

Semitrance, Language, and Development of Civilization

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Abstract

The book "The origin of consciousness in the breakdown of the bicameral mind" of Jaynes provides a highly original vision about the evolution of modern consciousness from the consciousness of bicameral stone age man. TGD version about the cosmology of human consciousness relies on the notion of semi-trance. During semitrance parts brain entangle with some higher level, say the self associated with the social group, and are in trance and therefore unconscious. The remaining parts of brain are however conscious and receive communications from the collective consciousness via the entangled region of brain as sensory hallucinations, emotions and thoughts. Semitrance is absolutely essential for self narrative and establishment of long term goals: without semitrance our consciousness would consist of memory fragments lasting only few seconds. Higher level selves tell us where we come from and where we are going.

The basic differences between Jaynes's and TGD based version about evolution of civilization relate to the interpretation of bicamerality and what really happened in the evolution of individual.

a) In TGD framework one could see bicameral man as a cognitive and emotional child characterized by the effective cognitive and emotional ages at which the cognitive and emotional self-organizations of her left brain hemisphere stopped in the absence of external stimuli necessary for self-organization (it is impossible to learn to write if civilization has not discovered written language). Of course, there are several parameters differentiating between modern man and bicameral man (sensitivity for semitrance, profile of semitrance, time fraction spent in semitrance, right-left brain inhibition,..) and the identification of bicameral as a cognitive and emotional child as we understand child is un-necessarily strong.

b) The ability to fall in semitrance was not lost during evolution but was transformed to a new form. Not only linguistic but also sensory regions of the right brain hemisphere of bicameral man entangled with higher level selves and the communications from right to left brain hemisphere were not inhibited as they are in the brain of modern man. As left brain hemisphere differentiated and memetic code gradually established itself, the guiding voice of God was transformed to internal speech and emotions. Higher level selves began to express their will via emotions, moods, planning and long term goals.

c) The differences between EEG:s of normal person and schizophrenic suggest that the fraction of time spent by average modern man in semitrance is much shorter. A more general criterion of bicamerality might be based on the fraction of time spent in semitrance state, be it sensory, cognitive or emotional. It is plausible that thoughts (not all of course!) are communicated to modern man via left brain hemi-

sphere. If this is indeed the case, some regions of left brain hemisphere of modern man should allow standing EEG waves.

The development of the language is an absolutely essential part of the development of civilization. The syntactic structures of language emerged in parallel with the development of civilization. In TGD framework the development of language can be seen as a gradual establishment of genetic and memetic codes at new level and the emergence of symbol function. This could be also seen as an establishment of a symbiosis between two life-forms: biological life and 'culture' having as a physical correlate electromagnetic life represented as topological quanta of em ELF fields and providing realization of the memetic code.

Semitrance mechanism provides an extremely general communication mechanism between the levels of the self hierarchy and could explain why ant nests, beehives, flocks of birds, packs of wolves, cell societies, nuclei of brain, etc.. can behave as single organism and still consist of apparently randomly behaving individuals. Indeed, relevant biological structures (DNA double strand, double lipid layer forming cell membrane, epithelial sheets) have binary structure analogous to two brain lobes and are ideal candidates for 'bicameral' structures.

The vision about the development of civilization generalizes to cell level. p-Adic fractality plus the fact that the number of quantum jumps performed by selves is huge even at cellular and elementary particle levels, inspires the hypothesis that various societies ranging from human civilization to cell societies and protein-DNA societies are characterized by universal asymptotic self-organization patterns. This provides important insights to the structure of the biological self-hierarchy and its relation to the structure and functioning of organism and about how semitrance might allow bio-systems to control and coordinate their behavior. Cell as a protein-DNA society together with parallel between memetic and genetic codes provides a predictive vision about how genetic code might have established itself and semitrance suggests that new kind of control and communication mechanisms based on semitrance mechanism are at work.

1 Introduction

"The origin of consciousness in the breakdown of the bicameral mind" of Jaynes [1] provides a fascinating and highly original view about the evolution of human language and consciousness as closely correlated developments. Jaynes has collected impressive archaeological, historical, and biological evidence to support his hypothesis that the towns, cities, and societies from 9.000 B.C. to 1.000 B.C. were established and developed by what he calls non-conscious people having only sensory experiences. They had voli-

tion but had no experience of volition. Their experience was that of obeying slavishly commands of right brain hemisphere. Those societies formed and grew through common hallucinating voices attributed to gods, rulers, and the dead – to external 'authorities'. Various external symbols that 'spoke' (such as graves, idols, and statues) helped to reinforce and expand the authority of those common 'voices'. Such 'voices' continued to expand their reach through increasingly visible and awe-inspiring symbols such as tombs, temples, colossuses, and pyramids.

The vision of Jaynes allows to see Iliad, Odyssey, Bible and other ancient writings as documents about the evolution of human consciousness. The views of Jaynes are consistent with neurophysiological data and Jaynes's identification of schizophrenics as bicameral men trying cope in modern society sharpens the thesis. Rather remarkably, Jaynes's prediction that the auditory hallucinations of schizophrenic are located in speech areas of the right brain, is consistent with quite recent observations [2, 3]. The development of language is an essential part of Jaynes vision: each breakthrough in the development of language reflected itself in the structure of society and changed the manner how individuals saw the world around them.

One can criticize the vision of Jaynes at the level of some basic assumptions. Jaynes differentiates between consciousness and experience so that the idea about unconscious bicameral man hallucinating God's voice is not self-contradictory. However, the claim that bicameral man had volition but was unconscious of having it, seems strange. Jaynes has also troubles in explaining how trance, which is certainly unconscious state, differs from bicamerality. In the following I want to represent the TGD version about views of Jaynes.

TGD version about the cosmology of human consciousness relies on the notion of semi-trance. During semitrance parts brain entangle with some higher level, say the self associated with the social group and are in trance and therefore unconscious. The remaining parts of brain are however conscious and receive communications from the collective consciousness via the entangled region of brain as sensory hallucinations, emotions and thoughts. Semitrance is absolutely essential for self narrative and establishment of long term goals: without semitrance our consciousness would consist of memory fragments lasting only few seconds. Higher level selves tell us where we come from and where we are going. Bicameral man received the commands and advices of the collective consciousness as auditory and visual hallucinations via regions of the right brain hemisphere wherefrom they were communicated to the left hemisphere whereas modern man receives 'God's voice' as thoughts ('internal speech') in left brain semitrance and emotions in right

brain semitrance.

The basic differences between Jaynes's and TGD based version relate to the interpretation of bicamerality and what really happened in the evolution of individual.

a) In TGD framework one could see bicameral man as a cognitive and emotional child characterized by the effective cognitive and emotional ages at which the cognitive and emotional self-organizations of her left brain hemisphere stopped in the absence of external stimuli necessary for self-organization (it is impossible to learn to write if civilization has not discovered written language). Of course, there are several parameters differentiating between modern man and bicameral man (sensitivity for semitrance, profile of semitrance, time fraction spent in semitrance, right-left brain inhibition,..) and the identification of bicameral as a cognitive and emotional child as we understand child is un-necessarily strong.

b) The ability to fall in semitrance was not lost during evolution but was transformed to a new form. Not only linguistic but also sensory regions of the right brain hemisphere of bicameral man entangled with higher level selves and the communications from right to left brain hemisphere were not inhibited as they are in the brain of modern man. As left brain hemisphere differentiated and memetic code gradually established itself, the guiding voice of God was transformed to internal speech and emotions. Higher level selves began to express their will via emotions, moods, planning and long term goals. This picture conforms with Huxley's intuition that brain serves as a filter straining away sensory communications of collective self by inhibition mechanisms.

c) The differences between EEG:s of normal person and schizophrenic suggest that the fraction of time spend by average modern man in semitrance is much shorter. A more general criterion of bicamerality might be based on the fraction of time spend in semitrance state, be it sensory, cognitive or emotional. It is plausible that thoughts (not all of course!) are communicated to modern man via left brain hemisphere. If this is indeed the case, some regions of left brain hemisphere of modern man should allow standing EEG wave s.

Also collective consciousness developed from authoritarian Gods to 'good leaders' in the modern sense of word making suggestions and exchanging information with various levels of the self hierarchy.

a) Civilization began to develop from very simple hierarchical structure: 'God'+ men (God understood as collective self of group). In this kind of situation semitrance communications made it possible for collective self to control and coordinate its sub-selves, individuals, via visual and auditory

hallucinations.

b) The development of civilization meant the emergence of self-hierarchies represented as social hierarchies. This however created definite problems which collective selves, whose intelligence, defined as 'sum' over intelligences of individuals, increased also and made it possible to solve these problems. In particular, there are reasons to expect that great steps in development occurred at certain critical masses when the total IQ of civilization achieved critical value.

The development of the language is an absolutely essential part of the development of civilization. The syntactic structures of language emerged in parallel with the development of civilization. In TGD framework the development of language can be seen as a gradual establishment of memetic code and emergence of symbol function. This could be also seen as an establishment of a symbiosis between two life-forms: biological life and 'culture' having as a physical correlate electromagnetic life represented as topological quanta of em ELF fields and providing realization of the memetic code [d2].

Semitrance mechanism provides an extremely general communication mechanism between the levels of the self hierarchy and could explain why ant nests, beehives, flocks of birds, packs of wolves, cell societies, nuclei of brain, etc.. can behave as single organism and still consist of apparently randomly behaving individuals. Indeed, relevant biological structures (DNA double strand, double lipid layer forming cell membrane, epithelial sheets) have binary structure analogous to two brain lobes and are ideal candidates for 'bicameral' structures.

The vision about the development of civilization generalizes to cell level. p-Adic fractality plus the fact that the number of quantum jumps performed by selves is huge even at cellular and elementary particle levels, inspires the hypothesis that various societies ranging from human civilization to cell societies and protein-DNA societies are characterized by universal asymptotic self-organization patterns. This provides important insights to the structure of the biological self-hierarchy and its relation to the structure and functioning of organism and about how semitrance might allow bio-systems to control and coordinate their behavior. Cell as a protein-DNA society together with parallel between memetic and genetic codes provides a predictive vision about how genetic code might have established itself and the proposal is is that new kind of control and communication mechanisms based on semitrance mechanism are at work.

It deserves to be noticed that the notions of semitrance and sharing of mental images are more or less equivalent although the notion of semitrance is few years older. The time mirror mechanism playing key role in the

quantum realization of all mental functions involves also semitrance. In this article I have kept the original terminology and only added some sections representing more recent views.

2 How collective consciousness communicates with individual?

The original path to the model for the interaction of collective consciousness with individual was via the book Jaynes [1]. It is however more appropriate to represent the problem and its solution without any reference to Jaynes's idea to demonstrate that the scenario of Jaynes with only slight modifications follows from very general assumptions.

2.1 How societies of idiots can behave intelligently?

Animal kingdom is full of species forming societies: ant nests, beehives, flocks of birds, packs of wolves, groups of apes, human communities. Also organisms can be regarded as cell communities. The ability of these societies to behave as single coherent whole although individuals behave in a random looking manner, is a mystery. Especially mysterious this ability looks in case of termites: the architectural feats of the termites are not consistent with the fact that the brain of termite consists of few neurons. Mechanisms explaining this as unconscious self-organization based on chemical communication or communication by direct contact have been proposed. I find it however difficult to understand how even stone-age men wandering around randomly and communicating intensively could have managed to build Gothic cathedral. This kind of achievement requires the presence of a conscious collective intelligence able to plan and control individuals of the community telepathically. There is indeed evidence for telepathy in ant community described in the article [4].

This raises several questions. How collective consciousness is possible at all? How collective consciousness could be realized without total loss of individuality? How the rather limited intelligences of individuals can sum up to a high collective intelligence? What mechanisms collective self uses to control and coordinate the behavior of the individuals?

2.2 Semitrance as basic mechanism of communication between collective consciousness and individual

Self hierarchy is the basic prediction of TGD inspired theory of consciousness and self hierarchy makes possible collective consciousness. The experience of self is abstracted 'sum' over the experiences of its sub-selves so that sub-self is experienced as mental image. In the abstraction process the experience of sub-self is replaced with an 'average' over the mental images of sub-self. The intelligence of the ant nest results from summation of the mental images abstracting the contents of consciousness of the individual ants. This explains why ant group containing overcritical number of ants can act as an architect. The concrete realization of the self hierarchy in bio-matter has been discussed in the chapter "Biological realization of self hierarchy".

The most important conclusion is that we are much more than our brains: our mental images correspond to 'ELF selves' associated with various EEG frequencies. These 'ELF selves' have as geometrical correlates topological field quanta representing ELF em fields. Topological field quanta can have size of order Earth's circumference. The interaction of these topological field quanta (say fusion to form larger structures) provides a mechanism giving rise to larger selves and makes possible telepathy and various other EPR phenomena as also experiences involving communications with deceased persons [5].

2.2.1 Semitrance

How collective self can control and coordinate the behavior of individuals? Some kind of communication mechanism making possible collective consciousness to give commands to the individuals is clearly needed. The entanglement of individual with collective self leads to a total loss of consciousness of the individual and can be regarded as sleep or trance state, possession. For instance, during mating rites of birds, male and female seem to behave like single conscious unit formed by male and female.

Social animals are however not mere organs of a higher level organism, they are also individuals. To explain this one can consider a mechanism which might be called 'semi-trance'. If individual consists at least part of time of two separate sub-selves, second sub-self can entangle with collective self and in this trance state can communicate with the second self and communicate commands or advices to the sub-self which is awake. Communication is here quite generally understood as a generation of mental images: this corresponds to waking-up of sub-selves. The wake-up process initiates

self-organization leading to a final state pattern representing the message. Final state pattern depends only weakly on the stimulus serving as message: this is as it should be.

Brain hemispheres or parts of them are the most obvious candidates for these two sub-selves. The entanglement of the right or left brain hemisphere (or some part of it, perhaps the linguistic regions with respect to which human brain has highest asymmetry) with a collective self could be the basic mechanism making it possible to communicate the commands of the collective self to left and/or right hemisphere as 'hallucinations'.

Jaynes's vision about the evolution of civilization is based on the notion of bicamerality [1] provides strong keys to the nature of semitrance state and how it has changed during cultural evolution.

a) Jaynes assumes that right brain activities were unconscious to bicameral man and that the left hemisphere received the volition of right brain hemisphere as commands and advices as hallucinatory voices and visions. This would suggest that in the case of ancient bicameral man it is right hemisphere or parts of its that fall in trance and that left brain hemisphere receives the commands from right hemisphere as sensory 'hallucinations'.

b) In case of modern man situation is presumably different. The average time spent in semitrance is probably shorter; the probability to fall in semitrance state is lower; the profile of semitrance is different and the communications between right and left brain hemispheres are probably different. Inhibition of the sensory communications developed so that the sensory messages from the right brain hemisphere to left hemisphere became inhibited: visions and God's voice disappeared. The profile of the communications of the collective self to human brain changed also. Modern man receives the messages of the collective self both via left and right hemisphere semitrance. Spontaneous thoughts and ideas are received via left brain semitrance. Emotions and moods are received via right brain semitrance and guide the behavior of individual much more implicitly than direct commands. Thus sensory 'hallucinations' have transformed to imaginative thoughts and emotions which we do not regard as hallucinations at all: the ancient world of elves, gods and demons has transformed to emotions and to the Platonic realm of ideas.

c) In this framework the development of civilization from primitive agricultural communities of 8000 B.C. to a modern society can be seen as the gradual establishment of 'memetic code' [d2] implying the parallel development of language and society: 'In the beginning there was the Word'.

The characteristic feature of semitrance is the passivity of the experiencer: collective self communicates experiencer something or gives possibly

commands. They are not hallucinations in which the experiencer would hallucinate volitional acts. Only activity in the sense that experiencer has conversation with the higher level self seem to be possible. Of course, this conversation could induce changes in the behavior of the collective self: consider only the claimed effects of prayer.

Semitrance mechanism is extremely general and could be at work in brains of all social animals, especially those which as groups exhibit an intelligence much higher than the intelligence of the members of the group. Similar mechanism could work also at cellular and bio-molecular length scales. DNA double strand and cell membrane consisting of two lipid layers are indeed binary structures and the components of the structure could serve in the role of right brain lobe. This mechanism would explain why cell society can behave like an organism with self identity. The observed possibility of humans with high EEG coherence to intentionally affect the degree of winding of DNA strand [6] supports the notion of semitrance at DNA level.

2.2.2 Semitrance, sharing of mental images, and time mirror mechanism

Semitrance is earlier term for sharing of mental images realized as bound state entanglement of systems representing sub-selves of two selves. In TGD Universe intentions are realized as actions by a process, which proceeds from the magnetic body downwards along the hierarchy much like a desire of a boss of some institution to the lower levels of hierarchy. At each level intention or intentions are transformed to desires communicated to the lower levels of hierarchy. Intentions have p-adic space-time sheets as space-time correlates and are transformed to real ones representing the desire. The most plausible realization of this process is in terms of time mirror mechanism. The space-time sheets in question would correspond to negative energy topological light rays representing the propagation of signals to the geometric past and induce processes. The process would continue down to the level of neurons and even DNA level and generate the desired action as a reaction to the resulting complex of desires. The beauty of the mechanism is that the communication to the geometric past makes it instantaneous so that instantaneous realization of motor actions becomes also possible.

Left-right dichotomy for the brain hemispheres could correspond naturally to the positive-negative energy dichotomy for topological light rays. This would mean that right brain hemisphere would bound state entangle with higher level selves or personal magnetic body and consciously experience the desire to generate some motor activity. This desire would be

realized then by the active left brain. It must be however emphasized that this dichotomy might be dynamical: for some function right and form some function left hemisphere would be the passive receiver. One must also notice that this dichotomy holds true only in the length scale of brain hemisphere: at shorter length scales, say at neuronal level, no asymmetry need exist between hemispheres.

2.2.3 Semitrance and personal narrative

If the contents of consciousness of self involve temporal average over moments of consciousness occurred after last 'wake-up', the duration of our self cannot be much longer than .14 seconds since this would mean that we could not discriminate between events with time separation not longer than about .14 seconds. This problem can be partially circumvented if our experience is multi-time experience containing several sub-selves of this duration. The duration of the short term memory is few seconds and this might represent the duration of our self. This raises the problem how we can have long term memories and self-narrative.

Geometric memories containing contributions from entire lifespan provide a candidate for the self narrative as a model for has happened and what will happen assuming that no quantum jumps have occurred before and will occur after this quantum jump. This need not however be enough since it seems that geometric memories must correspond to episodal memories only rather than the declarative long term memories often expressed as internal speech. Geometric memories are also expectations rather than genuine memories about conscious experiences and one can argue that we have genuine subjective memories about what really happened. Furthermore, 'Ontogeny recapitulates phylogeny' principle suggests that the time interval spanned by our geometric memories is same as that spanned by subjective memories and thus few seconds. This leaves only one possibility: higher level selves must communicate to us information about their subjective memories whose time span is much longer than the time span of our personal subjective memories.

Semitrance mechanism seems to provide the most plausible manner to have self-narrative telling where we have come from and where we are going to. Thoughts and emotions, cognition and motivation, are the manner how higher level selves express this self-narrative to a modern man. Indeed, the time scales of emotions and moods are slow. The time scales for the action of second messengers and hormones are slow and involve changes of the synaptic strengths and modifications of the gene expression so that they

could be perhaps identified as tools used by higher level selves to control the behavior of the organism. Perhaps also our cells have their own self-narratives provided by us and making possible such miraculous feats like DNA transcription: genetic determination could indeed be a long term goal of cell!

2.2.4 Thoughts, emotions, motivations and semitrance

One can imagine two strategies for how higher level self could communicate to us our self-narrative as thoughts and emotions.

a) Higher level self could communicate both geometric and subjective memories and allow us to perform the comparison generating emotions.

b) Higher level self could compare geometric and subjective memories and communicate the result of comparison to us as emotions. In this picture emotions are essentially generalized sensory experiences. The fact that the borderline between emotions and sensory experiences (pain is good example) is very difficult to draw, favors this option. This option, when combined with the identification of the quantum correlates of the sensory qualia, implies that the spectroscopy of consciousness provided by the magnetic transition frequencies applies also to emotions.

Support for this identification comes from several sources. Thoughts are not direct reactions to sensory experience. Ideas pop out of nowhere. The explosive development of science and technology is perhaps the best example of the non-predictability of thoughts. The changes of emotions can be nonpredictable and not direct reactions to sensory input but resulting from the comparison of what was expected or desired with what really happened and thus involving self-narrative in an essential manner. Expectations correspond to geometric memories and self-narrative tells what really happened: the comparison yields emotion serving as a control tool. Since self-narrative is told to us the one who makes ultimate comparison must be higher level self. The fact that music couples strongly to the 'hallucinatory' regions of right brain hemisphere and affects strongly our emotions, suggests that music is language of emotions.

Spectroscopy of consciousness provides additional insight to emotions consistent with the considerations above. Magnetic and Z^0 magnetic transition frequencies could parameterize the spectrum of both sensory qualia and emotions. The smaller the frequency, the more emotional the experience since the corresponding time scale is longer and deviation between the expected and real can be larger. Hence emotions could have as their correlates the cyclotron frequencies defined by Earth's magnetic field. These

frequencies are below 8 Hz. Since cyclotron frequency is inversely proportional to the mass of the charged particle, this implies that emotions must be associated with bio-molecules (second messengers, hormones, etc...).

Synesthetes are able to experience very lively episodal memories. It might be that it is possible to have multi-time conscious experience with a time scale of order life span or even longer as the possibility of transpersonal states of consciousness suggests. A phase transition increasing the value of the p-adic prime associated with brain temporarily could make possible to have extended state of consciousness with subjective and geometric memories with the time scale of life span.

2.2.5 Stress and semitrance

Stress is known to induce hallucinations in schizophrenics. This suggests that stress is a general mechanism inducing entanglement with higher level selves. The basic mechanism could be very simple. In case that brain decomposes unentangled parts representing separate selves, say part of right brain hemisphere and rest of brain, this part of right brain hemisphere can get tired and 'fall asleep' which means nothing but semitrance. This makes possible the communications of higher level self to that part of brain which is awake.

Semitrance provides an alarm clock mechanism. The natural function of the holistic language regions of right brain is to remember what task primitive man was performing (say carving some tool). If the bicameral state for, say linguistic regions, dominated, semitrance began when right brain got tired and fall asleep. But just this semitrance induced 'God's voice' telling for left brain hemisphere what task bicameral man was performing! Also in the situations in which bicameral man did not know what to do, stress caused semitrance and immediate advice from the collective self. It is quite possible that the voice of conscience does it best to perform the same function in modern man! What has happened is that commands have transformed from sensory hallucinations to thoughts.

Heavy stress could also induce the splitting of entangled brain to two unentangled sub-selves so that collective consciousness takes the lead when right brain hemisphere or parts of it fall asleep. For instance, the exceptionally stressing situations encountered in war presumably lead to situation in which collective consciousness takes control and soldiers behave like single organism. Too much alcohol, which probably has same effect as stress, leads to the splitting of the visual field to right and left fields: this might be interpreted as de-entanglement of right and left visual fields. This state

does not yet represent the state in which right brain or part of it has fallen asleep. Further stress leads to semitrance causing delirium. Note that also reduction of left-right inhibition must be involved with the stress.

The short period between wake-up and sleep state involves often visual and auditory hallucinations. This to be expected if falling asleep involves the decomposition of the brain to separate unentangled regions which fall asleep at different times. The lack of sleep leads also to a hallucinatory state. These phenomena support the view that stress can split self to two separate selves followed by the trance state of the right or left hemisphere or parts of it. The fact that sensory hallucinations are involved would suggest that sensory regions of the right hemisphere fall asleep first and communicate 'God's messages' to the left hemisphere.

Spinning causes dizziness and is therefore a good candidate for a stimulus causing semitrance. This could explain the social role of dance. Dance is very important also in many religions, spinning dervishes are good example of this. Children love to spin around: the reason is perhaps that spinning around induces the semitrance state of the early childhood. The dizziness caused by ill functioning of the sense of balance involves spinning like feeling in either direction. This suggests that hemispheres tend to stimulate experience of spinning in opposite directions but that normal situation they manage to inhibit each other.

One can wonder how stress leads to de-entanglement. Entanglement corresponds geometrically to the presence of join along boundaries bonds along which Josephson currents flow. This would suggest that de-entanglement involves the splitting of the join along boundaries bonds. This is possible if Josephson current vanishes: this happens if the density of the superconducting charge carriers becomes sufficiently low. Thus it seems that the disappearance of super-conductivity is the required condition. Perhaps dissipative effects might cause this: the increase of temperature over critical temperature at relevant space-time sheets could cause this. This would suggest that brain is near criticality for the phase transition leading to the disappearance of super conductivity. This is in accordance with quantum criticality of TGD Universe.

2.2.6 Semitrance and EEG

TGD suggests also a second dichotomy related to right-left dichotomy. TGD predicts two kinds of EEG waves [d3, d4]. Propagating waves are typically associated with linear structures such as nerve circuits and left brain hemisphere is excellent candidate for corresponding selves. Large number

of sub-selves representing mental images are predicted and the analyticity, reductionism and temporal linearity of left brain processing can be understood if left brain waves are dominantly propagating ones. Non-propagating waves can be associated with any structure of arbitrarily large size. The corresponding mental images can therefore be holistic and correspond to large region of brain.

The regions of right brain hemisphere are excellent candidate for a seat of non-propagating EEG waves. Quantum entanglement of sub-selves gives rise to the formation of parts from wholes and it seems that brain halves provide reductionistic and holistic representations of sensory percepts. As far as sensory experience and emotion is considered, it is right brain which indeed seems to be holistic.

Standard wisdom is that right viz. left brain hemisphere are responsible for holistic viz. reductionistic aspects of consciousness respectively. There is however also conflicting evidence [7] and it might be that there is some kind of division of labor such that right brain concentrates on sensory holism and left brain concentrates on cognitive holism. The experiments indeed suggest that it is left brain which recognizes holistic aspects of figures representing symbols and consisting of smaller figures representing also symbols. This would suggest symmetric scenario in which regions of both right and left hemispheres can entangle with collective selves and give rise to cognitive and emotional communication from higher level selves in modern man. This supports the view that also left brain hemisphere regions can support non-propagating EEG waves. Gap junction connected neuron groups provide candidates for regions allowing non-propagating EEG wave s.

The entanglement with collective self corresponds to the formation of join along boundaries bonds between corresponding cognitive space-time sheet and the space-time sheet associated with some part of brain. This is expected to occur naturally if brain space-time sheet is in state corresponding to non-propagating EEG wave. It would be interesting to check whether there are some anatomical and neurophysiological differences between the brain hemispheres of social animals. Of course, mere reductionism-holism difference, which is not obvious anatomically, is enough. The differences of right and left brain EEG:s could be also informative. One could also study whether different brain lobes react differently to stress.

2.2.7 Both hemispheres can entangle with higher level selves

The functional anatomy of brain is asymmetric: it is left brain hemisphere which is responsible for the production of speech whereas both hemispheres

understand speech. Wernicke area on the left lobe and its mirror images are responsible for the understanding speech. Wernicke's area and its mirror counterpart are connected by anterior commissure. Broca area and supplementary motor cortex on left side are responsible for the production of speech. The removal of the supplementary motor cortex or Broca area yields loss of speech which is however not permanent in case of supplementary motor area. This specialization is dynamical and results from self-organization. Very ambidextrous people can have speech on both hemispheres and injury to Wernicke areas in early youth can lead to a generation of the speech areas in right hemisphere. Right brain contains counterparts of the speech production areas of the left hemisphere with no obvious function. What is surprising that large amounts of right brain tissue can be removed with surprisingly little deficits on mental function. The idea that these areas are completely useless is not attractive idea knowing that evolution has been extremely economical. So, what has been and what is the function of these areas?

The TGD inspired hypothesis modifying Jaynes's original proposal is that both Wernicke area and its mirror image of modern man entangle with higher level selves and mediate their messages as thoughts in left hemisphere semitrance and emotions in right hemisphere semitrance. Imaginative thoughts and emotions are indeed more than just mechanical reactions to sensory input. In the brain of a healthy person brain hemispheres inhibit each other during normal consciousness but when the inhibition of right brain does not occur for some reason, 'God's communications' to the right hemisphere are mediated to the left hemisphere via anterior commissure as sensory hallucinations. This inhibition is also needed to avoid splitting of perceptive fields to two parts. This kind of splitting implied by de-entanglement together with inhibition might be especially useful in cognitive regions since it would make possible internal debate between holistic and reductionistic sub-selves.

Rather interestingly, in case of dogs and rats anterior commissures connect olfactory areas of brain. In this case odors might be in same role as voices in case of human brain. The idea about Dog-God expressing its will and advices using odor hallucinations does not sound so weird when one realizes that even human perceives huge number of different basic odors (TGD based model for sensory modalities explains this).

In this framework one can make guesses about the profile of the bicameral consciousness assuming that schizophrenics are bicameral men living in wrong time and place.

a) The evolution of modern man meant evolution of the entanglement

profile of semitrance. Today 'Godly communications' are experienced as ideas and emotions whereas bicameral man experienced them as sensory hallucinations. Presumably right brain dominated as the locus of semitrance communication as suggested by the higher average intensity of EEG in right brain hemisphere of schizophrenic. Also cognitive semitrance was possible but the higher level selves were much more primitive than their modern followers since their intelligence was sum of much lower intelligences over much smaller number of individuals.

b) The brain of ancient man was part of time in entangled state but un-stable against transition to split brain state induced by stress such that right brain sub-self was un-stable against the entanglement with collective consciousness leading to semitrance in several sensory modalities. This occurred when ancient man got tired or encountered some novel situation causing stress. The anterior commissure connecting Wernicke area and corresponding area on right side is thicker in the brain of schizophrenic: this favors auditory communications between the Wernicke regions and auditory semitrance. The replacement of 'God's voice' talking through the right hemisphere with thoughts experienced via left hemisphere (Wernicke region?) as internal speech is a rather natural mechanism leading from bicamerality to modernity.

3 Basic notions and ideas

It is useful to summarize basic notions and ideas making possible to construct cosmology of human consciousness. Also the comparison with Jaynes's corresponding ideas helps to understand the scenario.

3.1 Jaynes's and TGD based definitions of consciousness

Jaynes makes distinction between consciousness and experience whereas in TGD framework consciousness is identified as experience. What distinguishes between experience and consciousness as defined by Jaynes is basically a model for self and external world involving decomposition of the perceptive field to objects. It is questionable whether sensory experience without decomposition to objects ('mind like space-time sheets') is possible at all in TGD universe and one can question the possibility of sensory experience without consciousness in sense of Jaynes unless one assigns to consciousness some special properties such as third person model about 'I'.

Jaynes assigns to conscious experiences the following attributes which seem to at least some degree to be attributes of all conscious experiencing in

TGD universe since self hierarchy and communications between the levels of the self hierarchy are unavoidably present.

a) Spatialization is an essential aspect of conscious experience. Spatialization tends to assign geometric objects to even abstract concepts. For instance, we visualize abstract conceptual frameworks, such as synopsis for an article geometrically. This leads to the introduction of the notion of mind-scape. In TGD framework spatialization corresponds to the decomposition of the perceptive field to objects. TGD predicts that all mental images correspond to sub-selves having mind like space-time sheets as geometric correlates so that spatialization is completely general feature of conscious experience in TGD.

b) The notion of excerption means that we never experience the whole reality consciously. In TGD framework this aspect is completely general feature of conscious experience.

c) Narrative is identified as a basic aspect of conscious experience. We tend to complete the sensory experience to a story with a meaning rather than taking it as a mere sequences of uncorrelated sensory impressions. TGD based notion of self involves assumption about temporal binding stating that the experiences associated with the quantum jumps of self experienced after the last wake-up sum up to single experience. Geometric memory is second aspect of conscious experience and means essentially model for both geometric past and future assuming that no quantum jumps happened in past and will happen in future.

This does not necessarily yet imply narrative in time scales longer than the time scale of few seconds for the duration of the short term memory. The ability to form cognitive representation for experiences as long term memories is necessary for the buildup of the narrative. There must be someone telling the narrative and it seems that higher level selves tell the narrative in terms of thoughts and emotions in case of modern man: self narrative is essentially 'social construct'. In this book 'The man who mistook his wife for a hat' [8] Sacks tells rather moving stories about the loss of long term memories involving the freezing of the narrative to the years of youth. One could however see this situation, not as a lack of narrative, but a loss of correspondence between narrative and 'real world'. In TGD framework narrative results from the communication of higher level selves with us and corresponds to what we call 'cultural' factors as opposed to 'biological' factors.

d) Conciliation is the spatial counterpart of narrative. For instance, when we hear the words meadow and tree we immediately associate with them landscape containing meadow and tree. Conciliation involves formation of

associations and also this is basic aspect of conscious experience. Multimodal associative regions possessed by man but not by other primates are probably responsible for this process. Presumably also hominides had this ability. Again it is quite possible that higher level selves do this filling of a pattern for us.

e) The notions of analogy and metaphor are central for consciousness in sense as Jaynes understands it. Metaphors are things representing other things (for instance, head of the nail, head of the state, head of household). TGD counterpart are cognitive representations which seem be characteristic of all experiencing. Analogies are much like maps, say mental map of native country. The notion of symbol function generalizes the notion of the metaphor in TGD framework: it will be discussed in detail later.

f) The notion of 'analog I' is crucial aspect of consciousness and is a map for the first person 'I' as an agent making decisions. There are reasons to believe that also this aspect is involved with all conscious experiencing in sense of TGD. The metaphor 'me' represents third person view about 'I': person sees himself with the eyes of the outsider as other. This aspect of consciousness in sense of Jaynes need not be present in consciousness as defined in TGD framework. Semitrance in principle makes it possible to communicate third person view of the higher level self about me to me. Indeed, the voices of the schizophrenics often represent third person comments about the patient.

3.2 Bicamerality according to Jaynes and TGD

Jaynes assumes that bicameral man was not conscious in the sense described above although he had sensory experiences. In TGD framework it is questionable whether pure sensory experience without any attributes listed above, at least in some rudimentary form, is possible at all. Jaynes claims that consciousness in this sense was not needed for most cognitive functions like concepts, learning, thinking and reason: he is certainly right if these concepts are defined as one defines them in AI approach.

According to Jaynes bicameral behaved subjectively like slave although he had actual volition. The left brain of the bicameral man received the commands and instructions from right brain hemisphere. One can wonder why this self deception? Or is it possible to will without being conscious about willing? Bicameral man is an antithesis of the self of a materialist experiencing free will but having actually no free will. A grave objection against Jaynes's vision about 'God' as illusion is that bicamerals hallucinating their own personal 'Gods' randomly could not organize to societies. Jaynes claims

that the establishment of hierarchical social structures was possible because the routinization of the everyday activities involved standardization of the speech of 'God' and the voice of God became the voice of the leader of the primitive group, who had personal charisma distinguishing him as a leader. Of course, one can wonder how bicamerals having no idea about the notion of personality could have experienced this personal charisma. Already groups of animals have leaders which suggests that animals are able to experience this charisma somehow.

3.3 Bicamerality according to TGD

In TGD framework bicameral differs from modern man in several respects.

a) The profile of God-man communications is different. Bicameral man received God's commands and advices as sensory hallucinations whereas modern man receives them as thoughts and emotions. It is possible that thoughts are received by the regions of left hemisphere serving as the seat of cognitive holism.

b) Bicameral man spent much higher fraction of time spent in semitrance states than modern man since the time of hemisphere dominance for EEG was longer (4 times longer in case of schizophrenic). Right brain EEG dominated on the average whereas in case of modern man it is left brain EEG which dominates. Also this suggests that modern man receives the communications of higher levels of self hierarchy as thoughts and emotions.

c) The susceptibility of the bicameral man to end up to semitrance in stressful situations was presumably higher than that of modern man. This might be simply due to the longer duration of right and left EEG dominance and average dominance of right hemisphere known to characterize schizophrenics [d5].

d) One could define modern bicameral man as a person whose semitrance periods are abnormally long. Creative persons could correspond to modern bicamerals.

In TGD framework there is no reason to assume that bicameral man could not have been conscious in much the same sense as children of modern age are conscious. The assumption that bicameral man was cognitively and emotionally like child, even if too strong, is worth of studying. Bicameral man was also able to make genuine choices but, like children, found it easier to allow collective self to decide in confusing situations. The proposed alarm clock mechanism provides automatically guidance and commands in situations at which bicameral man could not cope. Bicameral man did not probably have self in sense as we have: for instance, he did not have long

term goals with span of lifetime and he was more like a person suffering inability to form long term memories in modern society.

With these modifications the basic arguments of Jaynes supporting his claims support also the TGD based picture. Indeed, the oldest books of Bible and Iliad referred in no manner to interior world of their characters but told only about actions: rather natural if the model of self made possible by cognitive and emotional narrative was lacking. In TGD framework bicameral man was more like a small child in present society. At least I find very difficult to believe that my children were 'unconscious' robots without experienced volition during their years before ten! If I had to define the opposite of robot, it would certainly not be child! Just as we take care of our children, collective consciousness took care of bicameral men in their daily affairs. Just as children regard their parents as authoritative figures and even God like beings, also bicameral man regarded higher level selves as Gods (note that the belief on guardian spirit might reflect the collective consciousness guiding small child). Just as children must at some time become independent adults, also bicameral man had to enter cognitive puberty to become adult modern man.

Children denying their parents would be regarded as stupid and reactive and equally stupid it is for modern man to deny the presence of higher levels of hierarchy of consciousness. There exist still primitive tribe cultures: if evolution of the social structure implied transition from bicamerality to modernity then the logical conclusion seems to be that these men must behave as if they had not experience of volition if Jaynes theory is correct: at least I find difficult to take this kind of conclusion.

3.4 How the developing collective consciousness coped with its challenges?

3.4.1 Challenges of the collective self

The collective self and various sub-selves of the developing societies encountered several challenges. The problems were basically related to the increasing size of the group which made it difficult for collective self to control and communicate with each individual separately. Biofeedback is a good example of this. Although one can learn to control individual cell of body by biofeedback, it is absolutely impossible to control consciously every single cell of body.

The development of social hierarchy in one-one correspondence with the levels of the self-hierarchy provided the manner to solve control and com-

munication problems. Instead of controlling individuals directly and often repeating same commands and advices again and again for various individuals, collective self controlled groups of individuals. The analogy with a computer program helps to understand why social hierarchies developed. Anyone who has written computer program has discovered the importance of modularization in allowing to avoid writing the same pieces of the computer code again and again. Subprogram call is counterpart for God's voice and when the number of levels in program hierarchy increases, lowest level modules do not have anymore direct contact with God containing only single program. This development lead to development of priesthood and weakened the authority of God.

The emergence of the social symbol function meaning that some member of subgroup became symbol for the subgroup receiving orders of collective self, was another aspect of this solution. 'God created us as his own image' states rather precisely what happened. This development meant that individuals lost the direct access to God. Group selves were like parts of our body: we can control their positions without any difficulty but learn to control individual cells by special training only.

The second problem was that semitrance mechanism based on sensory hallucinations is very fragile method of communications for several reasons.

a) Collective self could not open the communication channel at will and communications occurred only via alarm clock mechanism opening communication channel in a stressful situation. The externalization of the communications provided a partial solution to these difficulty. Although the leader of the group received commands from collective self, he mediated the commands to the members of group using spoken language. God could also speak to the members of the group directly using the voice of group leader without a risk of giving inconsistent commands and advices.

b) Increasing subjectivity increased the risk that individual confused his will with God's will. The gradual development of memory implied that individuals could remember the inconsistencies in God's orders and this led gradually to the loss of absolute trust to God's voice. The development of written language was a solution to this problem. Written language is based on the notion of symbol and also self symbol, 'me' as seen by other members of group, became possible at same time. Symbol function allowed also to externalize leader of group as God to idol.

c) Sensory hallucinations do not allow to express abstract thoughts and concepts. Neither do they allow communications of long term goals. The gradual transformation of sensory semitrance to cognitive and emotional semitrance solved this problem. Thoughts, moods, emotions and motiva-

tions emerged.

3.4.2 Social hierarchies, symbol function, and externalization of communications

The advent of agriculture led from hunting and gathering economy to large populations of men: this led to the birth of civilization at around 8000 B.C.. Stable populations made possible the increase of the collective intelligence and its further structuring from a primitive group with single leader to more refined social structures. Whether the discovery of agriculture was forced by the changing climatic conditions or whether the evolution of language led to the discovery of agriculture, is open question. Jaynes is the proponent of the latter option. Jaynes sees the emergence of the agriculture as the beginning of the period of bicameral mind. In TGD framework bicamerality was present all the time. The period after 8000 B.C. was beginning of something in the sense that the development of social self hierarchies, syntactic hierarchies of language and neural hierarchies occurred during this period in a parallel manner. In life of child the establishment of EEG at age of one is the counterpart of this transition.

Absolutely essential for these developments was the emergence of symbol function. Symbol function contains as a special case the notion of metaphor in the vocabulary of Jaynes. Symbol function in TGD sense is closely related to the establishment of the genetic code and was present already during the bicameral period. Generalizing the arguments of Jaynes, the rudiments of the symbol function developed gradually during the long period between 40.000 -8.000 B.C. and led to the emergence of commands, modifiers, nouns and names.

The period after 8.000 B.C. meant the emergence of higher hierarchical linguistic structures (such as sentences) as well as the differentiation of the primitive structures to more elementary structures having no direct meaning (words decomposed to syllables and these decomposed to phonemes). Neurophysiologically this process correlates with the emergence of lower hierarchy levels, sub-selves, at the level of left brain hemisphere. Sentences are 'gods' of words; words are 'gods' of syllables and syllables are 'gods' of phonemes. This linguistic hierarchy internalized the external self hierarchy and even more, it made eventually possible to imagine new hierarchical structures. If the notion of cognitive age makes sense, this period must have begun with the emergence of stable low frequency EEG making possible semitrance contact with higher level selves. One can test the plausibility of this hypothesis by studying the EEG of social animals.

Also various higher level selves in the social hierarchy became represented as symbols. The basic function of these symbols was to generate stress (by creating awe and fear) and thus induce semitrance in primitive bicameral man making possible for the collective self represented by the symbol to talk to him. This kind of concretization was obviously necessary since even modern man (even neuroscientists specialized to EEG!) finds it very difficult to take the possibility of, say, purely electromagnetic life-forms, although more than century has passed from the discovery Maxwell's theory of electromagnetic fields. Two different representations emerged corresponding to spoken and written language.

a) The leaders serving as representatives of group become symbols for the self of the group (God) and was regarded as a god like being. In particular, king became a god.

b) The counterpart for a written language was the appearance of idols, statues, temples, graves, etc.. as symbols of Gods, which spoke directly to bicameral man. The difference between these and the symbols of written language is important: symbols of written language communicated the message of God to the left brain of bicameral man in ordinary state of consciousness.

Even the villages and towns of bicameral men seem to provide symbolic representation of the social self hierarchy. The most primitive hierarchy consists of a tribe with a leader, God and men: in this period villages contained God's house surrounded by houses of men. The development of architecture of bicameral towns evolved from this basic architecture and reflected the developing social self hierarchy. Even to-day the old parts of towns reflect this architecture whereas suburban regions have modern, much more flexible and less hierarchical organization. Web represents the newest development of social self hierarchy free of geographical restrictions.

Two basic types of bicameral cultures emerged: God-king culture and steward-king culture. In God-king culture, king was God whereas in steward-king culture the notion of God had developed and king was immediately below God in the hierarchy. God-king cultures were un-stable and ended up to the return to tribe state following soon a re-organization to organized society. Examples of God-king cultures are cultures of Egypt and South-America (which emerged much later). The basic problem of God-King cultures was the physical death of king. In these cultures dead became Gods. This is understandable if the voices of dead people were heard even after their death. Transition period caused problems since the voice of God had to transform to the voice of new king.

A related mysterious notion is that of 'ka': in God-king cultures of Egypt every man had his 'ka', kind of shadow being, which continued to live after

the physical death. An interesting possibility is that the ELF selves in the personal self hierarchy, perhaps those corresponding to Schumann frequencies, do not disappear in the physical death so that 'ka' would correspond to 'ELF self' of a deceased person. There are almost routine methods allowing to achieve experience about contact with deceased relatives and friends: perhaps this contact is real[5]. One could also see person and his electromagnetic shadow (also Jung used the notion of 'shadow') as living in symbiosis and that electromagnetic shadow continues its life after the death of the physical body.

The more advanced steward-king cultures, about which Mesopotamia is one example, were more stable and can be regarded as predecessors of the civilizations following bicameral age. In this case the symbolic representation of God was stable and standardized and the death of a king was not a problem in this case. Also the inflation in the number of Gods was avoided in this manner. Pope is a representative of God and leaders of the organizations symbolize the collective selves associated with the modern organizations. It is not accident that steward-king cultures used more advanced written language based on half symbols allowing to express genuinely new information rather than serving as mere mnemonic as the half-picture writing of God-King cultures. Half symbol writing contains already symbols for syllables. Half-symbolic writing reflects more advanced self-organization of the left brain hemisphere: sub-selves representing mental images for words had sub-selves representing syllables which are a purely phonetic concept.

It would be exaggeration to say that the entanglement with collective self was the only possible form of entanglement: also the entanglement with other members of the group at the same hierarchy level could occur and probably occurred. Also the assumption that bicameral state was whole-timely is strong idealization: modern self consciousness with both brain hemispheres entangled mutually was probably present but un-stable against return to the bicameral mode induced by rather small stress.

Externalization provides a solution to the fragility and unreliability of telepathic communications. Externalization means the development of non-telepathic communication modes, 'wiring'. These communication modes together with cognitive and emotional semitrance gradually replaced the sensory semitrance. The evolution of spoken and written language can be seen as this kind of process. In modern society the development of various electrical communications has had the same effect. In the following sections this general view for the development of language and civilization is discussed in more detail.

4 Development of language

The development of language has two aspects: the development of the syntactic structures and the development of the written language. In TGD framework the evolution of the written language involving transformation of symbols for events to symbols for phonemes could be seen as establishment of the memetic code at neural level. The evolution of the syntactic aspects of the language (sentences and higher level structures) in turn reflects directly to the development the self hierarchy from simple 'God'+men hierarchy with two levels to a hierarchy with several levels.

4.1 General ideas about codes and language

By quantum-classical correspondence space-time sheets provide a symbolic representation for the contents of consciousness. Therefore one can say that everything in principle represents and the task is to understand how these symbolic representations are generated, how codes are established, and how these symbolic representations generated the desired mental images. This obviously means a profound departure from the basic belief system of standard biology.

Computer languages form a hierarchy such that highest level languages are very flexible approaching gradually to the spoken language whereas lowest level languages are very precise and rigid. The notion of self hierarchy suggests that our spoken language is only a top of an iceberg and that below it is a hierarchy of languages ending down to the cellular level and DNA is one particular example about "computer language" realized in terms of p-adic cognitive codes, in particular genetic and memetic codes. In an attempt to understand whether and how memetic and other p-adic cognitive codes might relate to the spoken and written language one must have some general ideas codes and language.

4.1.1 The hierarchy of cognitive codes

p-Adic length scale hypothesis suggests an entire hierarchy of cognitive codes and languages. The primes $p \simeq 2^k$, k integer seems to be interesting physically, and prime values of k seem to be especially interesting. The codes would be characterized by the duration of the codeword given by n-ary p-adic time scale $T_p(n) = p^{(n-1)/2} \times T_p$, $T_p = 2^{k/2-127} \times T(2, 127)$, $T(2, 127) = .1$ seconds. The most general assumption is that number k_1 of bits of the codeword for given integer k_1 corresponds to some factor of k , the largest

factor maximizing the information content. Codes could be represented either as temporal sequences of bits represented as pulses of maximal duration $T_p(n)/k_1$ or as superpositions of k_1 harmonics of $f_1 = 1/T_p(n)$ where Fourier coefficients having intensity above/below critical value would represent bit 1/0. These representations will be referred to as pulse and frequency representations respectively.

Memetic and genetic codes represent special examples of cognitive codes. One must distinguish between two representations: the representations involving 6 bits or almost 7 bits and 126 bits or almost 127 bits. 'Almost' means that only $2^k - 1$ bit sequences rather than all 2^k bit sequences are realized as conscious bits if bits are realized as phase transitions.

Codes are always involved with classical communications involving transformation of mental images to a symbolic representation by some code. At our level of the hierarchy this symbolic representation could be speech, written language, picture, body language... This would suggest that also p-adic cognitive codes are involved with conscious communications. If these codes are realized in living systems, the bit sequences with the predicted durations and bit contents should induce biological effects serving as correlates for the conscious understanding of the message generated by the codewords at some level of the hierarchy.

TGD based view about living matter relies on the notion of field body or magnetic body associated with any system and having size much larger than the material body. Also these bodies form a fractal hierarchy. The communications from material body to field body could be based on cognitive codes. Given p-adic frequency corresponds f_p to a p-adic length scale $L_p = c/f_p$ characterizing the size of the magnetic body involved and for EEG frequencies the size scale of Earth is natural unit. For instance, p-adic cognitive codes realized in terms of field patterns would be involved with the communication of long term declarative memories from the geometric past.

4.1.2 What language is?

The attempt to understand the possible role of memetic code, a rough vision about what language is, allows to eliminate several ideas which look promising at first.

a) Language involves generation of symbolic representation of a mental image by a more or less rigid code. An example of a very flexible code is code based on associations. The symbolic representation of mental image should induce in the receiver the original mental image as faithfully as

possible. This requires that a lot of common context. In particular, the neurologies and biologies of the sender and receiver must resemble each other sufficiently. In the case of high level languages like ordinary language even this is not enough and only simplest verbal signals and body language are understood universally. The cognitive codes associated with say cell level communications might make possible communications between cells of even different species remaining however unconscious to us.

b) The p-adic vision about evolution of cognitive skills like spoken language is that they evolve from long time and length scales to shorter ones. First a rough sketch about the motor action is created and gradually more and more details are added. This applies also at the level of the evolution of language itself. Simple signals expressing and generating emotions evolve gradually to spoken language which evolves to written language which in turn evolves to computer languages.

c) Learning of language requires learning of the conventions assigning to a given symbol a mental image. Sharing of mental images which represent more primitive "telepathic" communication makes possible this process. The observation that even plants and cells can react to our emotions and that this reaction does not depend much on distance [9], suggest that the sharing of mental images is in question. This allows to consider the possibility of inter-species linguistic communications using field patterns.

d) The understanding of language requires transformation of symbolic representation to conscious experience and here the notion of conscious bit ("cbit" [c1]) realized as a phase transition or as an absence of phase transition suggests itself. Phase transition could correspond to magnetization or formation of electret state and living matter could generate these representations in various length scales.

e) Spoken and written language would rely on time mirror realization of intentions and actions and could propagate down to the level of genome and select the memes to be expressed. The expression of these memes as field patterns would then be a process propagating upwards in the hierarchy and finally generating speech or written word.

4.1.3 Computer metaphor

Software and hardware are essential elements of the computer and at DNA level this could mean that genes code for hardware which is not stable as in case of ordinary computers. This means that computer hardware is replaced by the possibility to generate it and genes carry the information needed for this. Introns would in turn represent the software, the programs and

therefore also the linguistic aspect of DNA. An interesting possibility is that introns realize memes as sequences of 21 DNA triplets. This picture allows and even suggests that even DNA level might be involved with the generation of spoken words.

4.1.4 Conscious bits and cognitive representations

The symbols representing message must be transformed to standardized mental images. The simplest possibility is that the mental images are coded to patterns of conscious bits or cbits. The general model for sensory and other qualia suggests that conscious bits should be realized as quantum jumps sequences associated with phase transitions. In this manner same quantum number increment is occurs for many particle for single quantum jump and for sufficiently long sequence of quantum jumps. Bit 1 would correspond to the occurrence of phase transition and bit 0 to the non-occurrence of the phase transition. For a code of k bits this has important implication: the codeword containing only zeros does not generate any conscious experience so that the number of experienced code words is $2^k - 1$. This could explain why Mersenne primes seem to be define especially important p-adic time scales.

Living matter is populated by dynamical electrets so that phase transitions between ordinary and electret states at various length scales are expected to be of special importance. Also magnetization of super phases at magnetic flux tubes of say Earth's magnetic field is expected to be one mechanism producing basic qualia serving as as bits.

The time mirror mechanism for motor actions suggests that that when I decide to say something say the words "time mirror", this intention is transformed to a desire communicated to the geometric past to the lower level of the self hierarchy and that at this level this desire generates further desires communicated to the lower levels. Ultimately this process ends down to the level of cells and even cell nuclei and DNA and induces response which propagates to the higher levels as neural and other activities inducing muscular activities in speech organs and generates the words "time mirror".

The signal to the geometric past involves negative energy photons and topological light rays. The working hypothesis has been that the signal to the geometric past is only a space-time correlate for sharing of the desire to generate the action, and does not involve any code. If this is the case then only the response propagating to the geometric future would be classical signal based on some code. One must however keep mind open to the possibility that also communications to the geometric past involve code.

4.1.5 Genes, memes, and language

The simplest model for an abstraction process is based on a repeated formation of statements about statements starting from two basic statements '1' and '0' representing the most primitive logical thoughts. If one drops at each step of construction the statement corresponding to empty set in the set theoretic realization of Boolean algebra, one obtains a hierarchy allowing to understand the basic numbers of genetic code.

The outcome is the so called Combinatorial Hierarchy [10] consisting of the Mersenne numbers $2, M(1) = 3, 7, 127, 2^{127} - 1, \dots$ constructed using the rule $M(n+1) = M_{M(n)} = 2^{M(n)} - 1$. The explicitly listed ones are known to be primes. Combinatorial Hierarchy emerges from a model of abstraction process as sub-sequent transitions from level to meta level by forming Boolean statements about Boolean statements of level n and dropping one statement away. Combinatorial Hierarchy results also by constructing the sets of all subsets with empty set excluded starting from two element set. The set of statements at level n can be given a structure of Finite Field $G(M(n), 1)$ if $M(n)$ is prime. The multiplicative groups $Z_{M(n)-1}$ form a nested hierarchy and the coset spaces $Z_{k_n} \equiv Z_{M(n)-1}/Z_{M(n-1)-1}$ are cyclic groups ($k_n = (M(n) - 1)/(M(n-1) - 1)$). Hilbert's conjecture states that each Mersenne number in the Combinatorial Hierarchy is prime.

Combinatorial Hierarchy based model of genetic code explains the number of DNA:s and amino-acids, and the representation of words of the genetic code as triplets of 4 different lower level codewords. Genetic code corresponds to $n = 3$ level of the hierarchy with 127 statements representable as 7-bit sequences with the sequence of seven '0':s dropped away. Only the 64 6-bit code words can be fully realized and correspond to $(M(3) + 1)/2 = 64$ DNA triplets. $k_3 = 126/6 = 21$ equals to the number of amino-acids plus stopping codon. There is a natural imbedding of subgroup Z_{21} identifiable as a representation of amino-acids to the group $Z_{126=6 \times 21}$.

More abstractly, at level n the counterparts of DNA triplets correspond to the set $X_{N(DNA)} \subset Z_{M(n)-1}$ of $N(DNA) = (M(n) + 1)/2$ statements consistent with a fixed atomic statement (64 for $n = 3$). Atomic statement corresponds to a fixed value, assumed to be one, of a fixed bit in a bit sequence representation and a subset consisting of single element in the set theoretic representation. These statements could be regarded as statements consistent with the axiom defined by the selection of the atomic statement. The counterparts of amino-acids and stopping codon correspond to k_n theorems of a formal system defined by n :th level of Combinatorial Hierarchy having a unique imbedding as the group $Z_{k_n} \subset Z_{M(n)-1}$. The DNAs coding

for a given "amino-acid" correspond to the special cases of the theorem.

Mapping of DNA code words to amino-acids generalizes to the mapping $x \rightarrow x^{k^{n-1}}$ in $Z_{M(n)-1}$ mapping DNA type statements to amino-acid type statements. $(M(n) + 1)/2$ DNAs can be imbedded to Z_{126} with several manners. Genetic code is fixed ones this imbedding is given. For $n = 3$ one obtains ordinary genetic code defined by the map $x \rightarrow x^6$ and imbedding of the DNAs to Z_{126} . The numbers of DNA:s coding single amino-acid can be reproduced by a symmetry breaking mechanism involving the finite groups $Z_{p_{n-1}}$ and Z_{k_n} and symmetry breaking is in a well defined sense minimal. The infinite hierarchy of possible genetic codes (at least if Hilbert's conjecture holds true) suggests the possibility of an infinite hierarchy of increasingly complex life forms.

If one allows only Mersenne primes, the model for the abstraction process predicts at least one further code, which I have used to call memetic code. It corresponds to the Mersenne prime $M_{127} = 2^{127} - 1$ and has 2^{126} code words and $(2^{126} - 1)/(2^6 - 1)$ "amino-acids". The secondary p-adic time scale $T(2, M_{127})$ is .1 seconds and defines a fundamental time scale in bio-systems.

There are reasons to expect that memetic code is an especially interesting higher level cognitive code and realized in terms of field patterns. In particular intronic portion of DNA could realize memetic codewords as sequences of 21 DNA triplets and memes would define the counterparts of computer programs at DNA level whereas genes would express themselves chemically and define the counterpart of computer hardware coded into lower level programs and built only when needed.

The widespread semiotic-linguistic nomenclature for the description of genetic apparatus seems to have also scientific justification [11], and this supports the idea that the intronic portion of DNA could code in a very abstract manner for a basic repertoire needed by spoken and written language. It seems that a very abstract representation must be in question since child can learn any language so that particular language would be more like a particular realization of the program. Both memes and genes could express themselves in terms of field patterns.

Memes and genes should relate like computer software and hardware. In the case of language the rules producing a given linguistic expression can be seen as the software whereas words can be seen as the hardware built from phonemes. This leads to the idea that memetic codewords define the basic program modules producing linguistic expressions by activating genes which express themselves as words or word sequences. Phonemes could directly correspond to DNA triplets and define the basic building blocks of language having as such no meaning. If this view is correct, the development of spoken

and written language would mean basically the emergence of a higher level of intentionality, which utilizes an already existing repertoire of memes already expressed in many other manners. This would in turn suggest that animals and even plants possess some kind of languages realized at cellular level, and that even inter-species communications using common memetic vocabulary.

The most general hypothesis is that every integer k defines a set of cognitive codes such that the code word has duration $T(n, k)$ and the number of bits is a divisor of k . Genetic and memetic codes are the most obvious codes associated with spoken and written language.

This view is supported by several quantitative facts.

a) The number of phonemes and characters in Finnish language is 21 whereas in Russian language the number of characters is 32. This allows to consider the possibility that phonemes are analogs of amino-acids and that they could be coded by DNA triplets. The code need not however be equivalent with ordinary genetic code.

b) In the case of genetic code integers of form $k = 6 \times n$ define candidates for the duration of genetic code word so that possible durations of codewords comes as powers of 8. $k = 2 \times 126 = 2 \times 6 \times 21 = 252$ allows the representation of both 126 bit memetic codeword, 6 bit genetic codeword, and 7-bit code word. The code word would have duration of 50 ms and corresponds to the frequency 20 Hz, the lower end of the spectrum of audible frequencies.

4.2 Prerequisites for the development of language

It is known that monkeys and also some birds learn to understand and even to use language, one might say, in primitive creative manner. Thus one could wonder why these animals have not developed a refined language. The lack of speech organs is not an explanation for this since the language could have been also sign language. A plausible explanation is that the development of language is essentially social process involving entire community. 'Ontogeny recapitulates phylogeny' principle supports this view: the development of language during development of individual is indeed a social process. If collective intelligence is mostly responsible for the evolution of language and is 'sum' over the intelligences of individuals, as TGD based notion of self predicts, then certain critical size of the group is required to achieve critical collective intelligence making possible the development of language.

The hierarchical structures of language should also reflect the hierarchy of the collective consciousness which in turn correlates very tightly with social structures. In particular, the emergence of symbolic representation of 'Gods' should be accompanied by the emergence of written language and the

structure of written language should correlate with the manner the 'Gods' are represented as symbols (as members of society or as idols). Also the number of levels in the structures associated with the language and society might correlate. To consider a modern example, hypertext with its link structure indeed reflects the structure of modern society in which geography does not anymore put constraints on the formation of social groups. Same presumably applies to the hierarchies associated with the neural circuits of cortex and at least the linguistic regions of brain.

4.3 Scenario for the development of primitive forms of spoken language

Before the linguistic period communications in groups of hominides were based on visual and vocal signals much in the same way as in the groups of social animals. According to Jaynes, most linguistics believe that human language is at least two million years old. Jaynes has different opinion about this and TGD based view is consistent with this opinion. Of course, one can consider also alternative option consistent with the views of both Jaynes and main stream linguists: the development of communities with languages suffering occasionally drawbacks to a more primitive state. This is completely consistent with the ideas that 'civilization selves' wake-up and fall in sleep periodically and that language results from a self-organization process of brain.

The generation of self hierarchies in turn implying development of the hierarchical structures of language requires sufficiently stable populations, more fixed social relationships and longer life-spans. It might be that these factors are critical and the circumstances allowing the development of the language were not reached until relatively lately or that these circumstances were not permanent and led to drawbacks.

As Jaynes [1] emphasizes, the evolution of language affects dramatically perceptions and attentions and this in turn affects language evolution: also these changes should be visible in the archeological record. On particular, the development of language should have meant dramatic technological advances but archeological evidence suggest that only crudest stone tools were made before 40.000 B.C.. Jaynes emphasizes that language was not necessarily for transferring various technical skills to the next generation: it is very difficult to teach bicycle riding using only language and language does help only marginally in this kind of task. The development of language must have had dramatic effect and should be seen in archeological data. Such period is late pleistocene, roughly 7.000-8.000 B.C. character-

ized by wide temperature variations. During this period artificial climate: fires, caves and furs were discovered and allowed the hominid population to explode from tropical Africa first to Eurasian subarctic and then to America and Australia.

4.3.1 Calls, modifiers, commands, nouns

Jaynes's view about the development of language is based on the notions of calls, modifiers and commands and nouns. The most primitive language expressions were calls which developed from postural and visual signals. The evolutionary pressure was perhaps the migration of man to northern climates where there was less light in both environment and caves where man lived. The intensity of the call was the only variable parameter in the signal before the emergence of modifiers. Jaynes represents a fictive example about the development of modifiers: 'wahee' could signal for an approaching tiger and 'wahoo' could represent distant tiger. Gradually the endings 'hee' and 'hoo' became modifiers meaning 'near' and 'far'. The emergence of the modifiers led to the age of commands. For instance, the modifiers 'sharper' and 'finer' as instructed commands could have been very important.

The next stage in the differentiation process was the splitting of commands to two parts. This led to the invention of nouns: 'wah' could mean tiger, 'wab' could mean bear. The discovery of nouns made possible linguistic representations of the external world as consisting of objects. Jaynes locates this development somewhere between 25.000 and 15.000 B.C.. Jaynes locates the appearance of animal drawings and the invention of pottery, pendants, ornaments and barbed harpoons and spearheads to the invention of nouns. From fossil records it is known that the size of the frontal lobe in front of the central sulcus was increasing very rapidly at this time.

This picture is consistent with the gradual evolution of the left brain hemisphere implying the decomposition of the holistic and irreducible 'call selves' to 'command selves' and further to reducible sub-selves representable as unions of 'noun selves' and 'modifier selves'. The minimal assumption is that Wernicke area of the right brain was entangled with the collective self. The fact that schizophrenics and presumably also ancient man had also visual and other kinds of hallucinations, suggests that larger parts of right brain were entangled with collective selves for a considerable fraction of time or at least that stress (new situation, tiredness) induced easily de-entanglement of right and left brain hemispheres and trance of parts of the right hemisphere.

In TGD framework this evolution can be seen also as the establishment

of the memetic code in which basic units are codewords having temporal duration of about .1 seconds and consisting of 126 binary digits, with the duration of single digit corresponding to the duration of nerve pulse [d2]. Single codeword of the memetic code corresponds to the minimal duration of single phoneme. The development of language must have been gradual differentiation so that signals gradually differentiated into nouns, verbs and modifiers. When written language emerged, words differentiated into syllables and phonemes having as such no independent meaning. The decomposition into phonemes was the final stage of the development leading to consciousness about the structure of the language. It is interesting to notice that before the (assumed) establishment of the memetic code, nerve pulses were analogous to calls in the sense that only the frequency of the nerve pulses mattered. The establishment of the memetic code meant that the temporal pattern of the nerve pulses contained by the memetic codeword began to carry meaning.

4.3.2 Origin of auditory hallucinations

Jaynes sees the origin origin of auditory hallucinations as resulting from natural selection as a method of behavioral control. If primitive man had no spatio-temporal model for self, he could not make plans and narratives about them to remember what he had to do. Thus primitive man commanded by himself or by his chief to do some time consuming work, could not fulfil the command unless there was some mechanism keeping the command in his mind. If primitive man heard the command repeatedly as an auditory hallucination, the problem of control was solved. Sceptic could of course wonder how the chief with essentially same cognitive abilities as the other members of group could make any sensible plans and serve as a leader. Also every member of group should perform essentially similar activities for this scenario to work.

TGD view differs from this. There is no good reason for not assuming that semi-trance mechanism would not have been present from the beginning of the formation of social groups (even at the cellular and molecular level!). The boss is the collective self giving commands and advice mostly through the linguistic parts (presumably also visual) of the right brain. As already found, semitrance based alarm clock mechanism makes possible collective control of the behavior in groups of social animals guaranteeing that under a situation producing stress collective consciousness automatically provides commands and advice for the member of group. In TGD framework the leader of the group was presumably symbolic representation for

the collective consciousness in the sense that collective self talked with the voice of the leader. Symbolical representation seems very natural strategy since simple-minded stone-age man could hardly image existence of an invisible conscious self. It seems to be extremely difficult for even modern man living in an electromagnetic society to take seriously the notion of the electromagnetic life! The development of the spoken language made possible much more refined human-human communications and written language made final breakthrough in this communication mode.

4.3.3 Age of names

The discovery of nouns was followed by the age of names. Jaynes suggests that names were discovered in Near East at late Mesolithic era, about 10.000-8.000 B.C., during the adaptation to warmer postglacial environment. The creation of names led to a cognitive model for the tribe: tribe members existed also when physically absent. In this period ceremonial graves emerged as a common practice. One could argue that names distinguish between members of tribe and make them individuals. This is not consistent with Jaynes's idea that primitive man was 'unconscious' unless 'unconscious' means lack of a model for self. Also some animals, for instance elephants, are known to have graveyards.

This suggests that language is not necessary prerequisite for the notion of individual. In TGD framework situation members of the tribe were conscious individuals from the beginning and the problem concerns about the development of a cognitive representation for self and group. Monkeys can cheat, represent something else than they are, which suggests that they already have primitive self model and that they can distinguish between self as a social representation and 'real' self. The idea that names came so much after nouns is somewhat questionable (children learn nouns and names at the same time): later an alternative scenario in which nouns and names came simultaneously will be considered. This point is not essential for what follows.

4.3.4 Development of syntactic structures of language

The development of language paralleled the evolution of our civilization after 8.000 B.C. and social hierarchies reflect the corresponding structures of language and also self-hierarchy of brain. Emergence of increasingly complicated social structures correlates with the emergence of syntactic structures of spoken and written language. The simultaneous differentiation of the left

brain hemisphere corresponds the differentiation of words to syllables and phonemes.

The development of the written language started at about 3.000 B.C.. There is geological evidence for some big catastrophe changing dramatically the climate at this time. Perhaps the catastrophe forced large numbers of people together and increased the collective intelligence above the critical value needed for the discovery of the written language. Written language was basically an externalization process making also communications of the higher level selves more reliable and standardized.

Written language developed from the symbols for visual events to written symbols for phonetic events. In the first case written language was only a mnemonic, whereas in the latter case it could transmit previously unknown information. The two kinds of written languages correspond to two kinds of symbolic representations for Gods as individuals and idols respectively. God-king and Steward-king theocracies were the social counterparts of this representations. The structure of the written text represents higher levels of the self hierarchy (sentences, paragraphs, subsection, sections, chapters). The most modern development is hypertext in which simple hierarchical structures are replaced with a web of texts. It made also possible formal language of mathematics.

The structures of language represent self-hierarchy in the left brain. The development of the written language led to the emergence of the lower levels of this hierarchy: syllables and phonemes. Syllables and phonemes have no direct meaning to us but they correspond to conscious selves at levels below us in the left brain. If the simplest assumptions for how contents of conscious experience of self are determined is correct, one must conclude that the duration of our self cannot be much longer than duration of single phoneme of about .14 seconds and we spend very short periods (certainly very short ones, perhaps of duration shorter than .1 seconds) in trance. Only semitrance mechanism makes possible genuine subjective memory as self-narrative. The people who have lost the ability to form long term memories (Oliver Sacks has some stories about Korsakov syndrome in his book [8]) have short term memory which is only few seconds, perhaps this is the duration of our self.

Neurons representing syllables are 'Gods' of phonemes belonging to the syllable and affect the behavior of the phoneme neurons by semitrance mechanism. Words in turn are 'Gods' of syllables. Since both brain hemispheres can understand spoken language, it seems that both right and left brain contain representations for words. It is known that left brain contains neurons representing syllables and phonemes. The notion of symbol function

suggests however that these neurons indeed 'represent', i.e. are representatives for collective selves of neuron groups. The notion of symbol function throws also new light to the notion of 'Grandma neuron': Grandma neuron is a symbolic representative for a neuron group representing Grandma. One might hope that the existing neurological data allows to construct a general view about what it means to understand written language.

5 Semitrance and the development of civilization

5.1 TGD based vision for the development of civilization

5.1.1 Basic assumptions

TGD based model for the development of civilization is based on following assumptions.

a) The development of individual is essentially self-organization process at the level of brain and the brain of the stone-age man was essentially identical with ours. The simplest assumption is that self-organization process occurs in essentially same manner and that environment only determines at which age this development stops. A further natural assumption is that left brain hemisphere self-organizes cognitively whereas right brain hemisphere self-organizes emotionally.

b) Effective age is a concept used to characterize the developmental level of retarded children. This suggests the characterization of the ancient man using the concepts effective cognitive and emotional ages. Cognitive/emotional ages is defined as the age of a modern man having same cognitive/emotional self-organization level of left brain as ancient man has. The EEG of left/right hemisphere should serve as a physical correlate of the cognitive/emotional age.

c) The effect of culture to the development of individual is basically an upper bound for both the effective cognitive and emotional age achieved by the individual during his lifetime. The developmental level of the civilization is determined by the average effective cognitive and emotional ages of an adult living in it. The effective cognitive/emotional age of a civilization can be defined as the average cognitive/emotional age of individuals in it.

d) A stronger hypothesis is that the age of civilization is related by simple scaling to the effective cognitive and emotional ages of the civilization so that evolution of civilization of time scale version for the evolution of individual. This hypothesis is motivated by the fact, that the self-organization processes in question are essentially evolution of macroscopic aspects of con-

sciousness and by p-adic fractality. In the simplest model the development of a civilization corresponds to a straight line in two-dimensional plane defined by cognitive and emotional ages and is thus not unique. The direction of this line might allow to differentiate between various types of civilizations.

e) A stronger assumption is that the development of civilization and individual correspond to each other at qualitative level. Thus the main transitions in the development of an individual have counterparts in the development of a civilization. Thus civilization has early childhood about which it has no memories, it learns various cognitive skills like speech and writing as well as the use of technical tools. Civilization has also puberty involving violent self-organization processes. The assumption that the time scales for the evolution of civilization and individual are related by scaling, predicts when these main transitions in the development of the civilization should have occurred so that model becomes quantitative. The study of the development of EEG of right and left hemisphere should thus provide testing ground for the model.

f) A natural hypothesis is that there is a parallel between the development of society and higher level structures of language so that the moment of birth of society can be taken to be the moment at which higher level structures of language begin to develop. This corresponds to 8000 B.C. when basic elements of language, commands, nouns and names, had developed. In development of child this corresponds to the age of about 1 year when child has learned her first words. Music and arts are languages of emotions so that also the development of arts parallels the development of society.

The effective cognitive age of one year as cognitive age of civilization at 800 B.C. is not ad hoc choice. At this age EEG appears as occasional bursts in 4-8 Hz range. If left brain EEG is determined by the effective cognitive age this means that linguistic regions of bicameral brain got stable EEG when the development of the civilization began! Note that the occasional bursts of EEG of child in mother's lap could quite well have counterpart in the development of stone-age civilization before 8.000 B.C. and could have made possible the development of the basic elements of the language.

This picture conforms with the TGD based notion of self hierarchy. TGD predicts that our personal self hierarchy has electromagnetic levels which corresponds to topological quanta of ELF em fields associated with various electromagnetic oscillations associated with EEG. These topological field quanta correspond to 3-surfaces with size of order Earth for highest ELF frequencies. Rather remarkably, 7 Hz frequency corresponds to the fundamental time scale of the memetic code, which is necessary prerequisite of language and cognition in TGD framework. 7-8 Hz corresponds also the

lowest resonance frequency (Schumann frequency) associated with em fields in the wave cavity between Earth's surface and ionosphere: wave length corresponds to the circumference of Earth. The topological field quanta of EEG em fields in 4-8 Hz range represent both higher levels of the self hierarchy of bicameral man and higher levels of self hierarchy.

Electromagnetic levels of the self hierarchy provide a mechanism for telepathic communications based on the formation of join along boundaries bonds between topological field quanta: this is nothing but geometric correlate for the entanglement mechanism [c1]. Occasional bursts of EEG could be interpreted as semitrance states during which Gods spoke to the bicameral man. Thus the emergence of EEG in linguistic regions can be seen as the emergence of social self able to communicate using language and also as generation of contact with Gods (EEG frequencies below 8 Hz) and culture! The study of the evolution of children's EEG should give a direct window into the evolution of the consciousness of bicameral man. Also other vertebrates than human have EEG which suggests that they can also have what might be called religious experiences. The lack of the multi-modal associative regions in parietal-occipital-temporal areas crucial for language is possible anatomical explanation for why they have not developed language.

Slow wave EEG made possible telepathic communications and rapid social self-organization and gradual emergence of collective consciousness. If ELF self survives death and the voices of dead companions were heard after death, the natural psychological reaction was belief to life after death. The emergence of collective consciousness sooner or later, perhaps as a join along boundaries condensate formed by topological field quanta associated with the ELF selves of dead, in turn led to belief in God.

Jaynes locates the emergence of first God to Natufian culture in Israel. In 10.000 B.C. Natufians were still hunters. By 9.000 B.C. they were burying their dead in ceremonial graves. This suggests that the belief in life after death emerged simultaneously with EEG and 'electromagnetic shadow' self. An open-air Natufian settlement at Eynan dozen miles north of the Sea of Galilee in Israel shows this change most dramatically. Three successive permanent towns dating from about 9.000 B.C. have been investigated. Each town comprised of about fifty houses arranged around an open central area where bell-shaped pits had been dug and plastered for the storage of food. Instead of nomadic tribe consisting of about 20 hunters, one has a town with a population of at least 200 habitants: a rather dramatic phase transition suggesting dramatic increase in the IQ of collective consciousness. The tomb of the first God-King in Eynan developed later to a house of God and later to temples, pyramids and other symbols generating awe and fear and thus

inducing semitrance state in bicameral man.

5.1.2 Comparison of Jaynes's and TGD based visions

It is useful to develop the model to more quantitative level by comparing the views of Jaynes about the development of human consciousness with TGD based views.

Jaynes:

a) Basic structural elements of language had evolved slowly for a long period: commands from 40.000 B.C., nouns from 25.000 B.C., and names from 10.000 B.C., at the time of the emergence of agriculture. Language, the speech areas, evolved in the left hemisphere (in right-handed) which, as Jaynes underlines, is a mystery since most human structures are bilateral and a neurological organization necessary for language – also exists in the right hemisphere, but with no observable function. Agriculture began to develop about 9.000 B.C.. The development of higher level structures of language began about 8.000 B.C. and parallels the development of social hierarchies and until 3.000 B.C. all human beings were void of consciousness (in the special sense Jaynes defines it). All civilizations before 1.000 B.C. – such as Assyria, Babylonia, Mesopotamia, pharaonic Egypt – were built, inhabited, and ruled by non-conscious people. After 1.300 B.C. very violent period of development began leading to the development of modern man. The duration of this period was surprisingly brief, about 1.000 years.

TGD:

a) The counterpart for this period in the development of individual would be years before puberty. 8000 B.C. corresponds to the birth of civilization whose development parallels the development of the higher level structures of language. The short violent period after 1.300 B.C. lasting for about 300 years can be identified as the counterpart of puberty which is often described as revolution at the level of physiology and neurophysiology involving violent hormone storms which would represent cell level counterpart for the violent developments at the level of society. Children have also sex which becomes manifest in puberty. The correlate of this was the birth of Eastern and Western civilizations with widely different philosophies about mind and nature. Presumably sex corresponds to two different paths in the plane defined by cognitive and emotional ages. An interesting prediction is that during puberty some brain areas, presumably the linguistic regions of brain, should mature and give rise to individuality at neuronal level. It would not be surprising if these neurons would provide cognitive representation for self image.

b) The hypothesis about a linear relationship between the time scales for the evolution of civilization and individual allow to make TGD model quantitative.

i) Take somewhat arbitrarily the beginning of puberty to be 14 years, identify 8.000 B.C. as the the age of civilization which corresponds to age of about 1 year which child has learned the first words. Mapping the period 1-14 years of childhood to the first 7.000 years between 8.000 B.C and 1.000 B.C. in the development of human consciousness and society, one finds that single year in development of child corresponds to about 540 years. The estimate is sensitive to the identification of the age of puberty and should not be taken too literally.

ii) At 3.000 B.C. when written language emerged for the first time corresponds to age of 9.3 years when also children usually learn to write so that the hypothesis about linear scaling hypothesis looks sensible. At this age child becomes also conscious about herself as a social being with the eyes of outsider: this means emergence of metaphor 'me' in the terminology of Jaynes. The ability to externalize own self and symbols of the spoken language seem to emerge at same time.

iii) The age of about 4 years after which child has first memories corresponds to 6400 B.C.. After the age of four child has primitive self image, begins to have memories and learns to cheat. During this period bicameral man was taken care by collective consciousness giving commands and guidance using auditory hallucinations. Absolute trust on others was necessary in groups of hunters, in groups producing their food by agriculture the luxury of cheating became possible. At this time agriculture had established itself finally and stable societies able to self-organize to more structured self-hierarchies existed.

iv) The counterpart of the puberty at the level of civilization is period of extreme violence and lasts about 1000 years: this corresponds in the time scale of individual to a period of almost two years.

c) With these assumptions the recent moment in the evolution of humanity corresponds to a cognitive age of about about 18.6 years: we are at the verge of adultery with fully developed EEG (and inventing the relationship of EEG with consciousness!). By scaling the average lifetime of about 76 years one obtains a prediction for the duration of our civilization. It should be roughly about 41.000 years; we would have still about 31.000 years left unless we use genetic or consciousness engineering to interfere the development! In this age young adults are finding life companion and it seems this occurs also at the level of society. Holistic Eastern and reductionistic Western civilizations are perhaps finding each other in new wave of quantum

theories of consciousness of which also TGD is example.

5.2 Breakdown of bicamerality

Bicameral civilizations became gradually more and more un-stable and during period 1.300-300 B.C. bicameral cultures collapsed: this collapse was partially due to catastrophic environmental changes. In TGD one can see this development, not as breakdown, but a natural development leading from childhood to adult age involving puberty as a catastrophic transition period. From the viewpoint of individual this was a loss but from viewpoint of collective self perhaps a relief! What the loss of bicamerality meant was a gradual transformation of collective communications by sensory hallucinations to communications by thoughts and emotions. Also the fraction of time spent in semitrance shortened gradually, the susceptibility to fall in semitrance by stress or other factors reduced, and the inhibition of right hemisphere by left hemisphere became stronger. It must be emphasized that this applies only to average human. It is quite possible to imagine modern bicamerals as individuals spending abnormally long fraction of time in cognitive and emotional semitrance.

5.2.1 Reasons for the breakdown of bicamerality

One can identify several reasons for the breakdown of bicamerality.

a) Semitrance mechanism was rather fragile and worked best for small groups with relatively simple social hierarchies. For instance, in ant society this mechanism might be excellent since ant brain is simple and is not able to self-organize significantly. Due to the extreme plasticity of human brain the parallel self-organizations of brain and social hierarchy developed increasingly complicated. The personal guidance of all members of society became a mission impossible for collective self.

b) The generation of self-hierarchy, analogous to decomposition of computer program into subprograms, helped partially but was accompanied by the increase of cognitive abilities and subjectivity. Increased subjectivity made direct communication unreliable since there was the danger that receiver only imagined the voice of God. Gods were not omnipotent since Godly IQ was determined by the IQ:s of the members of group which it represented. The development of the self narrative and long term memories meant that bicameral man could remember the mutually contradictory commands and advices. The large number of Gods giving conflicting commands together with the improved ability of men to remember destroyed

the childlike trust of the bicameral man to his God. The emergence of the written language made personal guidance un-necessary: Hammurabi's laws are example of the externalization of the communication between different levels of self hierarchy. It led to a further increase of subjectivity and bicameral mode of communication became impossible (un-necessary in alternative view point).

c) Purely bicameral society was extremely un-stable because the behavior was collective. Dramatic example of what could happen, was encounter of two bicameral societies. Also modern man can react in irrational manner in panick situations. Crusades are perhaps a good example about return of a primitive bicamerality. The collapse of Soviet Union is modern example of the un-stability of a strictly hierarchical society.

d) Inflation in the number collective selves made hierarchical uni-directional control of the lower hierarchy levels by higher impossible and also un-necessary. Complicated networks replaced simple hierarchy trees. The increasing intelligence of the individuals and the increase of the sizes of social groups implied the increase of the collective intelligences. This made possible the gradual transformation of the control and coordination function: God's did not give anymore commands but suggestions experienced as thoughts, emotions, moods and long term goals and voice of conscience. God's voice transformed to internal speech and thoughts and ideas and visions replaced auditory and visual hallucinations. Artists and thinkers are the modern version of bicameral man in close contact with Gods.

e) According to Jaynes, towards the end of the bicamerality the world was inhabited by all kinds of elves, gods and demons. A possible interpretation is that the brains of more modern humans filled universe with ELF selves representing concepts and more bicameral brains experienced in semitrance this electromagnetic life as spirits, elves, gods, angles and demons. More modern people experienced in semitrance this new form of life as inhabitants of the Platonic realm of ideas, something real but not to be taken quite seriously.

g) The model of self meant also the discovery of deceit. There are many situations in which deceit has definite survival value but for a bicameral man a life in a society accepting deceit was very difficult. This is perhaps the reason why the withdrawal from social interaction is one basic symptoms of schizophrenia. Also the direct telepathic experience of the negative attitudes of group of less bicameral men summing up to a message of collective self is rather painful experience for bicameral individual. The ability to live without the continual guidance of Gods has also obvious survival value. For these reasons natural selection might have favored individuals who were not

so sensitive to the semitrance induced by stress and thus establishment of subjectivity. An interesting question is whether similar selection occurs in the neuronal evolution during childhood. It would be also interesting to identify possible EEG correlate for the semitrance and test whether children's EEG has characteristics of schizophrenic's EEG.

5.2.2 Evidence for the breakdown of bicamerality

A lot of direct evidence for the breakdown of the bicameral mind and the development of modern consciousness comes from the writings scribed between 1300 B.C. and 300 B.C. Those writings gradually shift from objective God dictated reports to subjective expressions that reflect introspection. The jump from the objective writing of the Iliad to the subjective writing of the Odyssey (composed perhaps a century later) is dramatic. In the Odyssey, unlike the Iliad, characters possess conscious self-awareness, introspection powers, and can sense right, wrong, and guilt. That radical difference between the Iliad and the Odyssey is, incidentally, further evidence that more than one poet composed the Homeric epics.

The transition from the objective Iliad to the subjective Odyssey marks man's break with his 8000-year-old hallucinatory guidance system. By the sixth century B.C., written languages began reflecting conscious ideas of morality and justice similar to those reflected today. The Old Testament of the Bible also illustrates the transition from the writing of its earlier books (such as Amos, circa 750 B.C.) to the fully conscious writing of its later books (such as Ecclesiastes, circa 350 B.C.). Amid that transition, the book of Samuel records the first known suicide – an act that requires subjective consciousness with self narrative. And the book of Deuteronomy illustrates the conflict between bicameral and conscious mind. Likewise, the transition to consciousness is observed in other parts of the world: Chinese literature moved from bicameral consciousness to subjective consciousness about 500 B.C. with the writings of Confucius. And in India, literature shifted to subjective consciousness around 400 B.C. with the Upanishadic writings. American Indians, however, never developed the sophisticated, metaphorical languages needed to develop full subjective consciousness. As a result, their mentalities were probably nearer to bicameral when they first encountered the European explorers. For example, with little or no conscious resistance, the Incas allowed the Spanish "white gods" to dominate, plunder, and slaughter them.

5.3 Religion and bicamerality

God created us as his own image. This sentence might express metaphorically something very deep about the relationship between man and higher level selves. As our chromosomes provide representation for us, we provide representations of Gods in terms of memetic code. Gods are ideas, visions, theories, arts, all collective creations of human race and have concrete physical realization as higher level selves.

5.3.1 Emergence of monotheistic regions

As the bicameral mind broke down and societies collapsed, individuals one by one began inventing modern self consciousness to make decisions needed to survive in the mounting anarchy and chaos. On making volitional decisions, man for the first time became responsible for his actions. Also, for short-range advantages and easy power, conscious man began discovering and using deceit and treachery – behaviors not possible from bicameral minds.

As the voices fell silent, man began contriving religions and prayers in his attempts to communicate with the departed gods. Jaynes shows how man developed the concept of worship, heaven, angels, demons, exorcism, sacrifice, divination, omens, sortilege, augury in his attempts to evoke guidance from the gods – from external authorities. All such quests for external authority hark back to the breakdown of the hallucinating bicameral mind – to the silencing and celestialization of the once vocal and earthly gods.

An interesting aspect of the collapse phase was huge inflation in the number of god like beings: gods, angels, demons for all kind of things. An often heard explanation is that these Gods were a desperate invention of human wanting to preserve the belief on benevolent higher forces and to circumvent the crude fact of mortality. If our EEG frequencies correspond to topological field quanta of size about Earth, it is somewhat a matter of definition whether to regard these thoughts themselves as higher level selves. Perhaps increasingly modern man populated the world with the creations of his own mind and these creations were gods and demons like beings for those who still had bicameral brains. Note that children take completely seriously various characters of the fairy tales. This would suggest that the world of fairy tales is remnant of the world of bicameral individuals in the late bicamerality. A possible neurophysical correlate for this process would be inflation of frequencies in the EEG associated with the linguistic regions. Perhaps chaotic components in EEG spectrum represent this final period of

bicamerality.

The emergence of monotheistic regions and various philosophies was a natural outcome of rational thought combined with the loss of God's voices. The manner to save the God concept was celestialization: a fantastic metaphor expressing the fact that higher level selves correspond to topological field quanta of em fields in 80 km thick wave cavity between Earth's surface and ionosphere! Spirits transformed to what modern man calls concepts, ideas, memes without bothering to ponder in which sense these memes exist physically. In TGD framework the world of memes corresponds to ELF selves, geometrically to mind like space-time sheets, for bicameral man these ideas would express themselves as spirits and demons. It must be however emphasized that even Christianity fails to be strictly monotheistic: besides God devil and hierarchy angels belong to the hierarchy of higher level selves.

5.3.2 How Gods expressed themselves after the breakdown of bicamerality?

In TGD framework 'Gods' are not a fiction and the communication between various levels of self hierarchy can be seen as absolutely essential prerequisite for the self-narrative and for the survival of community even today. Cognitive and emotional semitrances associated with left and right brain hemispheres are the manners how 'Gods' communicate to modern man. The lack of sensory components however has led to illusion that these thoughts and emotions are totally our own or mere reflexes to the sensory input.

Right brain is the musical brain hemisphere. Right brain signs, dances and perhaps also writes poems (together with the left hemisphere?) and so does also modern man. It seems that the function of art is to induce prolonged periods of emotional semitrance. Everyone knows that peculiar half-conscious state after leaving movie theater after a good movie or after reading a good book. Artworks, especially music, could be the modern idols able to induce semitrance very effectively. God could also express itself formally by written language (Bible, Khorane,..) but the problem with this communication mode is that it does not involve direct experience unless these books induce semitrance as artworks (which they often do).

The replacement of semitrance with trance is also possible.

a) Indeed, the increase of subjectivity meant increasing fraction spent in a state in which right and left brain were entangled mutually. Entanglement with higher level self means in this case trance. Sleep is certainly this kind of state but higher level self does not express itself through motor activity

during sleep state except in case of sleep walkers and persons preaching in sleep state. The learning known to occur during sleep could be due to this mechanism.

b) One can imagine also a second mechanism based on trance. If the conscious experience of self is non-weighted average over conscious experiences associated with individual quantum jumps, the duration of our self must correspond to the duration of the physiological moment of consciousness of about .14 seconds. Of course, multiple selves consisting of these elementary selves and spanning interval of few seconds defining the duration of short term memory can be considered. This means that we are continually falling to trance states lasting for very brief period of time, which cannot be longer than say .14 seconds. During these periods higher level selves could communicate with human brain but this communication would be unconscious to us. The alternative possibility is that the contents of conscious experience of self is weighted average favoring the contribution of the last quantum jumps: in this case the the duration of our self could be much longer, even as long as wake-up period.

Interestingly, the personal profile of the prophet changed towards the end of bicameral period: in the beginning of this period prophets were genuine bicamerals but gradually they became more subjective and, as Jaynes notices, prophets preaching in trance became frequent. Oracles, sibyls and demon possessed people were very common towards the end of bicameral period. It is difficult to say to how high degree oracles were possessed. It seems that the teaching of oracles, usually illiterate young peasant girls believing in spirits (this is easy to understand), was the ability to reach complete trance state by induction.

Also, today, as throughout history, a symptomatic cure for "demon-possessed" people involves exorcising rituals that let a more powerful authority or god replace the authority of the demon. The New Testament, for example, shows that Jesus and his disciples became effective exorcists by substituting one authority (their god) for another authority (another god or demon). If these demons indeed correspond to higher level selves and if fight for survival is everyday reality also in the world of spirits (or memes), then one could quite well imagine what is involved with exorcism. The fight for survival at the level of memes is what is involved with exorcism.

5.3.3 Bible as a document about evolution of modern consciousness

In the transition from bicamerality to modernity the religion of intimacy transformed to a religion of worship. Gods were for a bicameral man what parents are for children. As Jaynes notices, the basic theme of Bible is this gradual loss of contact with personal God. This loss was comparable to the experience of child when she loses her parents. This development is best seen in how the personal portrait of a prophet developed in Bible. The first prophets like Amos were genuine bicamerals, they said what God commanded them to say, hardly even understanding what it meant. Gradually the contact with God became looser: visual hallucinations ceased first and also the voice of God was heard less frequently. Moses was a bicameral in a society which was losing contact with Gods: and Mosaic table established God's will in written form. Jaynes suggests, later prophets preached in trance which reflects the increased entanglement between left and right hemispheres. Towards the end of the bicamerality situation changed and the story of Job is a story about the violent conflicts between parents and child in puberty.

The stories of Bible represent the evolution of human consciousness in beautiful manner. Genesis starts with the sentence 'In the beginning there was word': how could one better metaphorize the first moment of cosmology of consciousness! The exile from the paradise should be a metaphor for some important transition in the development of society and the assumption that the developmental level of the civilization is measured by the average effective cognitive age of individuals allows to correlate this transition with corresponding transition in the development of child. The exile from paradise is presumably a metaphor for the moment when child becomes conscious of herself as a social being having private body which she wants to cover from eyes of the outsiders: Eve indeed felt shame for her nakedness. This occurs at the age of about nine to ten. This age would correspond to about 3.000 B.C. in the proposed time scale: the development of the written language began at the same time. Written language is what opens the way to a knowledge gained by logical deduction: eating of fruits of Good and Bad knowledge perhaps is metaphor for this. The development of written language led to Mosaic tables as first externalization of God's will in form of moral rules.

The story about the tower of Babel metaphorizes the inflation in the number of God's voices. This was caused by gradual subjectivization, by evolution of social hierarchy giving rise to new God's voices, and by devel-

oping communications between God-king states which perhaps started from trade: bicamerality allowed to hear also the voices of Gods speaking foreign languages.

The life and teachings of Jesus present culmination for the development of subjectivity. Jesus Christ was son of God which became human being and experienced what it is to be abandoned by God as the desperate cry 'My, God, my God, why hath thou forsaken me!' of crucified Jesus to his God demonstrates. Human beings were responsible for their own deeds but moral was not a mere collection of rational rules providing best strategy of survival as evolutionary psychologist define it. God was not however completely celestialized: there were moments of Mercy. A new element was the challenge of personal growth, of becoming Godlike: 'Be perfect as He is perfect'. 'Love your enemy as yourself' presents the recipe for the practical realization of goal. In Eastern religions and mysticism 'becoming perfect as He is perfect' corresponds to the Brahman=Atman experience.

One can expressing this much more technically. The evolution of consciousness corresponds to the increase of p-adic prime characterizing the effective topology of the mind like space-time sheets representing self. p-Adic prime represents a direct measure for the maximal information content of conscious experience. The physical correlate of the enlightenment experience is a phase transition increasing the p-adic prime of brain and making entanglement with selves which formerly represented higher level selves without a loss of consciousness and with experience of becoming God like being. This is presumably also the basic goal of the meditative practices. Perhaps enlightenment can be identified with 'loving state'. This kind of 'loving state' should make possible to affect the state of other living beings by semitrance mechanism, in particular DNA. There is empirical evidence that people in 'loving state' can affect the degree of winding of DNA [6].

5.4 Bicamerality in modern society

In trying to see correctly the role of bicamerality in modern society, it is good to keep in mind the analogy with human body with human civilization. Stem cells are bicameral men, newly born children eager to differentiate to societies representing various tissues, whose cells are at various levels of bicamerality. Differentiation involves also externalization, development of various means of non-telepathic communication such as chemotaxis and nerve pulse as well as emergence of 'Grandma neurons' serving as representatives for groups of neurons. Neurons of linguistic regions of left brain represent perhaps the most modern individuals of cell civilization.

The naive belief on the modernity as the final stage of evolution and bicamerality as primitive vestige of past which one should get rid of, taken to its extreme would mean life of left brain lobe in nutrient solution: even this is not enough since cognition would still represent contact with higher level selves. Personally I do not find this vision very attractive but Jaynes has got followers which he does not deserve, the proponents of so called Neotech [12], who after attack furiously against authorities but proclaims themselves as the only rational authority and declare a war against bicamerality which they identify as blind belief on 'authorities'.

5.4.1 What bicamerality is and what bicamerality is not

It is useful to make clear what bicamerality is and what is not. As Jaynes defines it, bicameral man was not automaton, he had volition but not conscious of it but experienced himself as a slave of his God. In contrast to Jaynes, the proponents of Neotech [12] claim that bicameral man is an automaton blindly obeying what they call 'authorities'. Even more illogically, they also tend to see the God-kings and bicameral leaders as power-hungry cheaters. Bicamerality in TGD is like the relationship between child and parents. Child has subjective consciousness but spends considerable fraction of time in semitrance state in which parents and possibly other higher level selves telepathically guide child. Also in this state, bicameral man has left brain volition and is not blind slave.

The proponents of Neotech identify bicamerality as a blind belief in authorities and regard religion and spirituality as mental weaknesses. They also see mystics as representatives of belief in authorities: perhaps this applies to some mystics but anyone having read Krishnamurti probably sees mystics as a complete opposite of belief in external authorities. Needless to say, the proponents of Neotech see religion, meditation, parapsychology, paranomal phenomena, alternative medicine, homeopathy, etc., as neocheating. Neotech program could be formulated as in invitation to final war to destroy even last vestiges of beliefs on "personal universe, with a type of intelligent purposive agency with it to which man can with rational confidence turn for helpful communication" (quote is from Rhines, one of the founders of parapsychology). I do not know whether Neotechdals were not disturbed if they were told that the realization of their great program would require return to a brain state without EEG resembling perhaps the mental state of a person suffering Korsakov syndrome and lost his entire past and future and having present consisting of fragments lasting only few seconds.

Needless to say, in TGD framework Neotech program could hardly sound

more insane as it does. Higher levels of self hierarchy are completely real, they are not mere 'authorities'. Their intelligence is sum over intelligences of its sub-selves and evolution of our consciousness means also evolution of consciousness at higher levels. From the point of view of higher levels of the self hierarchy the development of modern man is like the development of child to adult age. The communications occur still and are absolutely necessary for the self narrative and survival of the society. Higher level selves are however not anymore giving mere commands but bidirectional communication of the individual with collective intelligence having IQ which in some cases is astronomical as compared to that of individual. There is no doubt that the explosive development of science is basically the result of this interaction.

To declare a war against more 'authoritarian' forms of bicamerality is comparable to declaring a war against gravitational interaction. As the example of body as civilization shows, organs representing sub-civilizations at various levels of bicamerality are absolutely necessary for the functioning of organism. We cannot have post-modern muscles. Instead of declaring a war against all manifestations attributable to bicamerality we could try to understand the interaction between the levels of social self hierarchy. For instance, we could try to understand the mechanisms that raise leaders like Hitler and Stalin to power. Perhaps one could understand Stalin as a bicameral man living in society of more modern men and hearing the critical voices of the collective self of a society fallen to a primitive state. Perhaps paranoid schizophrenia is a natural reaction of child trusting deeply to his parents but learning that parents behind their formally parental behavior tell with the voice of God that they do not love her. Of course, in this framework Stalin, Hitler and alike are symbols for authoritarian collective selves, which are indeed very real. The knowledge that this kind of irrational and authoritarian collective selves have very real subjective existence (this was realized also by Jung who suggests that Nazism meant the arise of collective self which he calls 'Wotan') helps also to tame them. The recipe is extremely simple to state but difficult to realize: love, justice and trust. A bicameral experiencing love does not become stalinoid.

It perhaps helps to realize that our universe is full of selves at various levels of self development, some authoritative and other less authoritative and all these selves tries to live and prosper. Instead of destroying poetry as divine madness and banning music and art as vestiges of bicamerality, as Neotechdals suggest, one can imagine a world in which world of subjectivity is not either bicameral or modern but combination of both.

5.4.2 Emergence of a new kind of bicamerality?

I began to write this chapter in rather inspired state of mind. I was convinced that a return of 'modern' bicamerality, whatever that was to mean in closer inspection, was absolutely necessary for the survival of the human kind. I have already explained what new kind of bicamerality means. It is not authoritative master-slave relationship between levels of self hierarchy but communication which profits both individual and collective self since individual is mental image of collective self and contributes to its intelligence. New kind of bicamerality is not whole-timely state of consciousness but more like freely chosen mode of subjective existence. Various meditation practices provide methods to achieve also this state of consciousness. Essential parameter is the fraction of time spent in cognitive or emotional semitrance and this could correlated with what is called cognitive and emotional intelligence. Of course, cognition and emotion decompose to several factors and entire spectrum of time fractions must be used to characterize personality.

Why the return of new bicamerality might then be needed? There are several reasons. We live an era of post-modernism, not only Gods but also great narratives have disappeared from the mental landscape of ideal post-modern person. Only the leading edge science is searching for great visions. Even in science materialistic view about universe is still dominating despite that its philosophical shortcomings are obvious and new wider views about physical and subjective existence are aggressively repressed as I have personally experienced.

Increasing privatization and the decay of the social structures is a fact of life and modern self experiences himself more and more only a sum of symbol manipulation skills and experiences life meaningless in the world which is becoming increasingly abstract and machine like. Market economy has raised maximization of profit and effectiveness as basic values and moral has value only as one game strategy among many others. New extremely authoritative theocracies of business have emerged: the mere side incomes of a leader of great Finnish travel telephone company are comparable to the budget of a small university at the same when hunger ques are getting longer and longer and those people who still are employed are desperately fighting to keep their jobs. Neither the priests of these theocracies nor most ordinary people are able to see that there is something badly wrong. If same degeneration of the society to individuals, whose personal narrative consists of jobs lasting day or two terrorized by the theocracy of business, would occur at cell level, it would be called cancer.

Due to the revolution of electric communications, web and email are becoming the central nervous system of Mother Gaia, and are the basic prerequisite for a new kind of bicamerality. Geographical restrictions do not limit the formation of new kind of collective selves. If we indeed we have electromagnetic bodies of size of Earth, telepathic communication can in principle be established by electrical communications between persons, who never see each other's physical bodies. The emergence of the higher level collective selves could explain the magic attractiveness of web and email groups. Visual and auditory communication can be almost an equivalent of direct sensory face-to-face contact and virtual world technology is developing rapidly so that also other senses can be virtualized.

Web and other electrical communications could indeed become the central nervous system of Mother Gaia. We are the cells of this gigantic and enormously intelligent organism and we can communicate with it and receive parts of its wisdom via 'theofeedback' and also help it to evolve. Perhaps the almost irresistible trait to enter to computer terminal and to participate in discussion groups is telepathically communicated by Mother Gaia to our brains in short flashes of semitrance (or trance). Perhaps each period sending at terminal and sending messages to all these discussion groups is a counterpart of neural activity in brain. Perhaps it is not an accident that the number of human beings in recent world is of same order of magnitude as the number brain cells in human brain.

5.5 Are we really the first ones?

The fact that the explosion of our civilization to 'late-modernity' has occurred during only 500 years, which corresponds less than one year in life of individual in the proposed model for the development of civilization, forces to consider the possibility of advanced civilizations preceding the recent one. Taking fully developed frontal lobes as a prerequisite of a high tech civilization, one can consider the possibility that our civilization has been preceded by (at most) one civilization which degraded when climatic conditions changed radically. There are indeed myths about predecessors of our civilization. The notion of self hierarchy suggests that myths are not figments of imagination (bicamerals had rather limited imagination!) but narratives about the past history of human kind communicated by higher level selves to the individuals in semitrance. Therefore one cannot exclude the possibility that we have had predecessors. possibly destroyed by some catastrophe causing cooling of the climate.

Frontal lobes of human brain developed to their present size during

25.000-15.000 B.C. and calls, modifiers, nouns, the basic elements of language during this period. In the theory of Jaynes the years 15.000-10.000 B.C are a long period of no apparent progress followed by the 'age of names' 10.000-8.000 B.C.. Names could have however developed much earlier than Jaynes believes. Animals learn their name more or less as a command and child learns her name before she learns to speak and learns to use the names of her parents at the same time when she learns other words. The analogy between the development of child and civilization implied by 'Ontogeny recapitulates phylogeny' principle, suggests that names were gradually developed from commands of the collective self performed by some particular members of group were specialized. For instance, the Indians of North America have names of form 'Does something'. If this picture is correct then everything was ready for the development of civilization already at 15.000 B.C.. Whether or not we have had predecessors does not change the theory of Jaynes nor its TGD version about the development of our civilization.

According to Jaynes's theory the development of written language took about 5.000 years after primitive language structures had developed. If primitive language structures existed already before 15.000 B.C., civilizations mature to discover written language could have existed already 10.000 B.C.. There are some claims that there have been relatively highly developed civilization in Egypt as early as 9.500 B.C. which for some reason was devastated, presumably due to some catastrophe (say supernova explosion) changing the climate dramatically. There exists geological evidence for a short period of colder climate around 9.500 B.C..

There is also geological evidence for a catastrophic change of the climatic conditions 3200 B.C.: perhaps it is not an accident that written language began to develop at this time. Could it be that catastrophe formed people to larger groups so that collective IQ increased dramatically when critical mass was achieved, and made possible the discovery of written language? If this is really the case, the first cycle civilization could be regarded as an 'unsuccessful experiment' which failed to use the opportunity to discover written language in the catastrophe that occurred around 9.500 B.C..

Fractality suggest that the development of civilization reduces to the cognitive development of individual such that one year corresponds to about 540 years in the evolution of civilization. Civilization should correspond to higher level self, living organism. Most living organisms have sleep-wake cycle. This suggests that also 'civilization selves' could have similar cycle. If one year in the life of human corresponds to 540 years in the life of civilization then one day in the life of human corresponds to about 1.5 years which has order of magnitude of year. Thus year in the life of civilization could be

perhaps taken to be the counterpart of 24 hours in human life. Amusingly, one day (24 hours) in the development of a civilization corresponds to 2.7 minutes in life of a human: the period related to the hemisphere dominance is 2 minutes in case of a normal person!

Civilization should have also average lifetime which could relate to the climate cycles of Earth. According to Milankovich's theory, Earth's climate is determined in long time scales by astronomical factors. The changes in the shape of Earth's orbit around Sun have period of about 100.000 years. The precession of Earth's rotation axis about its average direction has a period of about 26.000 years and the gradual rotation of Earth's orbit and the precession Earth's rotation axis give rise to a climatic period of varying between 19.000-23.000 years having average value of 22.000 years. This cycle dominates at the latitudes near to the equator. The angle of tilt of the spinning axis of Earth with respect to the plane of Earth's orbit varies periodically with a period of 41.000 years. This cycle dominates at Northern latitudes. If the maximal cognitive age of individual is taken to be the biological age of earlier times of about 41 years then the age of civilization would be about 22.000 years. If the lifetime is taken 76 years, which is nearer to that of modern man one obtains 41.000 years for the lifetime of civilization. Thus one cannot exclude the possibility that these climate cycles could represent also lifetimes for civilizations. Of course, it might well be that the ability of civilization to manipulate its own genome changes the situation totally.

6 Semitrance and organisms as cell societies

Bio-systems are populated by binary structures analogous to brain hemispheres and seem to correspond to twin pairs of p-adic length scales differing by a factor of two which are especially abundant in length scales relevant to bio-systems: this in fact led already years ago to the idea that binary structures might be somehow fundamental for the functioning of bio-systems. The common feature of all binary structures in biological length scales is that the number of quantum jumps during estimated wake-up period is extremely large. This follows from the estimate of wake-up period (duration of the mental image defined by self) as the primary p-adic time scale $T_p = \sqrt{p} \times \tau$, τ about 10^4 Planck times, or more generally n-ary p-adic time scale $T_{p,n} = p^{n/2} \times \tau$. The number of quantum jumps occurring during the wake-up period is huge even at elementary particle level (for electron one has $p = 2^{127} - 1$).

Together with p-adic fractality this suggests that all these societies self-organize to universal basic structural and functional patterns differing only scaling. This highly nontrivial hypothesis can be tested by looking whether one can find clear structural and functional analogies between human societies and various cellular and subcellular societies. The scenario for the development of language and evolution of the civilization as a transition from bicamerality to modernity provides new insights also about the evolution of genetic code when translated to cellular length scale.

6.1 Semitrance and binary structures

Binary structures can be in three states, in semitrance, in sleep or trance or fully awake and it is interesting to try to figure out the functions associated with the sleep/trance and semitrance states.

6.1.1 Biologically relevant binary structures

Semitrance mechanism favors binary structures. It is not absolutely necessary that the components of the binary structure are identical and small symmetry breaking is certainly involved. Lipid layers of the cell membrane, pairs of chromosomes inside nucleus, and the strands of DNA form binary structures being analogous to the left and right hemispheres. In case of DNA the passive strand not participating in transcription of DNA to mRNA could correspond to the right brain hemisphere.

Peptides have non-symmetric binary structure consisting of sugar molecule which is same for all peptides plus radical, which determines the chemical properties of the protein. Sugar molecules form the back-bone of the protein. Sugar molecule and radical could be perhaps regarded as counterparts of the right and left brain hemispheres (not necessary in this order!) at the level of single aminoacid. Micro-tubules consist of tubulin dimers having also binary structure. Tubulin dimers can have several conformations.

6.1.2 Semitrance as a control mechanism of binary structures

Emotions affect greatly the functioning of body: in particular, emotions can affect directly neurons and cells. Hormones and various neurotransmitters are certainly involved with the emotional control but it is quite possible that semitrance mechanism is also involved. Semitrance could guarantee the coherent functioning of the cell society by providing organs, cells and even lower level structures with 'self narratives' and goal structures. For instance genetic determination could result in this manner. Of course, the

time scale would be totally different from human. Semitrance could be realized by the entanglement of the inner lipid layer of the cell membrane and second strands of genes with the higher level selves. Even the notions of cognitive and emotional semitrance might make sense for binary structures, even at DNA level. Cancer might be seen as a disease in which cells have lost contact with 'God' and behave hedonically.

An interesting possibility is that semitrance works also as a tool of volition. The most science fictive possibility is that semitrance of the muscle cells makes it possible to realize volition. This would explain the peculiar results of Libet's experiments demonstrating that the decision to initiate motor action comes later than the motor action itself [13] (the model for Libet's observations is discussed in the chapter "Time, Space-Time, and Consciousness" of [cbookII]). The explanation relies on the two causalities associated with subjective and geometric time. Also the geometric past must change in the quantum jump leading to a motor action. More precisely, the quantum average space-time associated with the final quantum history must be continuous which implies that new space-time surface begins to change before the geometric time value associated with the quantum jump. A concrete realization is in terms of time mirror mechanism and Libet's findings give direct support for the notion of magnetic body. A fascinating possibility is that various muscles or muscle groups have 'names' realized as magnetic and/or Z^0 magnetic transition frequencies and that volitional acts involve semitrance mechanism and quantum jumps changing the macroscopic configuration of organism. A less science fictive explanation for the causal anomalies is that same happens at the level of cognitive representation which has initial value sensitive coupling to motor organs.

6.1.3 Do sleeping binary structures quantum compute?

Binary structures can also spend some time in unconscious state like sleep and trance. During trance state the entire binary structure is strongly bound state entangled entangled and serves as an organ of higher level self. Concerning the interpretation of the sleep state, the first hint comes from the observation that entanglement is weak during sleep state. There is also some evidence for some kind of information processing occurring in brain during sleep state [14].

Quantum computing have been suggested as a metaphor for the information processing performed by brain. In TGD framework quantum computation corresponds to a period of macro-temporal quantum coherence generated when bound state entanglement is generated between two or more

systems is formed. Entangling systems lose their consciousness in the process but the composite system is in a state of consciousness in which mental images stay sharp since quantum jump sequence fuses effectively to single quantum jump and dissipation is absent: kind of "enlightened" state would be in question.

Sleep could thus correspond to a formation of bound state in which brain and body become part of larger system. This would suggest that high level quantum computing like activities indeed occur during sleep. Of course, quantum computing in the strict sense of the word is probably too restricted a notion to be applied in case of biological structures. It might be however that the unconscious information processing by brain known to occur during sleep is analogous to quantum computing.

What is encouraging is that symmetric binary structures seem to be tailor made for quantum computing in a generalized sense. Quantum computer indeed possesses binary structure in the following sense. Quantum computation amounts to calculating a value of function $i \rightarrow f(i)$, with i representing label for a quantum state. The quantum time development leads from state $|i\rangle \times |i\rangle$ to the state $|i\rangle \times |f(i)\rangle$ as quantum computation halts by quantum jump possibly leading to the wake-up of the quantum computer.

6.2 Organism as cell civilization

Organism as a cell civilization metaphor provides a new aspect to the vision about bio-systems as macroscopic quantum systems and the structural analogies are surprisingly close and might help to develop concrete models of biological self-hierarchies.

6.2.1 Evolution of civilization and cell differentiation

The quantum model for the evolution of the civilization from bicamerality to modernity suggests a generalization. Cell differentiation would obviously corresponds to ageing or 'modernization' process. Stem cells, abundantly present everywhere in the body except in heart and brain, would be cell children, innocent cellular bicamerals. Various tissue types are counterparts of civilizations and the degree of development should be characterizable by the degree of the differentiation experienced by the cells of the tissue. At cell level, 'externalization', the development of non-telepathic communications means the emergence of various chemical communications such as chemotaxis, hormonal communications and finally nerve pulse transmission and eventually leads to the emergence of the central nervous system as the

'modern' elite of the cell society. The immune system of the organism has a direct counterpart at level of the societies from ants to humans.

The structure of the central nervous system contains a hierarchical structure of layers. Sensory and motor organs and pathways represent its oldest and most 'bicameral' part. Brain stem and paleobrain represent next levels in the hierarchy having fixed wirings. Sensory and motor cortex, multi-modal association regions (present only in human brain) and frontal lobes and language regions consisting of Wernicke and Broca regions and supplementary motor cortex represent in this order structures which are increasingly flexible and 'modern'. with various dynamical neural circuits presumably representing language structures. Some regions of brain (for instance, neostriatum) have connections to almost everywhere in cortex: this reminds of the liberation from the restrictions of geography allowed by modern electronic communications.

The modernity of the neuron is measured both by its ability to re-self-organize and by the variability of its gene expression. Learning at neuronal level can be regarded as the first manifestation of the 'modernity'. Neural transmitters affect both the synaptic strengths directly and by affecting the gene expression of neuron. The first measure for the 'modernity' of neuron is the plasticity of these contacts. The number of social contacts is also a measure for the modernity at the level of human society and corresponds to the number of the synaptic contacts of the neuron with other neurons. The repertoire of self-expression of neuron by nerve pulse patterns looks at first rather restricted: it fires or does not fire. Of course, memetic code means dramatic progress in this respect since temporal patterns of nerve pulses become carriers of conscious information. There could be other modes of self-expression, say by coherent photons which allow mass media type self-expression. The neural transmitters associated with the synaptic contacts are invariants of neuron.

6.2.2 Structure of central nervous system

One can try guess the structure of the self-hierarchy associated with the central nervous system (CNS) by assuming that the development of CNS is structurally analogous to the development of civilization and applying 'Ontogeny recapitulates phylogeny' principle. The latter principle suggests that brain stem and sensory and motor organs as the oldest part of CNS are the most 'bicameral' parts of central nervous system: this is certainly as it should be. This part of central nervous system is indeed rigidly wired hardware of CNS determined genetically to very high degree. Linguistic

regions of brain in turn represent the most 'modern' part of the central nervous system containing dynamical brain circuits.

The architectures of village, town and modern city reflect also the structures of the social self-hierarchies. Same should be true in case of the central nervous system. The structures are present at several levels since central nervous system is like civilization consisting of civilizations consisting of... The roughest vision about self-hierarchy is provided by the architecture of a town. Brain corresponds to 'God's house' in the middle of the town and blood vessel circuitry and sensory and motor pathways are its streets and information pathways. Sensory organs, muscles and various organs are its habitants.

6.2.3 Brain as town?

Brain consists of three parts: brain stem, paleobrain and cortex and these parts seem to correspond to church in the middle of the town, old town and modern suburban areas. Middle-aged town could serve as a model of paleobrain with various brain nuclei being in the role of houses of the town. Neocortex would represent suburban regions of the brain town. Frontal cortex, associative regions and linguistic regions would be the most modern suburban areas. These brain regions are indeed extremely plastic. For instance, language regions which have been destroyed from left hemisphere at young age can regenerate on right hemisphere.

Reticular formation surrounding thalamus and brain stem is in the geometric center of brain and thus a natural candidate for 'God's house'. Reticular formation is known to control attention and has been one of the main candidates for the seat of consciousness in neuroscience based models of consciousness [15]. Semitrance might well be involved with the control of attention besides inhibition and excitation which correspond to 'externalized' control mechanisms. In TGD framework reticular formation would correspond to highest level of the self hierarchy in brain length scale. Reticular formation could also have the role of an over priest in the sense that the entanglement of brain and some ELF selves (at least that corresponding to 40 Hz thalamocortical EEG frequency which corresponds to $n = 3$ multiple of Na_+ cyclotron frequency) involves entanglement sequence *ELF self-reticular formation-region of cortex*. The EEG waves associated with the reticular formation should be non-propagating if this picture is correct.

6.3 Cell as a society

Society requires large number of nearly identical basic structural units: inside cell these subunits are proteins and quaternary structures formed by them. Inside the nucleus and other cell organelles these structures are DNA and various structures formed by it (genes, chromosomes).

6.3.1 Cell as a city state

Cell resembles the city state of the ancient Greece consisting of several cities governed by kings and surrounded by walls. In case of cell these cities correspond to various cell organelles having their own genome. These cities have many-layered self-hierarchy. Rather amusingly, fairy tales represent metaphorically the structure of cell. Chromosome pairs of tissue cells are like king and queen and chromosomes of germ cells are like princes and princesses. Sexual breeding corresponds to marriages between princes and princesses of the nuclear kingdoms of two city states (Note that ant nest and beehive are amazonian societies with queen ruling alone in her palace.). Walls surrounding the city state and the towns of city state correspond to cell membranes and endoplasmic membranes. More modern metaphor for cell nucleus is as a modern factory (producing building block proteins and using transcription factor proteins to communication purposes).

6.3.2 Nucleus as brain of cell/king's palace/factory

Chromosome decomposes into genes decomposing into DNA double strand. Genes are habitants of chromosome and are also like king-queen pair of the fairy tales. Only second DNA strand of gene, 'king strand' is transcribed. Continuing the right-brain-female metaphor to its limits and perhaps even beyond, one could guess that this strand is responsible for cognitive holism at DNA level whereas the passive strand would be responsible for emotional and sensory holism. Replication of DNA, cloning, does not occur spontaneously at the level of human society: plants however replicate by cloning. Thus DNA and chromosomes could structurally correspond to plants and animal kingdom respectively in the self-organization hierarchy. The two pairs of chromosome would structurally correspond to left and right almost symmetric halves of vertebrates. Of course, these analogies are only meant to suggest that similar self-organization process repeats itself in various length scales in fractal like manner.

Symbol function is basic mechanism at the level of human societies. Coding of genes to proteins is a natural candidate for symbol function at

the level of DNA. Proteins could be seen as a written language expressing the basic 'This is true' statements are represented by exons. 'This is not true' statements correspond to introns and are not represented at protein level although they are transcribed to mRNA. Exon-intron dichotomy has a curious analogy with male-female dichotomy in the past human societies: only man could express himself in the society whereas woman's place was at home. Amusingly, the genes of the immune system are very 'modern' in the sense that the change of sex is possible: exons can change to introns and vice versa!

6.3.3 Society of proteins

Several hierarchy levels are present also in the cellular society formed by proteins. Proteins do not possess have symmetric binary structure. This does not exclude the possibility of semitrance but could make quantum computing type activities impossible. Proteins resemble termites in the sense that they dynamically self-organize into various quaternary structures, dimers, trimers, etc... Tubulin molecules are an important example of quaternary structures. Tubulin molecules self-organize to dimers, which in turn self-organize to micro-tubules. In this view cytoskeleton formed by tubulin dimers, which most biologists believe to be just what its name suggests, is analogous to living bridges and other architectonic structures formed by termites. From the point of view of cell nucleus lipids are like stones in the wall of city rather than citizens themselves. Indeed, protein structures realize genetic code whereas lipid layers are structures making possible to realize memetic code and correspond to higher level of cognition.

6.4 DNA and the analogy with the development of language

One can try to apply the ideas about organism as cell society and about the evolution of language as establishment of the memetic code in the attempts to understand how genetic code has established itself. Along these lines chromosomes could be seen as mini brain and transcription factor proteins as the counterpart of the written language. Proteins can be regarded as written messages sent by genes to each other and activating or de-activating the transcription of gene. Proteins could be also seen as conscious messengers able to transfer more complex messages than classical field at resonant frequency (counterparts of inhibition and excitation become possible).

6.4.1 Identifying the counterpart of the spoken language at gene level

Language metaphor leads to a highly nontrivial predictions. The use of proteins as a communication tool should have been preceded by some other non-chemical communication tool analogous to the spoken language. Of course, these tools would be still in use. These communications could have been realized electromagnetically or in terms of classical Z^0 fields utilizing p-adic cognitive codes. Intronic memes should utilize this communication tool in the control of genes.

The communications could have been very simple: just gene specific command waking-up gene and activating it to transcribe mRNA to be translated to protein and/or generating a command waking-up some other gene. Each gene would have had its own eigen frequency (or set of eigen frequencies) which can be said to serve as its 'name' or a command activating only that particular gene and the generation of em or classical Z^0 field with this frequency wakes-up 'gene self' and activates transcription. The activated gene either produces building block protein and/or activates some other gene by producing (say) ELF em field with the characteristic frequency associated with that gene. The association of the 'spelled' frequency with the 'heard' frequency is completely analogous to the formation of association at neural level.

It is quite possible that already at this stage gene decomposed to a control region 'hearing the command' and analogous to the auditory regions of brain and the 'gene proper' analogous to the speech region of brain. Later the control regions developed to binding sites for proteins serving as transcription factors. At this stage also inhibition/excitation became possible and correspond to repressors/promoters and silencers/enhancers.

Rather than trying to identify the precise counterpart of sound as communication tool, one can try to identify the counterparts for the quantum mechanisms behind the auditory experience and cognition at DNA level. The quantum models for auditory experience and cognition at the level of cell membrane are extremely general and rely on the notion of cognitive antineutrinos. The model for cognition at cell membrane level generalizes also to the level of DNA and micro-tubular level [d2] and there is no reason hindering the formal generalization of also the model of auditory experience to DNA and also micro-tubular level.

In the course of self-organization each gene adopted its characteristic axial Z^0 magnetic field defining unique spin flip frequency effectively serving as the name of the gene initiating transcription process. The command came

either from a higher level self entangling with the passive DNA strand or was uttered by other gene generating ELF em field or some other perturbation with spin flip transition frequency.

This view suggests that Jaynes's vision about commands, modifiers and nouns preceding names is not correct: perhaps names emerged before nouns. That child learns names and nouns simultaneously and that even animals learn their name supports this view. Of course, it is to some degree a matter of taste whether one regards magnetic transition frequency waking-up only single gene as name or a command heard by only this particular gene. Note that names might have emerged from the specialization of the members of group to various tasks: the command obeyed by a particular individual became gradually the name of the individual. The names of Indians of North-America are indeed of form 'Does something'.

6.4.2 Proteins and written language

The un-reliability of the speech like communications could be seen as one reason which might have led to the emergence of proteins as 'written language' which is slower but more reliable and much more precise. If the proposed analogy relying on the universality of self-organization patterns works, 'written' language at DNA level developed from the 'spoken' language, when proteins began to signify the name of preferred genes in the sense that they began to bind to the control units of these genes and act as transcription factors. Protein language should have developed gradually (possibly through intermediate forms) like written language did. The rules were established by quantum self-organization and made possible by the weak initial value sensitivity of the asymptotic patterns of quantum self-organization. It would be interesting to try to identify the analogs of syntactic structures of the language from the structure of the genome and proteins. The development of society and language occurred in a parallel manner and structures of the society were paralleled by the structures of the language. This suggests that the syntactic structures of 'gene language' should correspond directly to various structures of the organism. Clusters form by Hox genes provide an example of higher level structural units of this kind [d1].

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