code is in terms of bits and using sequences of genetic codons as units of 6 bits. The second representation is in terms of 3-chords of light defining the allowed chords of a bio-harmony. Music expresses and induces emotions and bio-harmony would characterize a mood. Emotional intelligence would relate to this representation. Could it be that for idiot savants non-verbal emotional intelligence dominates.

The duality of these two representations of genetic code is highly analogous to the duality of momenta and position coordinates in wave mechanics. In quantum TGD this duality has as an analog $M^8 - H$ duality [L8, L9] stating that space-time surfaces can be regarded as 4-surfaces in $H = M^4 \times CP_2$ or in M^8. $M^8 - H$ duality relates these representations. H corresponds to ordinary differential geometric space-time representation involving also the notion of field. M^8 identifiable as 8-D momentum space corresponds to non-local algebraic and number theoretic representation, which is non-local and holistic since the momenta are analogous to frequencies. Scattering amplitudes in particle physics provide an example of this representation.

Both representations can be used and it depends on the situation which representation is more appropriate. Could it be that for ordinary *resp.* emotional intelligence H *resp.* M^8 representation is more appropriate? Could one exaggerate and say that not only idiot savants but also people in timeless meditative state and experiencing no separations (produced by cognitive SFRs), and maybe also children "live" in M^8 whereas the ordinary people with their tight time schedules and busily performing comparisons "live" in H? Momentum eigenstates are delocalized.

3.5.3 Are meditative states labelled by finite simple groups?

What could be the counterpart of meditative state without cognition be at the level of cognitive representations? Could it correspond to a situation in which it is not possible to create

separations as decompositions to unentangled system pairs by reducing the entanglement between the factors of the Galois group G?

This is certainly the case if G is simple, that is does not allow this factorization at all. Simple finite groups are the basic building bricks of finite groups: the classification theory for simple groups [A1] (`https://cutt.ly/Pj2i2Nx`) states that simple finite groups is cyclic and of prime order, alternating group consisting of even permutations of n objects, group of Lie type or one of the 26 sporadic groups or Tits group. The meditative states of pure consciousness would correspond to finite simple groups!

A question about possible classification of meditative states definitely raises eyebrows. But the power of mathematics is miraculous: if one agrees that thinking means SFRs (thought generates separations and comparisons) and that in meditative states thinking ceases, this is the conclusion. Rather paradoxically, the "idiot savant state" would be cognitively irreducible in the same sense as the states of Hilbert space with prime dimension do not allow a representation as entangled states. They would represent elementary particles of cognition - fundamental ideas - from which more complex thoughts are composed by performing repeated extensions. The basic advice of meditative practices is to stop thinking: maybe this is indeed the manner to achieve the state of understanding.

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