

# p-Adic Physics as Physics of Cognition?

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## Abstract

T(opological) G(eometro)D(ynamics) as a generalized number theory vision forces the interpretation of the p-adic physics (like reals also p-adic number fields are completions of rational numbers) as a physics of cognitive representations so that matter-mind dichotomy corresponds to real-p-adic dichotomy at the level of the geometric correlates of mind. This interpretation has far reaching implications for both TGD inspired theory of consciousness and for the general world view provided by TGD. Cognition is predicted to be present in all length scales and the success of the p-adic physics in elementary particle length scales forces to conclude that cognition is present even at this level. In this article these implications are studied from the point of view of cognitive consciousness.

p-Adic spacetime sheets are identified as the counterparts of cognitive representations: one could also assign them with memes, morphic fields, or analogous notions used by parapsychologists. The possibility to identify the inherent non-determinism of the p-adic field equations as the non-determinism of imagination makes this identification so attractive.

The phase transition of a p-adic spacetime sheet to a real spacetime sheet (p-adic spacetime region is simply replaced by a real region in a quantum jump between quantum histories) corresponds to a transformation of a thought into

action or sensory experience (during dreams and hallucinations) whereas the reverse transformation corresponds to the transformation of the sensory input into cognition. One possible view is that p-adic memes are everywhere waiting for their materialization by p-adic-to-real phase transition and that biological systems are only a special class of cognitive systems.

p-Adic teleportation for the massless extremals (MEs) is a basic mechanism making possible the replication and transmission of memes with an effective velocity which can be superluminal. Time reversed cognition is a basic implication of the teleportation mechanism. Basic cognitive functions are discussed in this conceptual framework. Time reversed reference waves generate time reversed holograms, which suggests an extremely general and simple model of healing using the phase conjugate of the reference wave inducing the 'disease program' hologram and thus forcing the program to run backwards. DNA strand and its conjugate strand have interpretation as representations of a command and its time reversal coded to holograms by MEs scanning DNA like reading head and coding nucleotide sequence to a lightlike vacuum current.

The obvious question is how to test p-adic physics empirically. First of all, thinking is p-adic sensory experiencing. Hence the reduction of theories-experimental science dichotomy to p-adic-real dichotomy seems natural: just like experimental science is an extension of everyday real sensory experience, theories represent an extension of everyday p-adic sensory experience (common sense thinking). Thus the basic test is how well p-adic physics based theories describe cognition. Secondly, the p-adic models for physical systems are strictly speaking models for cognitive models for real physics. The successes of these highly predictive models (consider only p-adic elementary particle mass calculations involving only very few integer valued parameters) supports the vision about p-adic physics as physics of cognition. p-Adic-real phase transitions as models for how thought is transformed to action and sensory input to thought provide a further testing ground for the new paradigm.

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## 1 Introduction

TGD as a generalized number theory vision forces the interpretation of the p-adic physics as a physics of cognitive representations. This interpretation has far reaching implications for both TGD inspired theory of consciousness and for the general world view provided by TGD. Cognition is predicted to be present in all length scales and the success of the p-adic physics in elementary particle length scales forces to conclude that cognition is present even at this level. In this chapter these implications are studied from the point of view of cognitive consciousness.

### 1.1 The three non-determinisms

TGD Universe is characterized by a 'holy trinity' of non-determinisms. The first non-determinism is associated with quantum jumps between quantum histories and is what makes possible subjective existence and consciousness. Second non-determinism is classical non-determinism of Kähler action and is related with macroscopic volition and probably also with sensory experience. The third non-determinism is inherent to all p-adic field equations and corresponds to the non-determinism of imagination and thus makes possible cognition. There is no conscious experience associated with classical nor with p-adic non-determinism as dualist might think. These three non-determinisms have turned out to be basic building bricks of TGD inspired theory of consciousness.

Mindlike spacetime sheets are the geometric correlates of selves in the TGD framework. In the real case mindlike spacetime sheets have a finite temporal duration. In the p-adic context this restriction is in principle unnecessary. Classical and p-adic non-determinisms make it natural to introduce the notion of association sequence defined as a sequence of spacelike 3-surfaces with timelike separations determining uniquely the absolute minimum spacetime surface going through these 3-surfaces. In case of  $CP_2$  type extremals discrete association sequences become in principle continuous sequences of 3-surfaces.

## 1.2 Classical non-determinism and volition

In case that classical non-determinism gives rise to macroscopic multifurcations of the time development of 3-surface, it is tempting to identify the branches of the multifurcations as alternative choices involved with volitional acts. The assignment of sensory experiences with real mindlike spacetime sheets explains why the contents of sensory experiences are localized with respect to geometric time.

The book "Gödel, Escher, Bach" by Douglas Hofstadter about self-reference has been perhaps the most fascinating of my intellectual arm chair adventures and it stimulated the dream about the identification of the physical counterpart of self-reference. The physics as a generalized number theory vision finally stimulated concrete ideas about how this self-reference might be realized. Classical non-determinism, besides being crucial for the construction of S-matrix in the approximation that particles correspond to  $CP_2$  type extremals, indeed seems to make possible self-referential Universe already at elementary particle level.

By crossing symmetry, one can interpret S-matrix elements as transition amplitudes between two vacua differing only by the presence of mindlike spacetime sheet containing zero energy state with incoming and outgoing particles having positive and negative energies respectively. These zero energy states thus provide physical representation for particle reactions and in fact also for sequences of particle reactions. Thus the classical non-determinism and the possibility of negative energies make possible for the Universe according to TGD to represent the laws of physics in the structure of zero energy physical states. That all possible vacua provide representation for physics is very much akin to the ideas of Eastern philosophies, and is bound to have deep implications from the point of view of TGD inspired theory of consciousness. In this chapter the main emphasis is however on the implications of the p-adic non-determinism.

## 1.3 p-Adic non-determinism and cognition

p-Adic non-determinism follows from the fact that functions with vanishing derivatives are piecewise constant functions in the p-adic context. More precisely, p-adic pseudo constants depend on the binary cutoff of their arguments and replace integration constants in p-adic differential equations. In case of field

equations this means roughly that the initial data are replaced with initial data given for a discrete set of time values chosen in such a manner that unique solution of field equations results. Solution can be fixed also in a discrete subset of rational points of the imbedding space. Presumably the uniqueness requirement implies some unique pinary cutoff.

Thus the spacetime surfaces representing solutions of p-adic field equations are analogous to spacetime surfaces consisting of pieces of solutions of the real field equations. Thus p-adic reality is much like the dream reality consisting of rational fragments glued together in illogical manner or pieces of child's drawing of body containing body parts in more or less chaotic order.

The obvious interpretation for the solutions of the p-adic field equations is as a geometric correlate of imagination. Plans, intentions, expectations, dreams, and cognition in general are expected to have p-adic cognitive spacetime sheets as their geometric correlates. A deep principle seems to be involved: incompleteness is characteristic feature of p-adic physics but the flexibility made possible by this incompleteness is absolutely essential for imagination and cognitive consciousness in general.

### 1.3.1 p-Adic-real phase transitions and matter-mind interaction

If one accepts the idea that real and p-adic spacetime regions are correlates for matter and cognitive mind, one encounters the question how matter and mind interact. A good candidate for this interaction is the phase transition leading to a transformation of the real spacetime regions to p-adic ones and vice versa. These transformations can take place in quantum jumps. p-Adic-to-real phase transition would have interpretation as a transformation of thought into a sensory experience (dream or hallucination) or to an action. The reverse phase transition might relate to the transformation of the sensory experience to cognition. Sensory experiences could be also transformed to cognition by initial values realized as common rational points of a real spacetime sheet representing sensory input and a p-adic spacetime sheet representing the cognitive output. In this case the cognitive mental image is unique only in case that p-adic pseudo constants are ordinary constants.

### 1.3.2 p-Adic teleportation

Massless extremals (MEs) are an excellent candidate for a hierarchy of life forms representing MEs. MEs represent classical gauge fields propagating with a light velocity such that the shape of the wave form is preserved. They allow the coding of any pulse shape to the shape of the classical gauge field and are thus optimal for representing information classically. This is why MEs are in a key role in TGD based theory of consciousness including the model of EEG (see the chapter "Quantum model of EEG and nerve pulse"). For the p-adic MEs conservation laws allow reflection in a spatial or temporal direction, and

one can consider gluing of pieces of ME to get zigzag curves with reflections in spatial or time direction. In the reflection to the direction of geometric past a time reversed copy of the cognitive representation is formed, in the next reflection a copy of the original is formed, etc... This mechanism makes possible both the meme replication and their transmission with a superluminal velocity. Even transfer of memes to the geometric past becomes possible. Time reversed cognition is the basic prediction very much analogous to the prediction of the antimatter in Dirac's theory of electron. Obviously p-adic teleportation and real-p-adic phase transition provide also general mechanisms for a large variety of paranormal effects.

### 1.3.3 Cognitive degeneracy and the survival of the fittest

The construction of quantum TGD suggests strongly that p-adic spacetime regions do not contribute to configuration space geometry and thus to physics in the conventional sense. This has nontrivial implications. First of all, all spacetime surfaces which differ only cognitively are physically equivalent and one can speak about cognitive degeneracy. This means that physical system with a large cognitive degeneracy is analogous to a system with a large state degeneracy. If the final states of quantum jumps have roughly the same probabilities, this means that quantum jumps lead with highest probability to those states for which cognitive degeneracy is highest. The mere ability to imagine would mean winning in the fight for survival. The possible weak point of this hypothesis is the assumption that probabilities for various final states are roughly the same. Indeed, if the cognitive degeneracy is roughly equal to the negative exponent of the Kähler function, as proposed earlier (see the chapter "Information theoretic aspects of TGD inspired theory of consciousness"), the two exponents cancel in the total probability for quantum jump to given physical state, and the argument fails.

An alternative, and perhaps a more realistic, manner to see the situation is that a physical system with high cognitive degeneracy has large repertoire of transformations of cognitive spacetime sheets to real spacetime sheets and is thus highly adaptive and survives for this reason.

## 1.4 How to test p-adic physics?

The obvious question is how to test p-adic physics empirically. Since the times of Newton physicists have modelled the world using solely real numbers. Hence a careful reconsideration of the relationship between physical theories and experimental physics is needed before one can answer this question.

The basic heuristic guideline is that thinking is essentially p-adic sensory experiencing. Hence the reduction of the Cartesian theories-experimental science dichotomy to p-adic-real dichotomy seems natural. Just as experimental science is an extension of the everyday real sensory experience, theories would

represent an extension of the everyday p-adic sensory experience (common sense thinking). Thus the basic test is how well p-adic physics based theories describe cognition.

Also indirect experimental testing is possible. The p-adic models for physical systems are models for cognitive models of real physics. The successes of these highly predictive models of models support the paradigm of p-adic cognition. A representative example is provided by the elementary particle mass calculations based on p-adic thermodynamics and characteristically involving only very few integer valued parameters and exponentially sensitive dependence of the masses on single integer parameter. Therefore either the success of the model is extremely improbable statistical miracle or the model indeed describes physical reality (see the fourth part of "TGD and p-Adic Numbers" [padTGD]). A second example is the consistency of the very strong predictions of p-adic length scale hypothesis with empirical facts. It is also evident that, in TGD framework at least, the physics of matter must be based on real numbers. For instance, p-adic non-determinism would mean that basic conservation laws would not hold true exact in piecewise manner: at the level of imagination this cannot be allowed but not in the laboratory.

p-Adic-real phase transitions transform thought to action and sensory input to thought. The theories of brain functioning should at the fundamental level involve modelling of these transitions and the success or failure of these models serves as a further test for p-adic physics as physics of cognition.

## 2 Various aspects of cognition

### 2.1 p-Adic physics and imagination

p-Adic non-determinism makes it natural to interpret p-adic spacetime sheets as geometric correlates of imagined worlds. The wildest vision generalizing the memetics of Susan Blackmore [Blackmore<sub>2</sub>] is that the world is full so p-adic spacetime sheets serving as geometric correlates for plans, expectations, dreams, intentions, conceptual memories, etc.. and waiting for their materialization to real spacetime sheets. Dreams would be the basic stuff of the reality.

The assumption that p-adic spacetime regions are responsible for the cognition and imagination explains why imagination is different from direct sensory experiencing. That imagination involves activity of the sensory areas of the cortex is consistent with this hypothesis. The hypothesis also explains dreams as resulting from a process in which p-adic-to-real phase transition transforms imagination to sensory experience.

Classical non-determinism makes possible also real mindlike spacetime sheets having finite time duration. A possible interpretation is that these spacetime sheets give rise to primary sensory experiences devoid of any cognitive content. What cognitive content means is of course not at all clear: for instance, is the

decomposition of the perceptive field into objects a purely cognitive and p-adic phenomenon or does it occur already for the purely sensory experience? One could however argue that the subselves of self give rise to the decomposition of the perceptive field into objects so that p-adicity would not seem to be essential.

## **2.2 How dreams and hallucinations relate to sensory experiences?**

Dreams could be seen as processes in which cognition is transformed into sensory experience. This would mean that p-adic spacetime sheets are transformed to real mindlike spacetime sheets serving as correlates of sensory experience. Clearly, the generation of dream would be a process reverse to the generation of cognition from sensory experience (see the chapter "General theory of qualia"). This view about dreams as de-abstraction process have been represented already earlier and explains nicely the observations of Claude Rifat about lucid dreaming [Rifat]. The strange piecewise logical consistency of dreams is indeed consistent with the p-adic non-determinism.

This view about dreaming is in accordance with the recent observations (reviewed in [Solms]) that dreaming is not produced by random inputs from brain stem to cortex but is cognitive skill learned gradually during infancy. The most primitive dreams represent static pictures, then these pictures become dynamical, and at the age of about eight the dreamer becomes a participant of the dream. In lucid dreaming the dreamer has taken active role in transforming cognitive representations to sensory experiences.

Hallucinations can be also seen as similar transformation processes although in this case experiencer is passive receiver of the sensory inputs. The semitrance model for the bicameral mind is based on the idea that these experiences are communicated by higher levels of the self hierarchy during semitrance.

## **2.3 Cognition and volition**

The basic vision is that volitional acts are realized as phase transitions of a p-adic spacetime region to a real spacetime region. These phase transitions are 4-dimensional and induces in quantum jumps.

### **2.3.1 Materialization of intentions**

Em fields, in particular ELF em fields, are crucial for TGD inspired model of brain and a natural assumption is that p-adic-real phase transitions occur also for massless extremals (MEs). Energy conservation requires the generation of MEs in pairs having opposite signs of energies. Generation of pairs of MEs have been suggested as a mechanism of coherent locomotion made possible by the maximally coherent momentum carried by ME and resulting as a recoil momentum of material system absorbing second ME. In fact, the mechanism

is optimal since the momentum of ME is completely coherent. Thus a possible interpretation is as a transformation of intention to real motion. Of course, it is difficult to say whether this mechanism occurs in cellular or microtubular length scales or perhaps even in macroscopic lengths scales.

### 2.3.2 The emergence of symbols

Conscious activities are highly symbolic: a push of button can initiate a nuclear war. The reduction of the p-adic-to-real phase transitions to some fundamental level, perhaps to the level of nerve pulse transmission, indeed makes possible a build-up of very complicated actions by using a repertoire of very simple basic actions serving as symbols in case that system is initial value sensitive. For instance, complicated motor actions could be realized first as neural activities serving as their symbols and transformed to real actions by the puppet-on-string mechanism as proposed earlier (see the chapter "TGD inspired model for intelligent systems"). Thus the p-adic cognitive representations might in case of brain reside at neural or subneural level.

p-Adic fractality suggests that cognitive representations are present at all length scales: in particular, p-adic MEs are excellent candidates for cognitive representations. Nothing however forbids a repertoire of simple MEs serving as symbols, typically frequencies or field patterns, and generating neural activities in turn amplified to macroscopic actions.

## 2.4 How cognitive representations are generated from sensory experience?

One can consider two kinds of mechanisms leading to the generation of cognitive representations. The first mechanism correspond to a phase transition changing real mindlike spacetime sheet representing the sensory input to a p-adic cognitive spacetime sheet (that is, real spacetime sheet is replaced by its p-adic counterpart in quantum jump between quantum histories). This would be presumably rather faithful transformation. This mechanism might be at work routinely at the level of brain and transform nerve pulse configurations of sensory data to cognitive representations and essentially being responsible for how the sensory data containing only basic qualia is transformed to world consisting of objects and actions. The ultrametricity of the p-adic topology making p-adic world 'granular' could be essential for this decomposition into objects. A possible fundamental definition for an spatiotemporal object would be as a region of p-adic spacetime for which integration constants of field equations are genuine constants. Note however that the notion of subself could provide alternative and more general definition of an object of perceptive field.

Second mechanism is based on the idea that real and p-adic spacetime sheets have a common boundary region which is 3-dimensional and consists of common rational points. If classical field equations were completely deterministic

the initial values on the boundary region would determine the behaviour in the interior more or less uniquely. Now the situation is slightly different since it is a subset of rational points of the imbedding space which are common to real and p-adic region, because there is binary cutoff involved, and because p-adic non-determinism is also present. The idea that the generation of a sensory representation via 'common rationals on boundary' mechanism has gradually evolved to the nervous system is attractive because sensory representations are basically generated by the input coming from the outer boundary of organismism.

### 3 p-Adic teleportation, replication of memes, and morphic fields

The notion of quantum teleportation is one of the ideas accompanying the development of the theory of quantum computation. The notion of p-adic teleportation suggests itself very naturally as a more flexible mechanism of teleportation. p-Adic teleportation in fact provides a model for the replication of memes and Sheldrake's morphic fields can be seen as a generalization of memetics in this framework.

#### 3.1 p-Adic teleportation

The idea is to teleport only the p-adic cognitive model of the object rather than the object itself.

a) The description of object is p-adic spacetime sheet representing the cognitive model of the real object. Object is thus basically 4-dimensional. This cognitive model could be constructed most naturally by p-adic-to-real phase transition. This phase transition could be followed by a replication which is in the p-adic case possible by zigzag type motion with temporal reflection at each temporal turning point of the path. In this manner one obtains time-reversed and ordinary copies of the object.

b) The zigzag curve makes it possible to transfer the object effectively instantaneously over arbitrarily long distances so that one can speak of p-adic telepathy. At the receiving end the p-adic cognitive representation must be transformed back to a real representation. This requires that the receiver and sender are sufficiently similar so that this transformation process is possible.

c) An objection against the time reflection is that there should be some control mechanism forcing it to occur in a predictable manner. If cognitive spacetime sheets is topologically condensed on larger mindlike spacetime sheet with some finite temporal duration, the reflection could occur automatically on the temporal boundaries of the larger spacetime sheet.

p-Adic teleportation between different brains could give rise to rather dramatic effects. I could admire the beautiful landscapes in a distant corner of globe where my friend is visiting or share even his/her feelings and emotions.

Again one must ask, whether this actually occurs to some extent: we certainly have the ability to feel empathy. Perhaps I could also teach some practical motor activity (one of those very few I handle) by hand to my friend by teleporting the imagined motion.

One could quite well argue that p-adic teleportation is precisely what we are at some basic level doing all the time when we communicate plans and intentions to our fellow human beings using written and spoken language. Typically, the drawings of a building could be seen as this kind of communication involving several symbolic real-p-adic steps and the realization would involve a lot of creative imagination.

### **3.2 Replication of p-adic cognitive representations by p-adic teleportation**

Memes are in central role in the theory of Susan Blackmore [Blackmore<sub>2</sub>] and p-adic spacetime sheets are excellent candidates for memes understood in a more general sense. Contrary to the vision of Susan Blackmore, memes would be conscious selves rather than unconscious deterministically behaving objects, and brain would not be an un-conscious machine used by memes but serving as conscious transformation vehicle materializing cognitive representations to real action and vice versa.

Although the notions of the meme and meme replication are very attractive, the mechanism of imitation is only partially known. The so called mirror neurons are certainly an important of it. In the p-adic context learning by imitation could be understood as a two-step process. First of all, a high-level p-adic cognitive representation is formed as in sensory perception. Secondly, this representation is transformed back to motor action to yield an imitation. Thus it could be that the enhanced ability to generate p-adic-to-real transformations in prima vista manner distinguishes between humans and animals.

#### **3.2.1 p-Adic teleportation as means of meme replication and transport**

p-Adic teleportation could make possible a replication mechanism of memes at microscopic level. A p-adic spacetime sheet, say a p-adic massless extremal, can define zigzag type piecewise continuous path in the spacetime: first travelling into the direction of the future, reflecting then to the direction of the past, then again to the direction of the future,... This motion would yield copies of the meme and if some copy is transformed to a real action, an imitation results. One could imagine that sensory input creates first a p-adic cognitive representation which then replicates and is transformed back to motor activity and that the replicate is associated with the mirror neurons.

One can imagine also less exotic replication mechanisms. If nerve pulse activity characterizes cognitive representation, inhibition and double inhibition

can make possible purely purely neural replication of the cognitive representations. Of course, this phenomenon might also result in the transformation of p-adic cognitive representations to neural real world representations.

### 3.2.2 Time reversed cognition

p-Adic teleportation predicts that time reflection yields time reversed cognitive representations. Also spatially reflected cognitive representations could result in spatial reflections. The observation of these representations could serve as a test of the theory. There is indeed some evidence for this rather weird looking time and spatially reversed cognition.

a) I have a personal experience supporting the idea about time reversed cognition. During the last psychotic episodes of my 'great experience' I was fighting to establish the normal direction of the experienced time flow.

b) The occurrence of mirror writing is well known phenomenon [Lambon-Ralph *et al*]. Spatial reflections of MEs are also possible and might be involved with mirror writing.

c) Reverse speech would be also a possible form of reversed cognition. Time reversed speech has the same power spectrum as ordinary speech and the fact that it sounds usually gibberish means that phase information is crucial for storing the meaning of speech. Therefore the hypothesis is testable.

### 3.2.3 Reverse speech

Interestingly, the Australian David Oates claims that so called reverse speech is a real phenomenon [Oates], and he has developed entire technology and therapy (and business) around this phenomenon. What is frustrating that it seems impossible to find comments of professional linguistics or neuroscientists about the claims of Oates. I managed only to find comments by a person calling himself a skeptic believer but it became clear that the comments of this highly rhetoric and highly arrogant commentator did not contain any information. This skeptic even taught poor Mr. Oates in an aggressive tone that serious scientists are not so naive that they would even consider the possibility of taking seriously what some Mr. Oates is saying. The development of science can often depend on ridiculously little things: in this case one should find a shielded place (no ridiculizing skeptics around) to wind tape recorder backwards and spend few weeks or months to learn to recognize reverse speech if it really is there! Also computerized pattern recognition could be used to make speech recognition attempts objective since it is a wellknown fact that brain does feature recognition by completing the data into something which is familiar.

The basic claims of Oates are following.

a) Reverse speech contains temporal mirror images of ordinary words and even metaphorical statements, that these words can be also identified from Fourier spectrum, that brain responds in unconscious manner to these words and that

this response can be detected in EEG. Oates classifies these worlds to several categories. These claims could be tested and pity that no professional linguist nor neuroscientist (as suggested by web search) has not seen the trouble of finding whether the basic claims of Oates are correct or not.

b) Reverse speech is complementary communication mode to ordinary speech and gives rise to a unconscious (to us) communication mechanism making lying very difficult. If person consciously lies, the honest alter ego can tell the truth to a subself understanding the reverse speech. Reverse speech relies on metaphors and Oates claims that there is general vocabulary. Could this taken to suggest that reverse speech is communication of right brain whereas left brain uses ordinary speech? The notion of semitrance used to model bicameral mind suggests that reverse speech could be communication of higher levels of self hierarchy dispersed inside the ordinary speech. There are also other claims relating the therapy using reverse speech, which sound rather far-fetched but one should not confuse these claims to those which are directly testable.

### 3.3 Healing by time reversal?

Temporal reflection of the p-adic MEs is allowed by p-adic conservation laws and generates a time reversed ME, which in turn can be transformed to real ME by the p-adic-real phase transition. The creation of the time reversed MEs is possible at least in the case that MEs appear in pairs of opposite time orientation having vanishing net energy. In quantum optics time reversal is known as a phase conjugation [Pepper] and is one of the basic notions of holography. MEs act as both quantum holograms and receiving and sending quantum antennae (see the chapter "Quantum antenna hypothesis"). MEs can generate reference waves of coherent photons interacting with other MEs and activating dynamical holograms of coherent light. If the reference wave is phase conjugated, the resulting hologram is time reversed.

What makes this so interesting is that MEs are at the highest level of quantum control in the TGD based view about biosystem as a symbiosis in which MEs control superconducting magnetic flux tubes controlling ordinary matter at atomic spacetime sheets via many-sheeted ionic flow equilibrium. The coherent light pattern emitted by ME resulting from the interaction of ME with the reference wave (its phase conjugate) could act as a control command (time reversed control command) inducing process (time reversed process). Conjugate reference waves would thus provide an incredibly simple and general mechanism of healing by time reversal allowing the living matter to fight against second law. This would be like a general initiating a war by just nodding or shaking his head.

#### 3.3.1 Electromagnetic realization of the genetic code?

The formation of the phase conjugates could occur completely routinely and explain also why DNA appears in double strands. DNA strand would correspond

to hologram and conjugate strand to the phase conjugate (time reversed) hologram acting as a control command and its time-reversed version. Thus living matter would have coded basic healing mechanism at the level of DNA making it possible to fight against second law with maximal efficiency. One can imagine several mechanisms for how DNA sequences are coded to holograms (see the chapter "Quantum model for cognition" of [cbook] and the chapter "General Theory of Qualia" of [cbook2]) and probably several realizations are actualized.

### 3.3.2 Healing by time reversal and Priore's machine

There is also some empirical support for the idea about healing by time reversal coming already from the period when only Soviet scientists knew about phase conjugation. In 1960's and 1970's French Antoine Priore built and tested electromagnetic healing machines of startling effectiveness [Bateman]. Tom Bearden has in this website document "The Priore Machine and Phase Conjugation" which I recommend for an interested reader for a more detailed exposition [Bearden] besides the material that can be found from the homepage of Tom Bearden.

In hundreds of rigorous tests with laboratory animals, Priore's machine cured a wide variety of the most difficult kinds of terminal, fatal diseases known today. Many of the experiments and tests were done by prestigious members of the French Academy of Sciences. The operation of the Priore machine was incomprehensible for both the inventor and orthodox French scientists. Into a tube containing a plasma of mercury and neon gas, a pulsed 9.4 GHz wave modulated by a frequency of 17 MHz was introduced. The waves were produced by radio emitters and magnetrons in the presence of a 1200 Gauss magnetic field. Experimental animals were exposed to this magnetic field during irradiation, and the mixture of waves (about 17 or so) coming from the plasma tube and modulating and riding the magnetic field passed through the animals' bodies.

Interestingly, the magnetic field used corresponds to magnetic length of order  $E - 7$  meters. It is equally interesting that a combination of magnetic fields and radiation was involved: this conforms nicely with the vision about biosystems as many-sheeted ionic flow equilibrium controlled by MEs. It is known that phase conjugated waves can be produced in plasmas. The so called four-wave interaction of waves of equal frequency is the simplest manner to amplify weak wave in the effective dynamical diffraction grating defined by the interference of two waves propagating in opposite directions. If a phase conjugate wave with a correct frequency results in this kind of situation, it could act as a reference wave acting with ME and initiate a complex time reversed biological programs at subcellular level. In particular, it could induce the time reversal of the 'develop-cancer' program controlling the development of the cancer cell population and lead to healing.

By its extreme generality this mechanism could apply to almost any disease which is a disease of the highest level quantum biocontrol. This mechanism

could be also used to induce de-differentiation of cells. The de-differentiation of cells to stem cells could be controlled by a similar mechanism. One can also wonder whether this kind of mechanism could make possible eternal youth (or rather eternal life) at cell level. An interesting question is whether the phase conjugates of EEG waves or time reversals of nerve pulse patterns could induce time reversals of brain functions.

### 3.4 A connection with the ideas of Shel Drake

In the chapter "Quantum theory of self-organization" I have discussed a possible TGD based justification of Shel Drake's ideas about learning at the level of species. The discussion can be easily rephrased in terms of p-adic cognition and p-adic teleportation and leads to a more detailed variant of the original model.

If one assumes that memes correspond to p-adic cognitive representations, that the replication of memes by zigzag mechanism is possible, and that MEs involved can have even sizes of order Earth size, it is not too difficult to imagine how species memory could be realized. p-Adic spacetime sheets take the role of the morphic fields in TGD framework and represent habits, skills, ideas,... Susan Blackmore would call these morphic fields memes but basically only a naming convention and generalization is in question (amusingly, skeptics honourize Shel Drake as a pseudoscientist but Blackmore as a serious scientist, perhaps because she has emphasized her skepticism in the publicity!).

The meme associated with the development of a particular skill could be realized in a particular brain and replicate itself. When the replicas would encounter other brains of the same species by p-adic teleportation, the skill could be manifested as a real action and lead to learning without direct the mediation of a direct sensory communication. Shel Drake's theory thus generalizes memetics and thus make Shel Drake pseudo scientist. That a given meme could be realized only in brains of the same species might be understood in this framework by using resonance argument: morphic resonance is the notion used by Shel Drake. It is also possible that stochastic resonance [Gammaitoni *et al*] to be discussed later in more detail could be involved with the morphic resonance. The individuals that learned the habit first, need not even live anymore since p-adic memes remain and replicate by zigzag mechanism even when the physical body dies. Amusingly, TGD predicts that the memes could travel also in the direction of geometric past so that also the geometric past could learn the skill! Creativity would obviously correspond to the p-adic non-determinism. Memes are continually changing and those which are transformable to real action are realized and correspond to discoveries.

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