Comments on "Explaining the Therapeutic Intent/Healing Bibliography of Research by applying the Three Levels Theory of Matter"

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Contents

1 Introduction

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The background of the article as described by authors is following.

It is generally known that external qi healing, prayer healing or therapeutic intent can be beneficial to patients of various illnesses and can bring the desired changes to physical subjects, but it is less known how the intention can bring the desired effect. The common question is where the energy comes from? This article explains the mechanism of nonlocal therapy by applying the Three Levels Theory of Matter as proposed by Zhineng Qigong founder, Pang Ming and supports the theory by applying the recent discoveries in modern science.

The basic idea of authors is that information is transformed directly to energy. The nasty question is following: Why not regard information as just one form of energy so that the entire notion of information would be redundant?

In the proposed theory the notions of simple and complex information - natural and conscious information - are introduced. One can wonder whether it is really sensible to introduce besides conscious information also the natural information, which I understood as non-conscious information? Does the notion of non-conscious information make sense at all? Should entropy be seen as potential conscious information rather than actual? Should one consider instead of it measures for complexity or representative capacity closely correlating with the number of states of system with same or nearly same energy? And should one call the purely physical counterpart of information - say bit sequences - just data? The correspondence between data (complexity) and conscious information is certainly 1-to-many. For instance, the effect of written text to my cat is quite different from that on me and a given bit sequence can have totally different meaning in two programming languages.

As a justification for this author mentions an interesting experiment suggesting that information can be transformed directly to work: this would realize Maxwell's demon and break second law for the subsystem considered. In the following I try to explain to myself the experiment in which Maxwell's

demon is realized without breaking of second law for the entire system without introducing the notion of conscious information. My comments are about this experiment. I hope that they could be useful.

2 Is conscious information the only possible form of information?

The article "Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality" speaks of transformation of information-to-energy. I am a little bit skeptic about this statement. To me it seems that one can understand the experiment (no violation of second law) in terms of entropy alone and there is no need to talk about information. Furthermore, if information can be transformed to energy, one can ask whether information is just one form of energy and therefore can be eliminated as a concept.

I begin by listing some questions revealing the reasons for my skepticism.

- Does the notion of non-conscious information make sense at all? Conscious information is always about something: does this mean that the identification of conscious information with some physical quantity certainly not having this property, is not possible?

- Could entropy seen as potential conscious information rather than actual?

- Should one consider instead of it measures for complexity or representative capacity closely correlating with the number of states of system? And should one call the purely physical counterpart of information - say bit sequences - just data: information without meaning? The correspondence between data (complexity) and conscious information is certainly 1-to-many. For instance, the effect of written text to my cat is quite different from that on me and a given bit sequence can have totally different meaning in two programming languages.

- Could one replace the notion of information with something more concrete? My own modest proposal for this something would be cognitive representations realized in TGD Universe in terms of p-adic space-time surfaces with the correspondence between real and space-time sheets being unique apart from finite measurement resolution.

In the following I try to explain to myself the experiment in which Maxwell's demon is realized without breaking of second law for the entire system without introducing the notion of conscious information at any stage.

3 An experiment realizing Maxwell's demon

The experiment seems to realize Maxwell's demon but - as authors emphasize - without the breaking of second law for the entire system including also Maxwell's demon. According to authors this means that information seems is transformed directly to work.

The aim is to make particle to move upwards along a helical ladder by a process which authors call transformation of information into work. Charged particles (not elementary particles) are in Brownian motion in a buffer solution - call this system S. There is a camera recording with constant time intervals the direction of motion of particle and an apparatus generating electric field - call the latter system E. If the particle moves downwards, the electric force is opposite to the direction of motion of Brownian particle. If the direction is upwards, no electric field is generated. The net effect is expected to be an upwards motion. The energy needed to generate electric field is negligible as compared to that needed to raise the particle along the ladder. The authors conclude that information is transformed to work. The entire arrangement $E + S$ however utilizes energy so that total energy is used to achieve the net effect more than the potential energy gained by the particle as also authors notice. According to experimenters, second law is not violated for $E + S$.

4 Can one understand the experiment using only the notion of entropy?

The transfer of information or potential information can be described by using the notion of correlation mapping states of S to those of E (not in 1-1 manner).

1. When photographs about Brownian particle are taken and recorded, a correlation is created between particle's direction of motion (moving upwards or downwards) and the state of the computer storing these data. The data is used to generate electric field stopping the charged particle if it moves downwards in the ladder: effectively a wall is created and particle stops. Therefore a correlation between the direction of particle's motion and action of feedback apparatus is created.

2. According to authors second law is not violated for the entire system $E+S$. Second law is however violated for the system S (this is just the idea of Maxwell's demon!). This looks obvious from the experimental arrangement creating correlations between S and E, which should be absent in genuine thermal equilibrium for S. Authors express their finding by saying that information is transformed to work. Information is defined as the negative of Shannon entropy for the two-state system assigned with the charged particle: particle is inside given angular range or not. The probability for this is estimated from free energy using thermodynamics. Experimental demonstration of information-to-energy conversion and validation of the generalized Jarzynski equality is provided.

3. To take into account the feedback authors consider a generalization of second law $\langle \Delta F - W \rangle \leq 0$ for the subsystem S to $\langle \Delta F - W \rangle \leq k_B T I$, where I is mutual information, that is the information obtained from the state of charged particle and defined using Shannon's formula. One could also say that I is the reduction of entropy associated with the Brownian particle when its direction of motion is detected. So called Jarzynski equality is shown to be true.

This inspires following comments.

1. I am not sure whether $E + S$ can be regarded as a system obeying second law. Boltzmann's equations and second law assume the absence of quantum coherence in time and length scales considered. Also thermal fluctuations can break second law.

   In any case, in thermal equilibrium for the entire system there should be no correlations between parts of the system. Now however correlations are generated between the direction for Brownian motion and action of feedback apparatus. Are these correlations consistent with the idea that second law applies to $E + S$? Non-equilibrium thermodynamics generalizing second law might be the right manner to describe the situation.

2. There is analogy with quantum measurement. Quantum entanglement between the states of the observed system and measuring system is created (analogous to the correlation between direction of particle's motion and feedback apparatus) and in state function reduction the entanglement is reduced (for standard quantum mechanics) and the states of the system and measurement apparatus are in one-one correspondence. The new element is the feedback.

3. One can describe the situation solely in terms of entropy and second law for $E + S$. One could of course formally identify information as a negative of the entropy associated with a two state system but this is not necessary. If all information is conscious information, this identification is wrong to my opinion.

5 Is thermodynamics enough?

Maxwell's had the intuition that "there's something more than thermodynamics". I think that this is true.

1. One often forgets that Boltzmann's kinetic equations implying second law hold only in time scale where quantum coherence is absent. Therefore one cannot describe electron in atom using

thermodynamics but must use Schrödinger equation. If the subsystem has long enough time scale of quantum coherence, one must treat it as a genuine quantum system.

2. If one takes seriously p-adic physics as a correlate for cognition, one ends up with the notion of number theoretic entanglement entropy and negentropic entanglement becomes possible for rational (and even algebraic) entanglement probabilities. The value of the number theoretic entanglement entropy can be negative and achieves minimum for some prime. The interpretation would be as information associated with entanglement whereas ordinary entanglement entropy would measure the uncertainty about either entangled state.

   The attractive idea is that negentropic entanglement serves as a correlate for the experience of understanding and other positively colored emotions: the reason is that the state pairs appearing in the sum defining the entangled state are analogous to instances $a \leftrightarrow b$ of a rule $A \leftrightarrow B$. Negentropic entanglement can be also stable with respect to Negentropy Maximization Principle (NMP) implying for ordinary entanglement entropy a reduction to a state with vanishing entropy (also with vanishing information - the best one can achieve for ordinary Shannon entropy as a measure of information!). The connection with Zeno effect is obvious: NMP implies that subsequent state function reductions either increase the negentropy or do not change the state at all so that the mental images representing genuine information is preserved. Note that the maximum negentropy state is purely mathematically very much analogous to maximal entropy state defining thermal equilibrium.

3. An interesting question is how second law generalizes if p-adic physics is accepted. Certainly local generation of genuine information becomes possible: in standard vision the local entropy can be only reduced to zero. The pessimistic generalization would be that second law still holds true: if negentropy is generated locally, a compensating entropy is created elsewhere. Looking at what happens around me, I tend to take the pessimistic generalization seriously. I do not however have a real mathematical justification for it.

4. The notion of finite measurement resolution is essential in physics. Cutoff length and energy are its realizations in particle physics and lead to the notion of effective field theory. Finite measurement resolution does not however have a really elegant mathematical formulation at the fundamental level. Certainly finite measurement resolution and finite cognitive resolution are bound to be an essential element in the definition of entropy since entropy restricts the amount of avaible information.

   My own proposal is that the inclusions of hyperfinite factors of type II_1- von Neuman algebras which emerge naturally in TGD framework - provide an mathematically elegant realization for this notion. Included factor would generate states which are not distinguishable from each other.

   Finite measurement resolution means discretization at space-time level. This discretization manifests in the p-adicization of TGD as finite angle resolution and spatial resolution and appears concretely in the definition of p-adic manifolds. p-Adic manifolds have chart maps to real manifolds defined by canonical identification and these maps must be restricted to a subset of rational points by internal consistency. The outcome is discretization. By the way, the inverse of the canonical identification define cognitive representations so that manifold theory and theory of cognitive science meet each other: p-adic chart maps are real chart maps for thought bubbles! The outcome is discretization at the level of 8-D imbedding space since the manifold structure of space-time surface is induced.

   How the increase of these resolutions relates to the second law is one of the many interesting questions. The notion of macro-state is what seems to be a representation of state containing only the available information. Second law is expected to hold true in given resolution. Could evolution by quantum jumps mean that these resolutions improve gradually? How second law should be generalized to take this into account? Does it generalize?