

TECHNIQUES ALTERING STATES OF CONSCIOUSNESS: PSYCHO-PHYSIOLOGICAL CORRELATES AND QUANTUM-INFORMATIONAL IMPLICATIONS

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Abstract. In the first part of the chapter, the psycho-physiological correlates of several Techniques Altering States of Consciousness are presented, demonstrating more or less characteristic features in Meridian (Psycho) Therapies, Microwave Resonance Relaxation, Autogenic Training, Transcendental Meditation, Musicogenic States, Healer/Healee Interactions, and Alertness/Drowsiness. Such a tool might be useful in evaluating the effectiveness of different techniques for stress reduction and for altering expressions of consciousness. In the second part of the chapter, fundamental field-related macroscopic Hopfield-like quantum-informational basis of the underlying quantum-holographic paradigm are considered, with implication that whole psychosomatics might be considered as a quantum hologram, both on the level of individual and collective consciousness. This enables quantum-holographic hierarchical fractal coupling of various hierarchical levels in Nature.

Keywords: altered states of consciousness, psycho-physiological correlates, meridian (psycho)therapies, microwave resonance relaxation, autogenic training, transcendental meditation, musicogenic states, healer/healee interaction, alert wakefulness and drowsy wakefulness, acupuncture system, consciousness, bodily hierarchical Hopfield-like neural networks, quantum neural holography, quantum decoherence, quantum-holographic paradigm, explicate order, implicate order.

1. INTRODUCTION

Consciousness is one of the oldest scientific problems, recognized already in ancient times, both in the civilizations of East and West. However, in contrast to scientific problems related to the structure of matter and physical interactions, and their implications for understanding of macroscopic and microscopic structural levels and phenomena, successfully scientifically resolved during past three centuries of explosive development of natural sciences, the problem of consciousness has remained *scientifically* unresolved to date. The reasons should be sought in extreme complexity of the phenomenon of consciousness, which required development of fundamental theories and methods, conceptually suitable for resolution of the problem.

Consciousness has been the central theme of philosophical essays for a long time from the very beginning of philosophical thought, or traditional esoteric practices of the East and West which have reached significant level in control of altered states of consciousness with significant philosophical and religious implications. The first scientific attempts to enlighten the phenomenon of consciousness appeared only in psychology of the second half of 19th century (through development of psychophysics and theories of personality), physics of the beginning of 20th century (through development of quantum mechanics and articulation of the problem of the so called wave function reduction, and the role of observer in that process), and computer sciences of the second part of 20th century (through development of artificial intelligence and the conception that the whole cognitive process can be reduced to a computer algorithm). However, due to scientific methodological difficulties the problem of consciousness was afterwards marginalized in these sciences.

Now prevailing scientific paradigm considers information processing within the central nervous system as occurring through *hierarchically organized and interconnected neural networks* [1-7]. It seems that this hierarchy of biological neural networks is going down sub-cellular microtubular *cytoskeleton* level, being according to some scientists a kind of interface between *neural* and *quantum* level [8] – the last one having within the Feynman propagator quantum approach an *analogous* mathematical formalism as the Hopfield associative neural network [9]. The mentioned analogy opens additional fundamental question how *quantum* parallel processing level gives rise *classical* parallel processing one, which is a general problem of relationship between quantum and classical levels within the *quantum decoherence theory* as well [10]; naturally, the same question is closely related to fundamental nature of *consciousness*, whose in-deterministic manifestations of free will [11-13] and other holistic manifestations of consciousness, like transitional states [13] and altered states of consciousness [14], conscious/unconscious transitions and consciousness pervading body [15] – necessarily imply that some manifestations of consciousness must have deeper quantum origin, with significant *psychosomatic and transpersonal implications* (cf. Sect. 3).

In Sect. 2, the *psycho-physiological correlates* of several *techniques altering states of consciousness* will be considered, demonstrating more or less characteristic features in meridian (psycho)therapies, microwave resonance relaxation, autogenic training, transcendental meditation, musicogenic states, healer/healee interactions, and alertness/drowsiness. Such a tool might be useful in evaluating the *effectiveness* of different techniques for *stress reduction* and for *altering expressions of consciousness*.

In Sect. 3, the *psychosomatic-cognitive implications* of *altered states of consciousness* and *holistic medicine* are considered, implying that whole psychosomatics is quantum hologram, on the level of individual and collective consciousness, which resembles Hinduistic relationship *Brahman/Atman*, as wholeness and its part which bears information about wholeness. This might serve as a basis of *quantum-informational medicine* related to *quantum-holographic* fractal coupling of the *cellular level/acupuncture system/consciousness/collective consciousness*.

2. PSYCHO-PHYSIOLOGICAL CORRELATES OF TECHNIQUES ALTERING STATES OF CONSCIOUSNESS ¹

The key problem of any future theory of consciousness is how to incorporate *altered states of consciousness* within a *new paradigm* (as elaborated in Sect. 3). This was our motivation to start examination of *psycho-physiological correlates* of several *consciousness altering techniques* (meridian (psycho)therapies, microwave resonance relaxation, autogenic training, transcendental meditation, musicogenic states, healer/healee noncontact interaction, and drowsiness) [16-18] – motivated also by search for rapid and reproducible EEG identification of different states of consciousness, useful in evaluating the effectiveness of consciousness altering techniques and related stress reduction.

¹ Part 2.1 of the chapter was prepared by D. Raković, Ž. Mihajlović Slavinski, M. Sovilj, S. Maksimović, N. Stevović, J. Bojovic, I. Džamić, S. Jovičić, and Dj. Baljodzović – with technical assistance of J. Stilin Mihajlović, J. Kunosić, M. Mladjenović, and M. Vasić which is hereby greatly acknowledged. Parts 2.2-2.7 of the chapter were prepared by D. Raković, M. Ostojić, M. Tomašević, D. Radenović, P. Šuković, and L. Škarić – with helpful discussions, data processing, and/or technical assistance of E. Jovanov, V. Radivojević, Ž. Martinović, N. Rajšić, Z. Šundrić, M. Čosović, Z. Jovanović-Ignjatić, Z. Arsenijević, M. Car, D. Kušić, and S. Stanojlović which are hereby greatly acknowledged.

2.1 Meridian (Psycho)Therapies

The Meridian (Psycho)Therapies are also called Energy (Psycho)Therapies, because of the common observation of majority of practitioners that psychological problems can be understood as manifestations of energy disruptions of energy configurations in the human energetic field. In essence, systems of *Energy/Meridian (Psycho)Therapies* (EMPTs) represent an application of the energy paradigm to the removal of psychological and emotional aberrations, diseases, and other maladies. The proponents of these therapies believe that the causes of these aberrations are disturbances in the energy field (or aura) of a human being, fundamentally manifested as energy structures, which naturally manifest themselves neurologically, biochemically, cognitively and behaviourally. The introduction of the energy paradigm into the fields of psychotherapy and spiritual technology represents a quantum leap in the understanding of these important areas, since it makes us look at them from an entirely different viewpoint. Psychological problems are resolvable far faster if we approach them as if they were disturbances in energy fields, than if we start searching for their historical causes – as was characteristically done in earlier times, beginning from the Freud psychoanalysis. Changing the structure of the energy fields that are at the roots of problems is enough to create healing or a shift in the Spiritual Consciousness. In this subsection we shall mention just few main systems of EMPTs and then Deep PEAT (*Primal Energy Activation and Transcendence*), Basic PEAT, DP4 Method, and Fore-Finger Method [19].²

Thought Field Therapy (TFT) was invented by clinical psychologist Roger Callahan, who started this energetic revolution in psychology and psychotherapy; TFT entails diagnostic procedures to determine meridian disbalance, combined with percussing at specific acupuncture points in a prescribed sequence (algorithm) in order to treat an array of psychological problems. *Emotional Freedom Technique* (EFT) was developed by Gary Craig, one of the first disciples of Roger Callahan; he founded it on the same basis as TFT, but, judging by the statements of many practitioners, it is simpler and more efficient than TFT, because it uses just one algorithm for all disturbances. *Tapas Acupressure Technique* (TAT) was created by Tapasvini Fleming, who fruitfully connected her knowledge of acupressure with meridian systems; briefly, TAT is a 'do-it-yourself' therapeutic technique, based on traditional Chinese Medicine, which is extremely efficient with all kinds of allergies, sensitivities with different kinds of food and negative environmental influences. *Eye Movement Desensitization and Reprocessing* (EMDR) was developed by Francine Shapiro, and works by diminishing sensitivity through eye movements and reprocessing traumatic incidents; it is simple and efficient method for healing traumas and disorders connected with anxiety.

On the other hand, in associative sequence during our *Deep PEAT*, in 'frozen' photo of problematic situation during *Basic PEAT* and *Fore-Finger Method*, and in alternating visualizations of the polarities of self/problematic situation in *DP4 Method*, the simultaneous effects of *visualization* and *touching of some acupuncture points* (in *Deep PEAT*, *Basic PEAT*, *DP4 Method*) or *several counter-clockwise rotations of the stuck 'frozen' photo* (in *Fore-Finger Method*) might be interpreted as *smearing and associative integration of the memory attractor of psychosomatic disorders* (cf. Sect. 3), through continuous imposing of new boundary conditions in the energy-state space of acupuncture system/consciousness. Having in mind very high efficiency of transpersonal circular meridian (psycho)therapeutic processes, i.e. from all relevant meta-positions of other persons involved in the treated trauma, this implies that these interactions of the trauma-related persons have quantum-gravitational origin in transitional states of the trauma-related persons (cf. Sect. 3). It should be also pointed out that discovery and neutralization of the client *Primordial Polarities* (Yin-Yang) during *Deep PEAT*, points to most fundamental roots of client's compulsive and unconscious life game, i.e. on deep roots of thought processes on the very borderline (*quantum-coherent*) *implicate order* – (*classically-reduced*) *explicate order* of the quantum-holographic individual/collective consciousness. In the moment of neutralization and getting conscious of *Primordial Polarities*, on the one hand they become quantum-entangled in quantum-coherent state of the *implicate*

² Deep PEAT, Basic PEAT, DP4 Method, and Fore-Finger Method are Meridian (Psycho)Therapies developed by Živorad Mihajlović Slavinski.

order, and on the other hand they become psychologically integrated in classically-reduced state of the *explicate order* of client's consciousness – and Being regains its spiritual and psychological freedom out of previously unconscious and compulsory life game.

The experiment with meridian (psycho)therapies was conducted in two parts, mutually separated for two months. In the first part of experiment, the 17 volunteers were asked to remove their vividly recalled three traumas by application of the Fore-Finger Method, Basic PEAT and DP4 Method, subsequently. In the second part of experiment, the 15 volunteers were asked to remove their recalled psychological traumas and reveal their Primordial Polarities by application of the Deep PEAT.

In both parts of the experiment, we studied psycho-physiological correlates (Gas discharge visualization (GDV) bioelectrography, Biofeedback electrophysiological measurements, Standard psychological tests) of the effects of the meridian (psycho)therapies described above, applied to volunteers with (more or less significant) psychological traumas.

GDV bioelectrography [20] was applied by using GDV camera type PEL-KO, to monitor the psychosomatic state of the volunteers just before and after application of every meridian (psycho)therapeutic method, by measurement of the stimulated electro-photon emission from all ten fingers in volunteers, whose information is software-transformed via an expert system based on Chinese and Indian traditional medicines into the human energy state, providing indirect information about the state of organs, meridians and chakras.

Biofeedback electrophysiological measurements [21] were applied by using ProCom2 device with software Biofeedback Infinity, to monitor basic skin response (BSR) of the volunteers before, during and after application of every meridian (psycho)therapeutic method, quantified via skin conductance (SC), providing indirect information about degree of skin moisture i.e. physiological excitement of the organism. Electrical conductance below 1 μS is considered as a measure of low physiological excitement, and above 5 μS as a measure of high physiological excitement.

Standard psychological tests consisted of the battery of three tests: (1) Digit Span test from WAIS-R, consisting of repeating the number series in forward consecutive direction (providing a measure of verbal attention span) and repeating the number series backwards (which assesses the short term memory) [22]; (2) MMPI (Minnesota Multiphase Personality Inventory) multidimensional personality test consisting of 201 items [23] (with 'correct'/'incorrect' answers used to calculate scores in one or more of the total of 11 scales comprising the MMPI); (3) CON-6 cybernetic battery of six conative tests, administered in the form of a questionnaire consisting of 180 questions [24] (with answers to the statements offered as five degree scales ranging from completely true' to 'completely false', used to calculate the scores of the six conative scales).

The results obtained are presented below.

For the first part of the experiment monitored by GDV bioelectrography, in 8 volunteers without significant traumas the biggest changes (the lowest t-test values) of distributions/mathematical expectations before and after meridian (psycho)therapies occurred at Vishuddha chakra (with t-test value 0.04) in the Fore-Finger method and at Sahasrara chakra (t-test value 0.09) in the Basic Peat method, while the smallest overall changes were observed in the DP4 method. In 9 volunteers with significant traumas their changes in distributions/mathematical expectations before and after meridian (psycho)therapies are far greater (far lower t-test values), which is the most apparent at Muladhara (with t-test value 0.04), Swadhistana (t-test value 0.11), Manipura (t-test value 0.07), and Anahata (t-test value 0.07) chakras in the Fore-Finger method, at Manipura (with t-test value 0.02) and Sahasrara (t-test value 0.09) chakras in the Basic Peat method, and at Muladhara (with t-test value 0.09) and Vishuddha (t-test value 0.11) chakras in the DP4 method.

For the first part of the experiment monitored by Biofeedback electrophysiological measurements, for 8 volunteers without significant traumas the mean values of the conductance were 3.7 μS during the visualization of the problematic situation and 2.6 μS after the Fore-Finger method applied (with t-test value 0.001), 4.4 μS during the visualization and 3.7 μS after the Basic Peat method applied (t-test value 0.092), and 4.9 μS during the visualization and 3.7 μS after the DP4 method applied (t-test

value 0.006). On the other hand, the higher values of the conductance were found in 9 volunteers with significant traumas, with mean values of the conductance 5.3 μS during the visualization of the problematic situation and 3.2 μS after the Fore-Finger method applied (with t-test value 0.002), 4.9 μS during the visualization and 4.1 μS after the Basic Peat method applied (t-test value 0.059), and 5.6 μS during the visualization and 4.3 μS after the DP4 method applied (t-test value 0.004).

For the second part of the experiment monitored by GDV bioelectrography, in 15 volunteers without significant traumas the biggest changes (the lowest t-test values) of distributions/mathematical expectations before and after Deep Peat meridian (psycho)therapeutic method occurred at Anahata (with t-test value 0.01), Vishuddha (t-test value 0.04) and Ajna (t-test value 0.02) chakras.

For the second part of the experiment monitored by Biofeedback electrophysiological measurements, the mean conductance in 15 volunteers without significant traumas was 6.0 μS during the visualization of the problematic situation, and 4.8 μS after the Deep Peat method applied (with t-test value 0.024).

The effects of meridian (psycho)therapies on standard psychological tests, completely evaluated on only 4 volunteers passing both parts of experiment, indicate no change in scores in the Digit Span test and in the CON-6 test, before and after the meridian (psycho)therapies. On the other hand, the results obtained using the MMPI test offer evidence of significant changes on the personality level of the subjects, before and after the meridian (psycho)therapies: the averaged profile of the subjects before (psycho)therapies indicated the dominant presence of the symptoms belonging to the neurotic spectrum (depression, hypochondria, hysteria, anxiety), while after the application of (psycho)therapies, symptoms related to anxiety, somatization as a way of dealing with stress, and repression of intrapsychic suffering were alleviated significantly (and can no longer be regarded as indicative of clinical syndromes), while only symptoms related to depression remained significantly increased.

2.2 Microwave Resonance Relaxation

The application of microwave resonance therapy (MRT) in biomedicine is a new trend [1,25,26], revealing sharply-resonant characteristic eigenfrequencies and sensory responses of the disordered human organism, when applied upon acupuncture points. Such quantum-like coherent characteristics of MRT inspired Sit'ko and coworkers to propose a quantum physics of alive [26], considering biological structures as macroscopic quantum systems with nonlocal self-consistent macroscopic quantum potentials, giving rise to nonlinear coherent electromagnetic (EM) microwave (MW) long-range excitations of biological nonlinear absorption medium with the cells as active centers.

In the above context the explanation for the efficiency of the MRT, as a noninvasive biophysical medical treatment, should be sought [27]: some disorders in the organism (related to local changes of dielectric properties of tissues and organs) give rise to deformation in the standing wave structure of the MW EM field of the organism, which influences corresponding changes in the spatio-temporal structure of the acupuncture system, and consequently resonance frequencies of its meridians, resulting in some disease. During MRT therapy, applying the MW source at a corresponding acupuncture point the excited meridian of patient's acupuncture system relaxes to the previous healthy condition, while reaching its normal resonance frequency responses upon the wide spectrum MW source – and following physiological mechanisms of acupuncture regulation (via nervous and endocrine systems [28]) the organism biochemically overcomes the disease.

The MRT was applied by the wide spectrum apparatus POROG-3, and the measurement of frequency was achieved by the narrow spectrum apparatus AMRT-01, adjusted manually. The frequency range of the POROG-3 is 52-78 GHz, with the output power density of 0.2-5 $\mu\text{W}/\text{cm}^2$. MRT generator was applied on acupuncture points in following order: Du 20, and the left-side points Li 4, Pc 6, H 7 and Ap 55, which resulted in relaxation [28]. The choice of the acupuncture points for the relaxation seance was achieved on the basis of well known principles of acupuncture stimulation, characteristics of the chosen points, and the therapist experience.

The study was carried out on 28 healthy adult volunteers (13 males and 15 females).

The experiment was conducted in a soundproof room, dimly lit for observation. Subjects were laid comfortably. Each session was divided into three sequential periods: (1) relaxing 5 min with eyes closed; (2) MRT 20 min; and (3) relaxing 5 min with eyes closed. During the first and third periods two random samples, one minute each, were recorded for every subjects. The EEG records were stored on a hard disk.

The subjects were classified in two groups: the group 1 (11 subjects) not previously subject to the MRT treatment, and the group 2 (17 subjects) being subject to the MRT in the past two years.

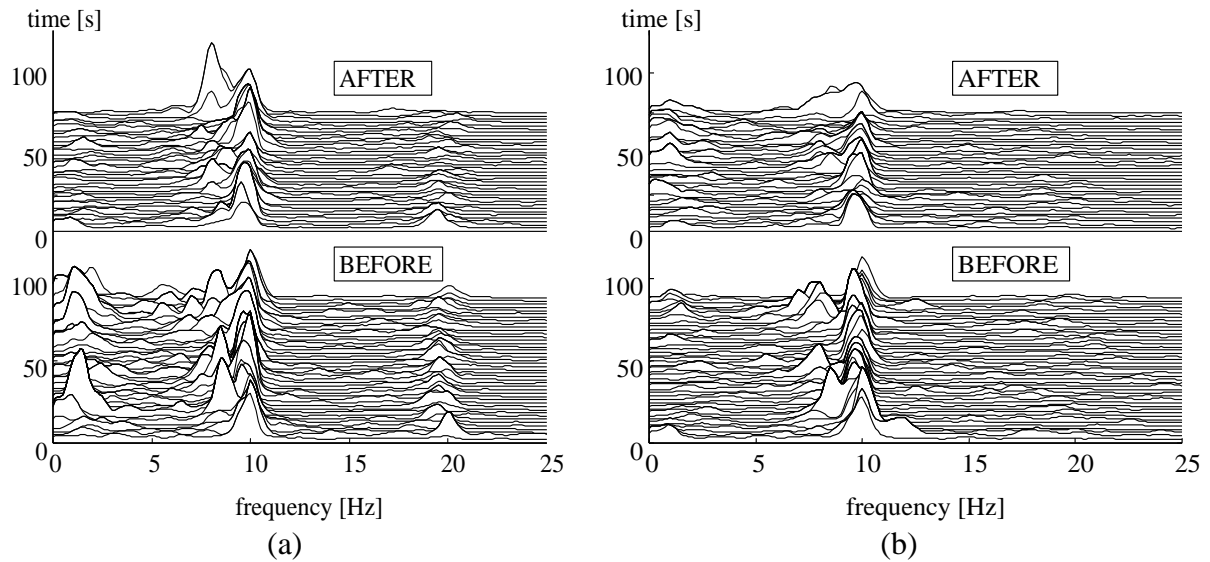


FIGURE 1. (a) Compressed power spectral arrays of the EEG for subject 7 obtained from the electrode C3 before and after MRT treatment, showing the decrease in the EEG power in all frequency bands; (b) Compressed power spectral arrays of the EEG for subject 18 obtained from the electrode T3 before and after MRT treatment, showing the decrease in the EEG power in α band.

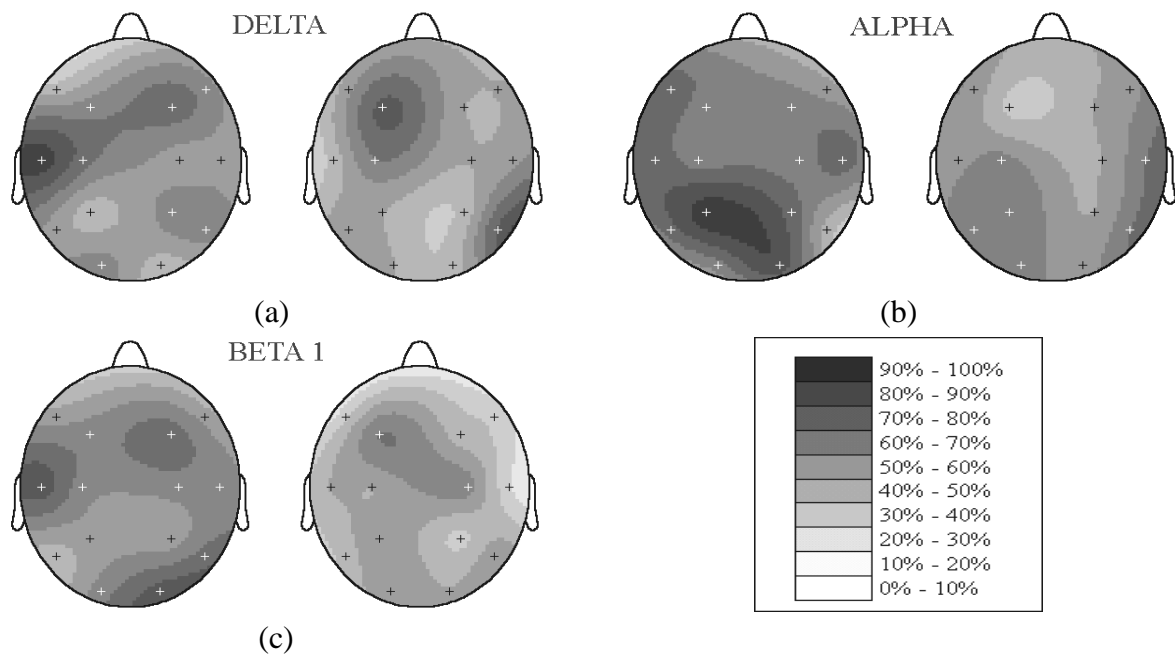


FIGURE 2. The topographic mappings of the number of subjects (in %) of the group 1 (left) and the group 2 (right), having the significant EEG power changes in the: (a) δ band (1-4 Hz), (b) α band (8-13 Hz), and (c) β_1 band (13-18 Hz). The gradual percentage changes are presented in various degrees of shading, as designated in the insert.

Both groups of subjects have significant changes in the EEG power over the whole head in the α and β_1 frequency bands, with observation that a percentage of subjects with minor reactions is much less in the group 1. The group 2 has also the significant EEG power changes over the whole head in a δ frequency range.

Two examples of spectral arrays in our subjects (N^os 7 and 18), showing the decrease in the EEG power, are shown in Fig. 1(a, b). Within the whole frequency range (1-30 Hz), 37 channels in the first group and 22 channels in the second group with the power changes in more than 50% subjects are notified. The changes are evident in δ , α , and β_1 frequency bands. In both groups of subjects, a decrease in the EEG power is more frequently observed than an increase. As an illustration, in Fig. 2(a-c) the topographic mappings of the number of subjects (in %) having the significant EEG power changes in the δ , α and β_1 frequency bands, for the two groups of subjects are presented.

The changes in coherency are not too significant. Most prominent changes, over the whole frequency interval (1-30 Hz), are registered in occipital region (O1 and O2). A decrease in the coherency is generally observed.

2.3 Autogenic Training

Autogenic training (AT) is a medically widely applied auto-suggestive technique of relaxation of muscles and blood vessels, recognition of the body feeling of breath and heart, and exercise for concentration, based on Schultz's idea of the equivalence of muscular and mental strain. By auto-suggestive short relaxing contextual messages associatively memorized at the subconscious level one's undesired psychosomatic reactions in daily stressful situations are softened: it can help in all functional psychosomatic disorders, where mistakes produced by habits should be corrected, or where severe emotional reactions should be smothered [29]. Technique of autogenic training is not only recommended for everyday anti-stress self-aid, but its short morning and evening exercising at home is a necessary condition for its success.

Although AT, in the context of psychotherapy, might be classified into relatively 'shallow or pragmatic methods, which are not concerned with the background of mental, neurotic, and psychosomatic disorders, but directly attack and remove the symptoms of these disorders' [30] – nevertheless Poro in his renowned *Encyclopaedia of Psychiatry* points out its great practical significance: 'Autogenic training is the most contemporary method of medical relaxation' [31].

The study was carried out on 30 adult volunteers who had been practicing the AT technique from 2 to 60 months, with a mean of 45 months. There were 3 males and 27 females, whose ages varied from 24 to 69 years with a mean age of 46 years. Prior to the experiment, subjects were verbally informed about all aspects of the experimental procedure. We intended to take the test with wide range of health conditions of volunteers. So 22 of them have been completely healthy and 8 of them have some medical problems taking medical drugs permanently (for whom AT has appeared significantly helpful, as they were taking less drugs).

Electroencephalograms were recorded by 19 EEG channels and 3 additional polygraphic channels (ECG, RESP, EMG) in order to follow the level of vegetative state. The experiment was conducted in a soundproof room, dimly lit for observation. Subjects were laying at the bed comfortably. Each recording session was done without any physical contact, moving the volunteer or opening his eyes. A session lasted about 10 minutes each. In first 2 minutes the apparatus was set up and volunteer was suggested to keep his/her eyes closed performing no exercise. Later on the suggestion was given that the AT exercise should start. After approximately 8 minutes volunteer finished his exercise, opened his eyes and told that he completed the task.

We selected three sequences of 60 s each: the first 60 s before AT suggestion, the second 60 s in the middle of the AT record, and the third as the last 60 s of the AT record. Our analysis has been performed on these three sequences for every volunteer. In the case of large amount of

artifacts (e.g. slow-waves due to eyeball, eyelids, or other movements) recognized after careful visual inspection, these epochs were rejected from analysis [32]. The applied methodology corresponded closely to the demands of psychophysiological experiments [33].

Experiment shows significant changes in power spectral density during experiment, especially in lower (δ , θ) and higher (β , γ , ω) bands.

The representative examples of spectral arrays for subject N° 16 are shown in Fig. 3 (with decrease in α band activity, and special increase in lower δ and θ bands and less increase in higher β band).

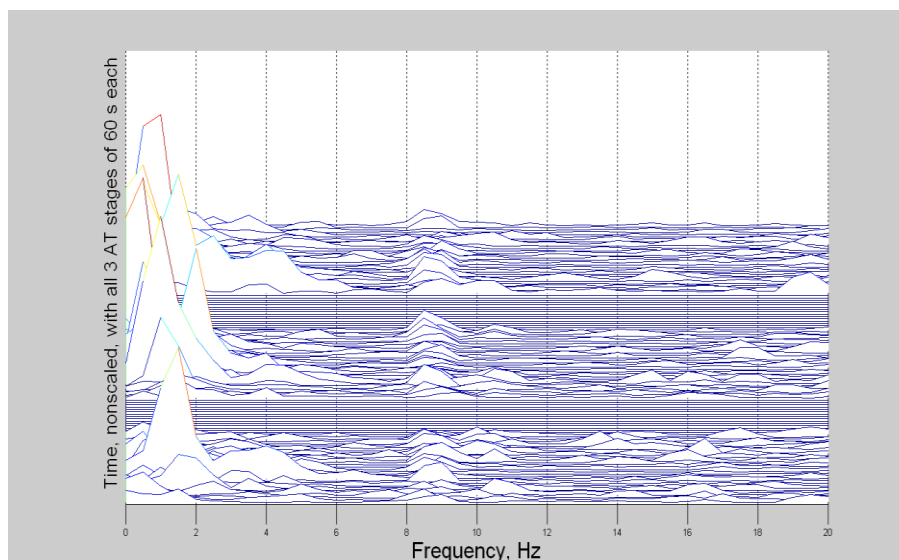


FIGURE 3. Compressed power spectral arrays of the EEG, in the frequency region 0-20 Hz – for subject N° 16 obtained from the electrode Fz before, in the middle, and at the end of AT. The rise in δ and θ bands is obvious.

Our preliminary U-test calculations have been performed to check out statistical significance of the mean coherence between the paired channels, showing most significant results for the F7-F8, T5-T6 paired channels in δ band.

2.4 Transcendental Meditation

In transcendental meditation (TM), normally practiced for periods of twenty minutes twice a day, the subject is instructed to sit quietly with eyes closed and is then taught to repeat a certain type of sound or ‘mantra’ according to a particular definite set of instructions. The mantras are a set of short speech sounds, meaningless in themselves, preserved by an ancient Vedic tradition and assigned to individuals by the instructor on the basis of a set of objective rules which is trained to apply. They are chosen so as to ‘resonate’ with the structure of an individual nervous system.

Subjectively, the meditator usually reports an immediate sense of bodily quiet and relaxation. An important feature of the subjective experience of the TM technique is the ‘expansion’ of consciousness [34]. As the mantra is experienced in successively finer stages, subjects report that the spatial extent of conscious self-awareness, which ordinarily seems to be localized in the area of head and upper body, undergoes a progressive expansion.

Wallace, Orme-Johnson, and Farrow [35], among others, have reported physiological changes during the practice of the TM technique that are consistent with these predictions, such as reduced oxygen uptake, reduced CO_2 elimination, constant respiratory quotient, reduced respiratory minute ventilation, reduced respiratory frequency, reduced heart rate, increased basal skin resistance, and EEG changes indicative of alertness. Wallace was led to propose that the TM technique produces a fourth major state of consciousness in which the mind remains alert while mental activity reaches a least excited state.

The study was carried out on 25 healthy adult volunteers who had been practicing the TM technique from 0.2 to 25 years, with a mean of 7.2 years. There were 15 males and 10 females, whose ages ranged from 17 to 68 years with a mean age of 32 years. All subjects were free of any medication. Prior to the experiment, subjects were informed verbally about all aspects of the experimental procedure.

The experiment was conducted in a soundproof room, dimly lit for observation. Subjects were seated comfortably. Each recording session was divided into two sequential periods: (1) relaxing 5 min with eyes closed and (2) meditating 15 min. During those periods two random samples, one minute each, were recorded for every subject. The EEG record was stored on a hard disk.

The representative examples of spectral arrays in our subjects (N^os 1 and 12) with slow α activity and θ burst during meditation, respectively, are shown in Fig. 4(a, b).

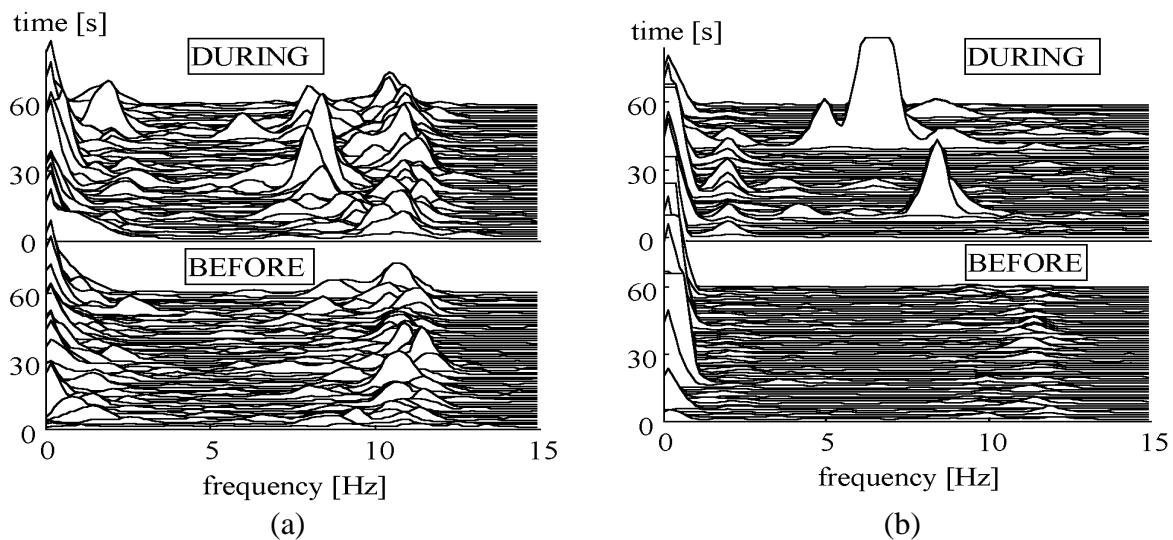


FIGURE 4. (a) Compressed power spectral arrays of the EEG for subject 1 obtained from the electrode P3 before and during meditation, showing the slow α waves at 8 Hz; (b) Compressed power spectral arrays of the EEG for subject 12 obtained from the electrode F3 before and during meditation, showing a θ burst at 6 Hz.

The comparison of the medians of partial EEG power for one derivation was performed using Wilcoxon matched pairs test. Fig. 5 shows the spatial distribution of the changes (z-scores) over the whole head. Shaded areas indicate the fields that have significant power increase.

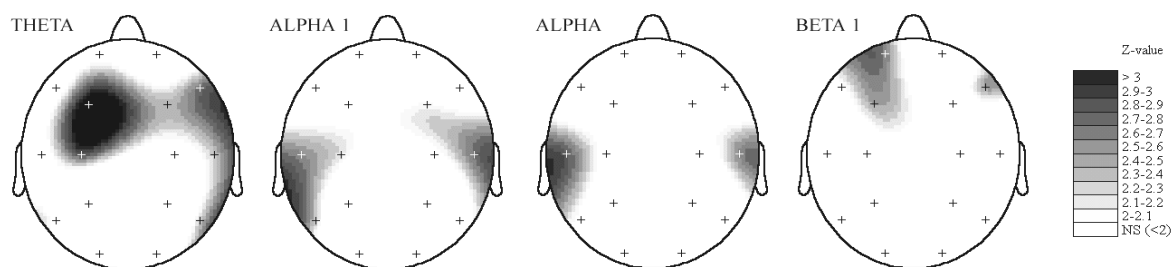


FIGURE 5. The topographic mapping of significant ($p < 0.05$) z-values of partial EEG power for each frequency band for the meditation study: θ (4-8 Hz), α_1 (8-10.5 Hz), α (8-13 Hz), and β_1 (13-18 Hz); Wilcoxon matched pairs test; inverse distance method.

Spatial distributions of medians of correlation dimension over the whole head before and during meditation did not show statistically significant changes.

The present study confirms previous reports [35-39]. The meditators as a group displayed a significant increase of θ activity ($z=2.00$, $p=0.046$) over the whole head. In particular, out of 25 meditators, 10 (40%) significantly increased their θ activity during meditation, and 4 (16%) significantly decreased. Analysis of each of the 16 derivations separately showed that the prominent θ wave activity is present in the frontal, central, and right temporal regions at frequency of 8 Hz (channel F3, $z=3.91$, $p=0.0001$). The patterns of θ frequencies fluctuated. Observed θ bursts were similar to the θ bursts occurring during phases of emotional excitation [40,41].

The consistent changes in the other frequency bands were not observed in meditator group as a whole. Out of 25 subjects, 12 (48%) significantly increased their slow α activity (8-10.5 Hz) during meditation, and 4 (16%) significantly decreased. The prominent slow α activity occurred in right frontal, central and temporal regions. During TM, there was a significant increase of α activity in 13 (52%) experimental subjects and significant decrease in 7 (28%), most frequently in temporal region (T3-T4). The increase of slow α activity during the TM technique is apparently due to the nature of the technique, which according to adherents involves the increasingly abstract experience of quieter levels of mental activity, attained without concentration or procedures of controlling the mind [42]. Increased orderly functioning of the frontal and central regions of the brain may be correlated with this improvement in mental abilities, especially since these brain areas are known to be responsible for such activities as sensory-motor integration, memory, cognition, concentration, judgment, and volition [38]. Those changes may not necessarily occur in long-term meditators. The subjects also showed a significant increase of prefrontal β activity.

Many of the previously published papers have reported physiological changes during meditation that seem to characterize substates of wakefulness [34,41,43-45]. Those changes have been interpreted as a support for the fourth major state of consciousness, the *restful alertness state*, being a combination of restfulness (increase in α and θ activity) and alertness (increase in β activity). This is in accordance with the Ellias and Grossberg model of neuron [46], which predicts that higher input to brain neural network increases frequency and decreases amplitude of oscillations. In this case, appearance of significant θ component and the α rhythm slowing may be the result of deprivation of the sensory input. On the other hand, increased β power could be a consequence of the increased mental activity.

2.5 Musicogenic States

The study of the perception of music is a paramount example of multidisciplinary research, in which musicians, psychologists, neurobiologists, physicists, and engineers must communicate and work together. This study comprises three broad problem areas [47]: (a) perception of musical tones; (b) interpretation of acoustical information relevant to music; and (c) emotional response to musical messages. In the past two decades, a considerable mutual integration of these three problem areas has taken place, due to the progress in the understanding of general human brain functions, and the recognition that in the conscious state even the simplest perceptual events are bound to trigger operations that involve the brain as a whole.

It should be also pointed out that one of the most profound consequences of the evolution of human brain functions (and human consciousness itself) has been the emergence of systematic postponing of behavioral goals and rearrangement of behavioral priorities. This led to conflicts between cortical functions and those of the limbic system: while in animals the limbic system is mostly activated by environmental and somatic input, in humans it can also respond to internally evoked images displayed on the cortex during the process of thinking. As motivation and emotion are integral manifestations of limbic function (assuring that all cortical processes are carried out so as to be of maximum benefit of organism, through the extended reticular-thalamic activating system [7]), in humans they can be triggered with no relationship to the instantaneous state of the environment. It is along this line that we should seek a lead toward understanding the human

emotional response to music (and to art in general), when the messages therein seem to be of no obvious survival value [47]. It might even be that deep artistic experiences of spectators could have strong spiritual note through spontaneous spectator's mental addressing on the masterpiece (exciting him in altered state of consciousness), and through it on the illuminating idea related to the artist in the moment of masterpiece creation [1,13,48,49] (cf. Sect. 3).

This motivated us to address our question on similar possible neurobiological origin of musicogenic altered states of consciousness, induced by deep spiritual music of different cultures [50], and its possible EEG correlates. The analogous more frequently used physical mechanisms for sound-induced altered states of consciousness is an introspective repeating of a certain type of sound or 'mantra', which is chosen so as to 'resonate' with the structure of an individual nervous system [34]. The sound resonances within the human lobe would be then achieved through a formation of standing sound waves, with principal harmonic (of ~ 1000 Hz) having its maximal amplitude in the centre of the lobe cavity, i.e. around the region of limbic system – therefore inducing the local stimulation of thalamic formation through some mechano-chemical receptors.

The study was carried out on 6 healthy adult volunteers. There were one male and five females, whose ages ranged from 18 to 29 years with a mean age of 25 years. All subjects were free of any medication. Prior to the experiment, subjects were informed verbally about all aspects of the experimental procedure.

The four types of spiritual music were provided to the subjects during experiments: (1) the Indian Bhajan in Sanskrit, (2) the Byzantine Easter liturgy in Greek, (3) the Maronit Song in Arabian, and (4) the Mozart Requiem in Latin.

The experiment was conducted in a soundproof room, with only one music a day. Each recording session was divided into three sequential periods: (1) relaxing 5 min with eyes closed; (2) listening of the music 10 min; and (3) after listening, 5 min. During those periods three samples, one minute each, were recorded for every subject. The EEG record was stored on a hard disk.

In most cases, during the listening of music, the EEG power decrease is observed in various frequency bands. In the three cases (out of 24), a significant power increase in θ and α bands is registered, in accordance with an intense aesthetic experience in these cases; the two most prominent spectral arrays before, during, and after the listening of music are shown in Fig. 6(a, b).

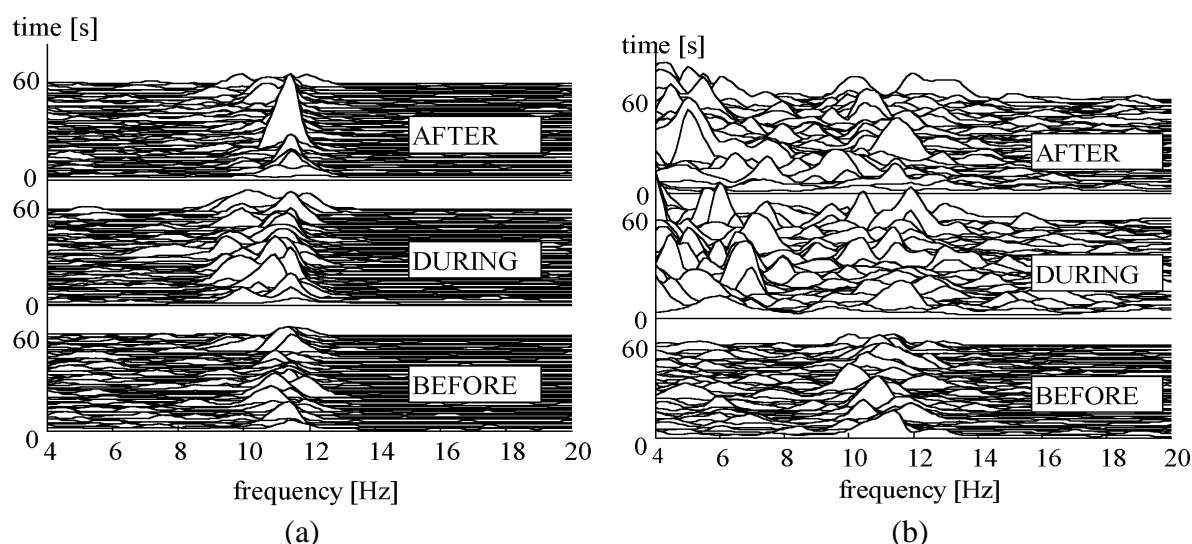


FIGURE 6. (a) The spectrogram with the observed EEG power increase in the α band and the appearance of slower α frequencies during the listening of music 1 in channel P3 of subject N° 3; (b) The spectrogram with the observed high EEG power increase in the θ band during the listening of music 1 in channel T6 of subject N° 4.

In Table 1, the results of the Wilcoxon matched pairs test for medians of EEG power of all 16 channels, prior and during the listening of music, are presented.

TABLE 1. The EEG power changes during the listening of music

MUSIC	SUBJECT N° 1			SUBJECT N° 2			SUBJECT N° 3			SUBJECT N° 4			SUBJECT N° 5			SUBJECT N° 6		
	BAND			BAND			BAND			BAND			BAND			BAND		
	θ	α	β_1	θ	α	β_1	θ	α	β_1	θ	α	β_1	θ	α	β_1	θ	α	β_1
1	-	-	0	0	-	0	-	+	0	+	-	0	-	-	-	0	-	-
2	0	-	-	-	-	-	-	-	-	0	0	0	-	-	-	x	x	x
3	x	x	x	+	+	-	-	-	-	0	-	0	0	-	-	-	-	-
4	0	-	-	0	-	-	-	-	-	x	x	x	0	-	0	x	x	x

+ sign. increase, - sign. decrease, 0 no sign. changes, x not recorded

2.6 Healer/Healee Interaction

The transitional states of consciousness [1,13] are presumably the basis of most transpersonal phenomena – being really described by seldom practitioners as not subjected to spatio-temporal limitations [20,51-68] – providing also explanation for their transitional nature and poor reproducibility: they elapse only ~ 0.1 s, and spontaneous conditions for them are achieved only every 1.5-2 hours, with periodicity of ultradian rhythms which govern the interchange of normal and altered states of consciousness [69]. However, it should be noted that the non-low-dielectric barriers in interaction with the low-dielectric displaced part of the ionic acupuncture system are helping in overcoming themselves in such induced transitional states – quite opposite to normal experience in usual mechanical interactions – enabling even their deliberate control and prolongation [1,51,54].

It should be also pointed out that the ionic nature of the acupuncture system suggests the possibility that ions in air (prana, qi, pneuma!?) can be physiologically effective [1,13,27,70-72], just through the acupuncture ionic system and biophysical mechanisms that lie in the basis of acupuncture regulation [28] (out of them, the positive ions have an catabolic influence (yang!?) and the negative ones an anabolic influence (yin!?) [1,13,27,70]). So, qi (sometimes erroneously referred as a new kind of biological energy, bioenergy) can be related to ions flowing through the ionic channels of the acupuncture system in the form of microwave (MW)/ultralowfrequency(ULF)-modulated ionic currents, with informational content coded in spatio-frequency form of currents and electromagnetic (EM) fields. It should be pointed out that a lot of experimental phenomena related to external qi gong treatment [69] can be reconciled with the ionic nature of qi. Hence, it seems that the healing process can be related with the transfer of ions between the healer and healee, and/or transfer of the MW/ULF-modulated EM information patterns responsible for normal functioning of acupuncture system and overall health [1,13,27,70]. Also, even distant displacements of healer's ionic structure in remote diagnosis and healing [62] could be expected in transitional states of consciousness (cf. Sect. 3).

This was our motivation to start examination of EEG correlates of the healer/healee noncontact interactions, as presumably most intriguing and relatively easily reproducible transpersonal phenomena [73]. This section presents preliminary results obtained during five healing sessions of one healer. Obtained results will be used to set-up framework of future research.

The study was carried out on one healer and five healthy adult volunteers. There were 3 males and 2 females, whose ages ranged from 24 to 30 years with a mean age of 26 years. All subjects were free of any medication. Prior to the experiment, subjects were informed verbally about all aspects of the experimental procedure.

The experiment was conducted in a soundproof room. Healer and healee were in relaxed state with eyes closed. Subjects had no physical contact. Each recording session was divided into three

sequential periods: (1) before the healing session (2 min with eyes closed, healer had no activity); (2) during the healing session 3 min; and (3) after the healing session (2 min). During those periods EEGs of healer and healee were recorded and stored on a hard disk

The healer's power spectrum exhibited some changes in θ region, the greatest being at frontal brain sites (Fig. 7(a)). The healee's power spectrum during the session exhibited changes in θ region at frontal brain sites too (Fig. 7(b)).

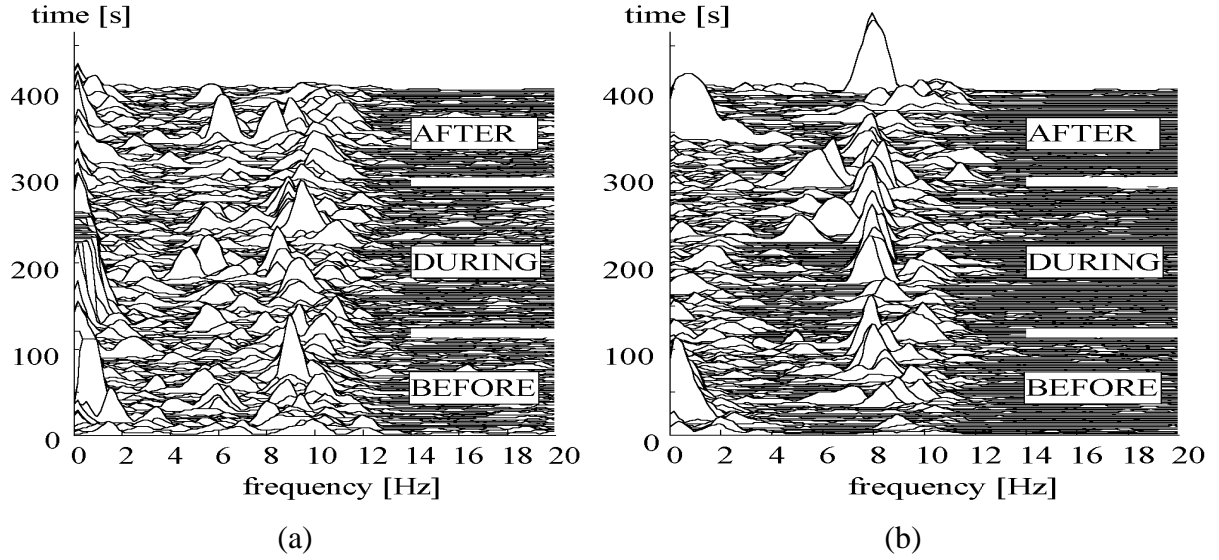


FIGURE 7. Spectrogram (channel T3) of (a) healer and (b) healee; increase in power is most pronounced in θ band during and after the healing session.

The Mann-Whitney U-test was used to analyse coherence spectral arrays. Significant changes in 3 out of 5 experiments were observed. Changes were most pronounced at channel T3 (both healer's and healee's). However, due to their small values, medians of coherence time series (30-50%) were not taken into consideration. Increase of coherence occurred only in short intervals. Epochs of 4 s, before and during the session were used to estimate maximum coherence value in α and θ bands.

An example of synchronized EEG signals of healer and healee 3 during the treatment, as well as the corresponding phase diagrams and coherence diagrams are shown in Fig. 8. The phase difference at frequencies with maximum coherence is 180° .

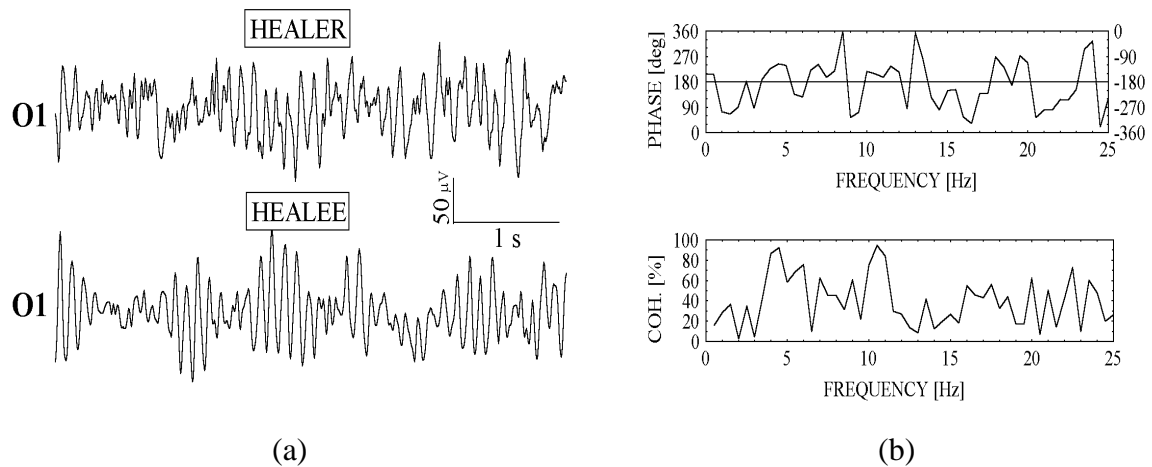


FIGURE 8. An example of short-time EEG synchronization with max. coherence; channel O1 of healer and subject N° 3; plots of (a) original signal and (b) phase and coherence diagrams.

2.7 Alertness/Drowsiness

Two interesting and to great extent related problems are automatic scoring of sleep stages, and detection of EEG segments of reduced vigilance level during awake stages.

The same standards for the visual classifying of sleep stages have been in use over 30 years [74,75]. These standards suffer from severe limitations, and therefore automatic procedures that implement them cannot give satisfying results. Hence, despite the advance of computer technology over the past decades, automatic scoring of sleep stages is far from being solved till now [76]. Man/machine agreement of even the best methods is limited by poor interscorer agreement obtained by comparing results of visual inspection of different electroencephalographers.

The situation is even more vague with the detection of reduced vigilance level segments from EEG recordings. Different approaches have been used to classify the degree of alertness during the awake stages, from subjective ratings, performance tests and neurophysiological measures. Subjective ratings are unreliable because of the fact that feelings such as alertness or drowsiness are poorly defined. Methods based on monitoring performance level like measuring reaction time to some stimuli, cannot give satisfying results as such measurement itself influences the subject's vigilance. It is evident, therefore, that it is the EEG on which the vigilance level estimation should be based. However, there are no universally accepted standards for visual classification of vigilance level during the awake stages, based on EEG traces. This is in contrast to the fact that the changes in EEG frequency bands, and occurrence of patterns assigned to changes of vigilance level, are assumed to be known. Different authors have used different approaches to combine these known characteristic changes in order to form meaningful rules, so further efforts should be obviously directed toward modeling underlying biological processes [76].

An effort in this work is done toward finding underlying functional relationship between power spectrum fluctuations related to changes of vigilance level (not used predetermined relationships), in order to estimate vigilance level by means of neural network classifier. Employing neural network classifier as a structure with modifiable parameters is of benefit for the following reasons: (a) underlying relationships which are assumed to exist, are not known, and are to be found; (b) by supplying the neural network with training sets obtained from recordings on single subjects, the network 'learns' individual patterns characteristic for lower vigilance; and (c) the method can be adjusted to correspond to the results obtained by visual inspection of different experts. This allows interaction between electroencephalographers and machine, that will lead to better understanding of underlying principles and therefore to more efficient standards.

Electroencephalograms of 30 healthy young subjects were recorded. Subjects were aged 20-28 (median: 25), 22 males and 8 females, and have passed neurological screening. Uniformly aged subjects were chosen because EEG changes with age, and universal rules for automatic detection of vigilance level should require much bigger experimental group. Recordings were performed between 2-4 p.m. Subjects were not sleep deprived, nor had any deviations from their usual circadian cycle, and they took no drugs.

Recordings lasted from 15 to 30 minutes, depending on subject's level of drowsiness i. e. frequency of occurrence of low vigilance segments on corresponding EEG traces. Subjects were not allowed to fall asleep (i.e. further from stage I of slow wave sleep – drowsiness). We required at least two minutes of low vigilance level in total EEG time. EEG signals were analyzed off-line, and epochs without artifacts, characteristic for full wakefulness and for lower vigilance were cut by experienced electroencephalographer and pasted to form two-minute long segments used, one as a representative of normal fully awake state (alert wakefulness), and another one as a representative of drowsy wakefulness.

Single layer perception neural network was used for vigilance level assessment. Training and test input vectors were made from one two-minute long segment of alert wakefulness and one of drowsy wakefulness. The state of alert wakefulness was assigned the value of 1, and the state of drowsy

wakefulness was assigned the value of 0. These values were supplied to the network as desired output values during the training session.

Segments of 30 s of both recording were used to construct training sets. The network was tested on the rest 90 s of each recording. To achieve high processing speed it was necessary to make input vectors of low dimensionality. Also, it was necessary to make the components of input vectors to be easy to compute. Thus, the power spectrum characteristics were used to form input vectors. Spectral analysis is the most important and most common technique in EEG time series analysis [77]. Due to great inter-individual variations in total power, the relative values were computed, i. e. the power in each frequency band was divided by the total power in all bands.

The slowing of dominant α frequency and widening of α peak are assumed to be the most important signs of drowsiness. However, it is not possible to see these events through changes of relative power in α band. Therefore, α band was divided into two bands, α_1 (7.5-9.5 Hz) and α_2 (9.75-12.5 Hz). These boundaries are carefully chosen so that values of relative power in these bands carry the same amount of information, as does the shift of the dominant α frequency, and widening of α peak.

Boundaries of frequency bands used were as follows: 0.5-3.25 Hz (δ), 3.5-7.25 (θ), 7.5-9.5 Hz (α_1), 9.75-12.5 Hz (α_2), 12.75-18 Hz (β_1), and 18.25-25 Hz (β_2).

Since it is shown in earlier studies [74] that significant differences in EEG patterns between hemispheres during the drowsiness do not occur, power spectrum was computed from the one hemisphere (right).

Slight vigilance fluctuations can occur in time periods as short as few seconds. Therefore, short time epochs were used to compute power spectrum characteristics. The use of 4-s long epochs provided a good compromise between time and frequency resolution. Frequency resolution was 0.25 Hz, which was good enough to successfully divide spectrum into bands. In order to improve time resolution, epoch overlapping of 2 s was used. Thus, 28 epochs were used for training, and 84 epochs were used for testing.

In order to find the power spectrum characteristics that best reflect the expert's knowledge used for visual classification results from previous studies were consulted as well [78-84]. Characteristics that in combination with perceptron neural net proved to give the most satisfactory results are shown in Table 2. These values were used to form input vectors for both training and testing. Input vectors during the training phase were supplied to the network along with the desired values of output. During training cycle, perceptron neural network assigned the weighting values to each component of the input vectors. These weights were used in testing phase, in order to estimate the level of vigilance. Training network on each subject enabled the network to 'learn' individual fluctuations in EEG spectrum.

TABLE 2. Combinations of power spectrum values and electrode positions used to form input vectors.

FREQUENCY BAND	α_2	α_1	θ	θ	β_1	β_1	β_1	β_2	β_2	β_2	θ/α
ELECTRODE POSITION	O2	O2	O2	F4	F4	C4	O2	F4	C4	T6	O2+F4+F8+C4+T4

Numerical results were computed on a standard PC. Procedures for data manipulation and neural network implementation were developed in Matlab 4.2 environment [85]. Training and testing of the network took a few seconds of CPU time on PC 486/100 MHz.

3. PSYCHOSOMATIC-COGNITIVE IMPLICATIONS OF ALTERED STATES OF CONSCIOUSNESS AND QUANTUM-INFORMATIONAL MEDICINE ³

Beside previously mentioned holistic manifestations of altered states of consciousness, conscious/unconscious transitional states of consciousness and consciousness pervading body, contemporary investigations of *psychosomatic diseases* also imply the necessity of application of *holistic methods*, oriented to *healing the person as a whole* and not disease as a symptom of disorder of the whole, implying their *macroscopic quantum origin* [1,70,86]. In the focus of these quantum-holistic methods are body's *acupuncture system* and *consciousness*, with surprisingly significant *psychosomatic-cognitive implications* [1,70,86], which will be reviewed in this section.

The quantum electromagnetic (EM)/ionic basis of the acupuncture system (of 'non-threshold' electrical 'gap junction' (GJ) synapses [87]) is implied by *resonant windows* in frequency and intensity in tissue interactions with extremely weak 'non-threshold' EM fields [88] (undetectable by nervous system of 'threshold' electrochemical synapses [1,70,86]), and successes of the Russian-Ukrainian school of microwave (MW) resonance therapy [25,26] and its *quantum-coherent characteristics* (highly resonant microwave sensory response of the disordered organism, biologically efficient nonthermal microwave radiation of extremely low intensity and energy, and neglecting microwave energy losses across acupuncture meridians), as well as successes of German school of ultralowfrequency (ULF) electropuncture [89] and the *resonant stimulation* of the acupuncture analgesia endorphin (~ 4 Hz) and serotonin and/or norepinephrine (~ 200 Hz) mechanisms [90] – which is now associated with the appearance of *Quantum-informational medicine* (that might also include acupuncture-sensitive *homeopathy* [89] and other *energetic/bioresonance/bioinformational methods* [91]).

And as recent Peruš's theoretical investigations show that any *quantum system* has formal mathematical structure of *quantum-holographic Hopfield-like neural network* [6,9] – then *memory attractors of the acupuncture network* can be treated as *psychosomatic disorders* representing EM MW/ULF-modulated (*quantum*)*holistic records* (which might be therefore removed only holistically, supported by an extreme efficiency of the *quantum-informational therapies*, that consequently erase the very information of the psychosomatic disorders, cf. Fig. 9) – which might represents biophysical basis of (acupuncture temporarily reprogrammable!) (*quantum*)*holistic local psychosomatics* [1,13,86,92,93].

Namely, according to the *Tibetan traditional medicine*, an acupuncture procedure must be repeated every several months [94] – presumably as a consequence of *restituted* patient's mental loads from his *mental-transpersonal-environment* of closely related relatives/enemies/deceased, that remained *non-reprogrammed* on the level of quantum-holographic collective consciousness (which might be supported by the Tibetan *pulse diagnostics* based on 20 pulses, enabling precise diagnosis of psychosomatic disorders not only of the patient himself *but also* of his family members and enemies). An additional support that the acupuncture system is really related to consciousness is provided by *meridian (psycho)therapies* (with very fast removing of traumas, phobias, allergies, post-traumatic stress, and other psychosomatic disorders [18,19,95,96]; cf. Sect. 2.1) – whose simultaneous effects of *visualization* and *tapping/touching of acupuncture points* might be theoretically interpreted as a '*smearing*' and *associative integration of memory attractors* of the psychosomatic disorders, through successive imposing new boundary conditions in the acupuncture energy-state space during visualizations of the psychosomatic problems [1,18,96] – so that *meridian (psycho)therapies* (alongside with psychosomatically healing positively-visualizing *meditation* [61] and other *deep psychotherapeutic techniques* [97]) might be also categorized into the field of *Quantum-informational medicine* [86]. Having in mind very high efficiency of transpersonal circular meridian (psycho)therapeutic processes, i.e. from all relevant mentally-addressed viewpoints of other persons involved in the treated trauma,

³ This theoretical part of the paper was prepared by D. Raković – with helpful cooperation of M. Dugić, M. Ćirković, M. Plavšić, G. Keković, D. Davidović, B. Tošić, S. Jaćimovski, J. Štrajčić, Dj. Koruga, M. Peruš, L. A. Gribov, I. Cosic, and A. Vasić which are hereby greatly acknowledged.

this implies that these interactions of the trauma-related persons have quantum-gravitational-collapse-related transpersonal origin via miniature ‘wormhole’ space-time tunnels in transitional states of consciousness of the related persons [1,13] (or ‘silver cord’ of vital energy of the astral/mental body, extrasensory observable in altered states between heart, stomach or throat chakras of the interconnected persons; in African-Haitian voodoo magic the ‘silver cord’ between the operator and the victim is intentionally created by visualization, while in Hawaiian hooponopono tradition the ‘silver cord’ is cut by visualization thus removing traumatic emotional relationship – which otherwise naturally exists between mother and child, and spontaneously arises by intense exchange of the vital energy between relatives, close collaborators, actual or ex-lovers, friends and enemies, and can even persist *post mortem* between the alive and dead persons [1,19,86]).

On these lines, according to theoretical relationship *consciousness/acupuncture* EM-ionic quantum-holographic Hopfield-like neural network (elaborated by one of us, D.R.) [1,13,86,92], *esoteric notions* like *astral body* (*manomaya*, *lingasarira*, *manovijnana*, *ka*, *psyche*, *subtle body*, *psychic body*, *soul*...) and *mental body* (*vijnanamaya*, *suksmasarira*, *manas*, *ba*, *thymos*, *noetic body*, *spiritual body*, *spirit*...) [98,99] might be biophysically related to *out-of-body displaced part* (connected with the body by miniature ‘wormhole’ tunnel of vital energy of the astral/mental body) *of the ionic acupuncture system*, and with embedded *EM component* of ionic MW/ULF-modulated currents, respectively. Then, transpersonal interactions [53-68] might be interpreted [1,13,86,92] by collapse-like consciousness-channeled quantum-gravitational tunneling of operator’s individual consciousness – mentally addressed on the target’s content of collective consciousness in operator’s (short-lasting highly-noninertial physically-equivalent-to strongly-gravitational) transitional states of consciousness – thus intentionally channeling composite state of the ‘field’ of target-under-influence-of-operator part of collective consciousness, $|\Phi\rangle_s \rightarrow |\Phi_j\rangle_s$, and automatically influencing complementary ‘particle’ output $|\Psi\rangle_E \rightarrow |\Psi_j\rangle_E$ in quantum-gravitationally-induced and

$$\text{consciousness-channeled collapse } (|\Phi\rangle_s |\Psi\rangle_E \rightarrow \sum_i c_i |\Phi_i\rangle_s |\Psi_i\rangle_E \xrightarrow{p_j = |c_j|^2 \approx 1} |\Phi_j\rangle_s |\Psi_j\rangle_E).$$

In this context, the association of individual consciousness to manifestly-macroscopic-quantum acupuncture system, and application of theoretical methods of *Hopfield-like neural networks* [4] and *quantum neural holography* [6,9] and *quantum decoherence theory* [100] (cf. Fig. 9), imply *two cognitive modes of consciousness*, according to the coupling strength consciousness-body-environment [1,92,93]: (1) *weakly-coupled quantum-coherent direct one* (in out-of-body [101] religious/creative transitional and altered states of consciousness, like prayer, meditation, creative dozes, lucid dreams...), and (2) *strongly-coupled classically-reduced indirect one* (in bodily perceptively/ rationally mediated normal states of consciousness, like sensory perception, logical and scientific thinking...) – *with conditions for mutual transformations* – and significant *epistemological implications* related to regained strong coupling of quantum-holographic contents of consciousness with bodily-environment, classically-reducing directly obtained quantum-coherent informational content. This explains in principle non-adequate informational rationalization of any direct quantum-holographic spiritual/religious mystical experience (as a general problem of the quantum theory of measurement, of reduction of the implicate order of quantum-coherent (quantum-holographic) superpositions into the explicate order of measured projective quantum and mixed classical states [1,92,93]!). After returning of the displaced consciousness upon the body, in order that transpersonally acquired information ascends to the level of normally conscious state, it is necessary to overcome two filters [1,13,92]: acupuncture system/nervous system threshold filter (which requires ‘emotional colouring’ of the solving problem) and frontolimbic-amplification filter (which requires ‘emotional-thinking priority’ of the solving problem). It should be pointed out that (practically) non-threshold potential of the acupuncture electrical GJ-synapses [87] makes body’s acupuncture system extremely sensitive quantum sensor [1,86], which can resonantly ‘detect’ even ultraweak EM fields [88]. So it seems that science is closing the circle, by re-discovering *two cognitive modes of consciousness* and at the same time by

imposing its own *epistemological limitations* – as it was preserved for millennia in *shamanistic tribal traditions* [102], or as it was concisely described by Patanjali in *Yoga Sutras*, pointing out that mystical experience (samadhi) is 'filled with truth' and that 'it goes beyond inference and scriptures' [103], or as this difference between faith and knowledge was formulated at the beginning of the last century by Berdyaev in his *Philosophy of Freedom* as the difference of two modes of cognition, prayer-mediated 'comprehension of the affairs invisible' and rationally-mediated 'comprehension of the affairs visible' [104]!

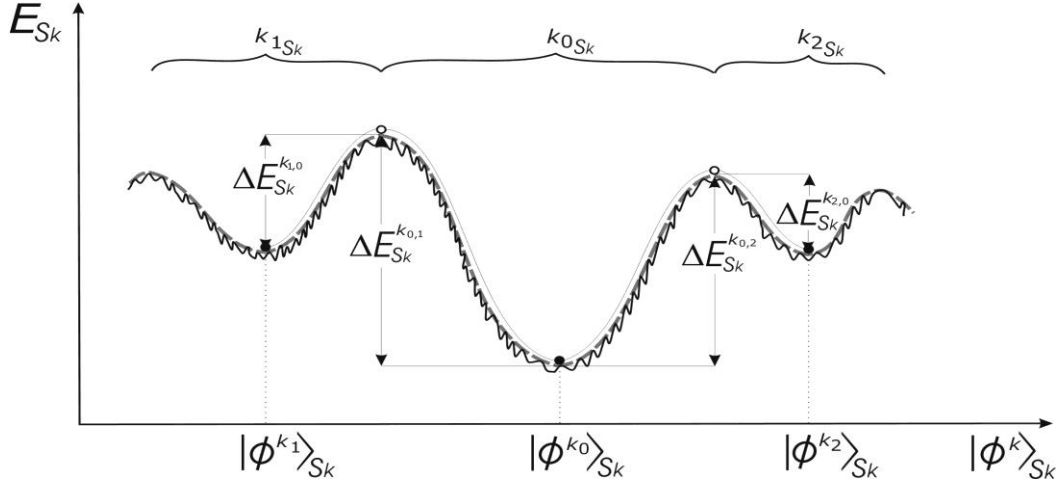


FIGURE 9. Schematic presentation of the memory attractors in the energy-state ($E_{S_k}(\phi^k)$) hypersurface of the quantum-holographic memory/propagator of the open macroscopic quantum system S_k (local cell's protein/target biomolecular one, local acupuncture system/consciousness, or nonlocal out-of-body consciousness/collective consciousness [1,86]):

$$G(r_2, t_2; r_1, t_1) = \sum_{i=1}^P \phi^{k_i}(r_2, t_2) \phi^{k_i*}(r_1, t_1) = \sum_{i=1}^P A_{k_i}(r_2, t_2) A_{k_i}^*(r_1, t_1) e^{\frac{i}{\hbar}(\alpha_{k_i}(r_2, t_2) - \alpha_{k_i}(r_1, t_1))}$$

It should be pointed out that quantum decoherence presumably plays fundamental role in biological quantum-holographic neural networks, through presented energy hypersurface shape adaptation (in contrast to low-temperature artificial qubit quantum processors where it must be avoided until the very read-out act of quantum computation) – which implies that Nature presumably has chosen elegant room-temperature solution for biological quantum-holographic information processing, permanently

fluctuating between quantum-coherent states $|\phi^k(t)\rangle_{S_k} = \sum_i c_{k_i}(t) |\phi^{k_i}\rangle_{S_k}$ and classically-reduced states

$$\hat{\rho}_{S_k}^k(t) = \sum_i |c_{k_i}(t)|^2 |\phi^{k_i}\rangle_{S_k S_k} \langle \phi^{k_i}|$$

of the open macroscopic quantum system S_k , through nonstationary (bioresonance) interactions with out-of-body farther environment and through decoherence by bodily closer environment of biological open macroscopic quantum system S_k .

It should be also pointed out that the proposed quantum-decoherence model might serve as bio-informational basis of *Quantum-informational medicine (QIM)* related to *acupuncture system/consciousness and its psychosomatic states* [1,86]. So, for instance, during application of some *QIM-therapy* for transferring disordered acupuncture system S_k from the psychosomatically excited state $|\phi^{k_2}\rangle_{S_k}$ into the attracting healthy ground state $|\phi^{k_0}\rangle_{S_k}$ (cf. Fig. 9), it is necessary during the strong (bioresonance) external action (T_{ext}) to provide external energy of the QIM-source for skipping over potential barrier of the (acupuncture palpatory-painful or psychologically traumatic!) disordered state ($\Delta E_{S_k}^{k_{2,0}}$), which after relaxation process (T_{rel}) of taking-off the excess external

energy ($\Delta E_{S_k}^{k_0,2}$), gives rise to condition of the completed quantum state change of the acupuncture system/consciousness, with additional decoherence time (τ_D) and decrease of one quantum of energy in the state $|\phi^{k_2}\rangle_{S_k}$ and increase of one quantum of energy in the state $|\phi^{k_0}\rangle_{S_k}$. By multiple repeating of this process, the depth of the memory attractor k_2 is getting shallower in favour of deepening of the attracting healthy state k_0 , finally giving rise to complete erasing of the psychosomatic disorder $|\phi^{k_2}\rangle_{S_k}$ and deepening of the healthy state $|\phi^{k_0}\rangle_{S_k}$, i.e. *dynamic modification of the potential hypersurface of the acupuncture system/consciousness*, in full analogy with the situation of learning classical Hopfield associative neural networks (cf. Fig. 9).

This could also apply to lower hierarchical local quantum-holographic macroscopic open cellular enzyme-gene level, with permanent quantum-conformational molecular recognition [1,105], and presumably represents a *natural framework for explanation of psychosomatic diseases* related to somatization of environmentally-generated memory attractor's states of the open macroscopic quantum acupuncture system/consciousness – *quantum-holographically projected* upon lower hierarchical cellular level, thus *changing the expression of genes* [1,86,106] (so called macroscopic ‘downward causation’, as biofeedback control of microscopic ‘upward causation’ in *ontogenesis and morphogenesis*, starting from the first fertilised cell division which initialises differentiation of the acupuncture system of (electrical synaptic) ‘gap-junctions’ [1,87]).

The above approach might be also generalized to highest hierarchical nonlocal level out-of-body consciousness/collective consciousness [1,92], with religious/social implications on necessity of *transpersonal spiritual quantum-holographic removing* of all unwilling side memory attractors – which unless will cause psychosomatic diseases and interpersonal fights in this and/or further generations they are transpersonally and unconsciously transferred to, on the level of *field-related collective consciousness* [1,86].

This implies that the *whole psychosomatics is a quantum hologram* [1,86,92], both on the level of *individual and collective consciousness*, which resembles Hinduistic relationship *Brahman/Atman* (‘*Atman is Brahman*’ [103]), as the whole and its part which bears information about the whole. The mentioned quantum-holographic picture also implies that quantum-holographic hierarchical parts carry information on wholeness, enabling *quantum-holographic fractal coupling* of various hierarchical levels [1,86]:

- *Su Jok therapy* as quantum-holographic coupling of bodily acupuncture system and its numerous projection zones [107];
- *acupuncture-based quantum-informational (un)intentional control of ontogenesis and morphogenesis*, starting from the first fertilized cell division which initializes differentiation of the acupuncture system of (electrical synaptic) ‘gap-junctions’ [1,86];
- *quantum-holographic language-influence on the genes expression* [108], with implications of great psychosomatic significance of thought-emotional contents;
- *meridian (psycho)therapies*, with very fast removing of traumas, phobias, allergies, post-traumatic stress, and other psychosomatic disorders, demonstrating closest relationship *acupuncture system/consciousness* [19,95,96];
- *Tibetan pulse diagnostics* as demonstration of transpersonally-addressed coupling of closely related relatives and enemies [94];
- *miraculous creativities of Tesla and Mozart* as examples of quantum-holographic coupling of individual consciousness and cosmic collective consciousness [109,110];
- ‘*Bible code*’ as demonstration of global quantum-holographic coupling of cosmic collective consciousness and coded individual probabilistic alternatives [111].

It should be finally noted, that our investigations are on the line of the again arisen scientific interest for investigation of the phenomenon of consciousness in the past decades – forecasting *great*

synthesis of two cognitive modes, *rationaly-scientific* (classically-reduced, in normal states of consciousness) and *creative-religious* (quantum-coherent, in altered and transitional states of consciousness) in the framework of the appearing *quantum-holographic paradigm* – where *personal role* becomes indispensable due to the influence and care for collective mental environment, which is *fundamental question* of both mental health and civil discency, i.e. of both spiritual and civil morality [1,13,86,92]!

On these lines, we recommend to readers Michael Talbot's excellent book *The Holographic Universe* [52], where he refers to renown quantum physicist David Bohm [112] and neuro-physiologist Karl Pribram [113], whose investigations imply that *Universe* might be a *giant quantum hologram*, a kind of *mind construct on the subject/object interface* – thus relativising a question *whether objective reality exists or fluctuate between implicate and explicate order!*? In his book, Talbot (himself extrasense) argues that most of well documented *mysterious phenomena*:

- *synchronicity, lucid dreams, eidetic pictures, multiple personalities,*
- *viewing and therapy of aura, visualizing, hypnotic and miraculous healings,*
- *mystical religious, out-of-body and near-death experiences,*
- *psychometry, precognition, extrasensory perception,*
- *psychokinesis, materialization, teleportation,*

(whose well *documented review* represents special value of this book!) might be presumably explained in the framework of the appearing *quantum-holographic paradigm*.

4. CONCLUSION

In the first part of this chapter, the *psycho-physiological correlates* of *Techniques Altering States of Consciousness* are considered. Our investigations demonstrated more or less distinguished features in psycho-physiological correlates (monitored by GDV bioelectrography, Biofeedback electro-physiological measurements, and Standard psychological tests) of the effects of *Meridian (Psycho)therapies* on (more or less significant) psychological traumas, applied to 17 volunteers in the case of *Fore-Finger Method*, *Basic PEAT*, *DP4 Method* and 15 volunteers in the case of *Deep PEAT*, 28 subjects of relaxation induced by *Microwave Resonance Relaxation* applied to corresponding acupuncture points (with slightly decreased EEG power in all frequency bands; it should be also noted that persons not previously subject to this treatment responded stronger, presumably as a consequence of the more imbalanced acupuncture system), 30 subjects practicing *Autogenic Training* (increased δ , θ , and α power, with decreased α power as well as increased coherence in α , especially right at the beginning of exercise), 25 subjects practicing *Transcendental Meditation* (increased β power in prefrontal region, increased θ power in left frontal and right temporal regions, increased α power in both temporal regions, and correlation between increased α power and decreased correlation dimension), 6 subjects with 4 types of spiritual music provided to induce *Musicogenic States* (with significant changes in only 3 cases out of 24, where increased θ and α power was observed in only those subjects who have described their musical experiences as very pleasant), 5 *Healer/Healee Interactions* (with increase in the maximum mean coherence of their EEG patterns in the α band observed only in short 4s time intervals), and 30 subjects for monitoring level of *Alertness/Drowsiness* (with implemented automatic procedure of the neural network classifier to assess the correlation between EEG power spectrum fluctuations related to changes of vigilance level, demonstrating linear separability of the states of alert wakefulness and drowsy wakefulness, allowing very fast data processing and possible real time applications in clinical practice).

In the second part of this chapter, the *psychosomatic-cognitive implications* of *altered states of consciousness* and *holistic medicine* are considered, implying that whole psychosomatics is quantum hologram, on the level of individual and collective consciousness, which resembles Hinduistic relationship *Brahman/Atman* ('Atman is Brahman'), as wholeness and its part which bears information

about wholeness. This might serve as a basis of *Quantum-informational medicine* related to *quantum-holographic* fractal coupling of the *cellular level/acupuncture system/consciousness/collective consciousness*. Also, the association of individual consciousness to manifestly-macroscopic-quantum acupuncture system, and application of theoretical methods of *Hopfield-like neural networks*, *quantum neural holography*, and *quantum decoherence theory*, imply *two cognitive modes of consciousness*, according to the coupling strength consciousness-body-environment: (1) *weakly-coupled quantum-coherent direct one* (in out-of-body religious/creative transitional and altered states of consciousness, like prayer, meditation, creative dozes, lucid dreams...), and (2) *strongly-coupled classically-reduced indirect one* (in bodily perceptively/rationally mediated normal states of consciousness, like sensory perception, logical and scientific thinking...). It should be noted that our investigations are on the line of the again arisen scientific interest for investigation of the phenomenon of consciousness in the past decades – forecasting *great synthesis* of the two cognitive modes in the framework of the appearing *quantum-holographic paradigm* – where *personal role* becomes indispensable due to the influence and care for collective mental environment, which is *fundamental question* of both mental health and civil discency, i.e. of both spiritual and civil morality.

REFERENCES

1. D. Raković, *Integrative Biophysics, Quantum Medicine, and Quantum-Holographic Informatics: Psychosomatic-Cognitive Implications*, IASC & IEPSP, Belgrade, 2009; D. Raković, *Fundamentals of Biophysics*, IASC & IEPFG, Belgrade, 2008, 3rd ed., in Serbian.
2. J. J. Hopfield, Neural networks and physical systems with emergent collective computational abilities, *Proc. Natl. Acad. Sci. USA*, 79 (1982) 2554-2558.
3. T. Kohonen, *Self-Organization and Associative Memory*, Springer, Berlin, 1984.
4. D. Amit, *Modeling Brain Functions: The World of Attractor Neural Nets*, Cambridge Univ, Cambridge, 1989.
5. H. Haken, *Synergetic Computers and Cognition: A Top-Down Approach to Neural Nets*, Springer, Berlin, 1991.
6. M. Peruš, Multi-level synergetic computation in brain, *Nonlinear Phenomena in Complex Systems*, 4 (2001) 157-193.
7. B. J. Baars, *A Cognitive Theory of Consciousness*, Cambridge Univ, Cambridge MA, 1988.
8. S. R. Hameroff, Quantum coherence in microtubules: A neural basis for emergent consciousness? *J. Consciousn. Stud.*, 1 (1994) 91-118.
9. M. Peruš, Neuro-quantum parallelism in mind-brain and computers, *Informatica*, 20 (1996) 173-183.
10. D. Giulini, E. Joos, C. Kiefer, J. Kupsch, I.-O. Stamatescu, H. D. Zeh, *Decoherence and the Appearance of a Classical World in Quantum Theory*, Springer, Berlin, 1996.
11. J. Von Neumann, *Mathematical Foundations of Quantum Mechanics*, Princeton Univ, Princeton NJ, 1955.
12. H. P. Stapp, Quantum theory and the role of mind in nature, *Found. Phys.*, 31 (2001) 1465-1499; H. Stapp, *Mind, Matter, and Quantum Mechanics*, Springer, New York & Berlin, 1993.
13. D. Raković, Brainwaves, neural networks, and ionic structures: Biophysical model for altered states of consciousness, in: D. Raković, Dj. Koruga (eds.), *Consciousness: Scientific Challenge of the 21st Century*, ECPD, Belgrade, 1995; D. Raković, Transitional states of consciousness as a biophysical basis of transpersonal transcendental phenomena, *Int. J. Appl. Sci. & Computat.*, 7 (2000) 174-187; D. Raković, Hopfield-like quantum associative neural networks and (quantum)holistic psychosomatic implications, in: B. Reljin, S. Stanković (eds), *Proc. NEUREL-2002* (IEEE Yugoslavia Section, Belgrade, 2002); D. Raković, M. Dugić, M. M. Ćirković, Macroscopic quantum effects in biophysics and consciousness, *NeuroQuantology*, 2(4) (2004) 237-262 (www.NeuroQuantology.com).
14. C. Tart, ed., *Altered States of Consciousness*, Academic, New York, 1972.

15. A. Shimony, in: R. Penrose, A. Shimony, N. Cartwright, S. Hawking (eds.), *The Large, the Small and the Human Mind*, Cambridge Univ, Cambridge, 1995.
16. D. Raković, M. Tomašević, E. Jovanov, V. Radivojević, P. Šuković, Ž. Martinović, M. Car, D. Radenović, Z. Jovanović-Ignjatić, L. Škarić, Electroencephalographic (EEG) correlates of some activities which may alter consciousness: The transcendental meditation technique, musicogenic states, microwave resonance relaxation, healer/heelee interaction, and alertness/drowsiness, *Informatica*, 23(3) (1999) 399-412; D. Radenović, D. Raković, Z. Jovanović-Ignjatić, M. Tomašević, V. Radivojević, E. Jovanov, Relaxation induced by microwave resonance therapy: EEG correlates, in: Lj. Rakić, G. Kostopoulos, D. Raković, Dj. Koruga (eds.), *Brain and Consciousness, Proc. ECPD Symp.*, ECPD, Belgrade, 1997; M. Tomašević, D. Raković, E. Jovanov, V. Radivojević, M. Car, EEG correlates of transcendental meditation, *ibid.*; L. Škarić, M. Tomašević, D. Raković, E. Jovanov, V. Radivojević, P. Šuković, M. Car, D. Radenović, EEG correlates of musicogenic states of consciousness, *ibid.*; M. Tomašević, E. Jovanov, D. Raković, P. Šuković, S. Stanojlović, M. Car, EEG correlates of healer/heelee states of consciousness, *ibid.*; P. Šuković, V. Radivojević, Ž. Martinović, D. Raković, E. Jovanov, A novel neural network approach to estimation of vigilance level from EEG power spectrum, *ibid.*; P. Šuković, *Electro-physiological Correlates of Vigilance*, M.S. Thesis, Faculty of Electrical Engineering, Belgrade, 1997.
17. M. Ostojić, D. Raković, N. Rajšić, M. Čosović, M. Tomašević, Z. Šundrić, Electrophysiological correlates of autogenic training, in: S. Jovičić, M. Sovilj (eds.), *Proc. 2nd Int. Conf. Fundam. & Appl. Aspects of Speech & Language*, IEPSP, Belgrade, 2005; M. Ostojić, *Electrophysiological Correlates of Autogenic Training*, M.Sc. Thesis, Faculty of Electrical Engineering, Belgrade, 2005, in Serbian.
18. D. Raković, Ž. Mihajlović Slavinski, M. Sovilj, S. Pantelić, N. Stevović, J. Bojović, I. Džamić, S. Jovičić, Dj. Baljoozović, Meridian (psycho)therapies: Psycho-physiological correlates, *Proc. 3rd Int. Conf. Fundam. & Appl. Aspects of Speech & Language*, IEPSP, Belgrade, 2009.
19. Ž. Mihajlović Slavinski, *PEAT and Neutralization of Primeval Polarities*, Belgrade, 2001; Ž. Mihajlović Slavinski, *The Return to Oneness*, Belgrade, 2005; Ž. Mihajlović Slavinski, *Invisible Influences*, Belgrade, 2008.
20. K. Korotkov, *Human Energy Field: Study with GDV Bioelectrography*, Backbone, New York, 2002; K. Korotkov, Measuring energy fields and states of consciousness by electrophotonic (GDV) technique, in: M. Sovilj, S. Jovičić (eds.), *Proc. 3rd Int. Conf. Fundam. & Appl. Aspects of Speech & Language*, IEPSP, Belgrade, 2009; see also www.korotkov.org.
21. M. Thomson, L. Thompson, *The Neurofeedback Book: An Introduction to Basic Concepts in Applied Psycho-physiology*, Assoc. Appl. Psychophysiol. & Biofeedback, Wheat Ridge CO, 2003.
22. J. Berger, M. Marković, M. Mitić, *Handbook for Vexler Individual Test of Intelligence*, Center for Applied Psychology of The Psychological Society of Serbia, Belgrade, 1995, in Serbian.
23. M. Biro, J. Berger, *Handbook for Application and Interpretation of MMPI*, Center for Applied Psychology of The Psychological Society of Serbia, Belgrade, 1998, in Serbian.
24. K. Momirović, B. Wolf, Z. Džamonja, S. Kon, *Cybernetic Battery of Cognitive Tests*, Center for Applied Psychology of The Psychological Society of Serbia, Belgrade, 1995, in Serbian.
25. N. P. Zalyubovskaya, *An Estimation of Effects of Millimeter and Submillimeter Microwaves upon Various Biological Objects*, M.Sc. Thesis in Biological Sciences, Kharkov State University, 1970, in Russian; N. D. Devyatkov, Influence of the millimeter wavelength range electromagnetic radiation upon biological objects, *Soviet Physics - Uspekhi*, 110 (1973) 452-469; N. D. Devyatkov, O. Betskii (eds.), *Biological Aspects of Low Intensity Millimeter Wave*, Seven Plus, Moscow, 1994; Yu. P. Potehina, Yu. A. Tkachenko, A.M. Kozhemyakin, *Report on Clinical Evaluation for Apparatus EHF-IR Therapies Portable with Changeable Oscillators CEM TECH*, CEM Corp., Nizhniy Novgorod, 2008.
26. Ye. A. Andreyev, M. U. Bely, S. P. Sit'ko, *Manifestation of characteristic eigenfrequencies of human organism*, Application for the Discovery to the Committee of Inventions and Discovery at the Council of Ministers of the USSR, No. 32-OT-10609, 22 May 1982, in Russian; S. P. Sit'ko, Ye. A. Andreyev, I. S. Dobronravova, The whole as a result of self-organization, *J. Biol. Phys.*, 16 (1988) 71-73; S. P.

- Sit'ko, V. V. Gizhko, Towards a quantum physics of the living state, *J. Biol. Phys.*, 18 (1991) 1-10; S. P. Sit'ko, L. N. Mkrtchian, *Introduction to Quantum Medicine*, Pattern, Kiev, 1994.
27. Z. Jovanović-Ignjatić, D. Raković, A review of current research in microwave resonance therapy: Novel opportunities in medical treatment, *Acup. & Electro-Therap. Res., The Int. J.*, 24 (1999) 105-125; D. Raković, Z. Jovanović-Ignjatić, D. Radenović, M. Tomašević, E. Jovanov, V. Radivojević, Ž. Martinović, P. Šuković, M. Car, L. Škarić, An overview of microwave resonance therapy and EEG correlates of microwave resonance relaxation and other consciousness altering techniques; *Electro- and Magnetobiology*, 19 (2000) 193-220; D. Raković, Biophysical bases of the acupuncture and microwave resonance stimulation, *Physics of the Alive*, 9 (2001) 23-34.
 28. C. Xinong (ed.), *Chinese Acupuncture and Moxibustion*, Foreign Languages Press, Beijing, 1987; Y. Omura, *Acupuncture Medicine*, Japan Publ. Inc., Tokyo, 1982; F. G. Portnov, *Electropuncture Reflexotherapeutics*, Zinatne, Riga, 1982, in Russian; A. I. Škokljčev, *Acupuncturology*, ICS, Belgrade, 1976, in Serbian.
 29. J. H. Schultz, *Das Autogene Training*; Thieme, Stuttgart, 1951, 7th ed.; H. Lindemann, *Autogenic Training*; Prosvjeta, Zagreb, 1976, Serbocroat transl. from German.
 30. L. Milcinski, Psychotherapy, its beginning and place of autogenic training in it, in: H. Lindemann, *ibid.*
 31. A. Poro, *Encyclopaedia of Psychiatry*; Nolit, Belgrade, 1990, Serbian transl.
 32. M. R. Nuwer, D. Lehmann, F. Lopes da Silva, S. Matsuoka, W. Sutherling, J.-F. Vilbert, IFCN guidelines for topographic and frequency analysis of EEGs and EPs. Report of an IFCN committee, *Elsevier Science Ireland Ltd Electroencephalography and Clinical Neurophysiology*, 91 (1994) 1-5.
 33. J. F. Bruce, T. A. Pedley, The role of quantitative topographic mapping or 'neurometrics' in the diagnosis of psychiatric and neurological disorders: the cons, *EEG Clin. Neurophysiol.*, 73 (1989) 5-9.
 34. T. Nader, *Human Physiology: Expression of Veda and the Vedic Literature*, Maharishi Vedic Univ., Vlodrop, 1995.
 35. R. K. Wallace, *The Physiology of Consciousness*, Maharishi Int. Univ., Fairfield, 1993; R. K. Wallace, Physiological effects of transcendental meditation, *Science* 167 (1970) 1751-1754; in: D.W. Orme-Johnson, J. T. Farrow (eds.), *Scientific Research of the Transcendental Meditation Program - Collected Papers*, MERU Press, Seelisberg, Vol. 1, 1977.
 36. J. P. Banquet, Spectral analyses of the EEG in meditation, *EEG Clin. Neurophysiol.* 35 (1973) 143-151.
 37. P. H. Levine, J. R. Hebert, C. T. Haynes, U. Strobel, EEG coherence during the transcendental meditation technique, in: D.W. Orme-Johnson, J. T. Farrow (eds.), *Scientific Research of the Transcendental Meditation Program - Collected Papers*, MERU Press, Seelisberg, Vol. 1, 1977, 187-207.
 38. D. J. Kras, The transcendental meditation technique and EEG alpha activity, *ibid.*, 173-181.
 39. A. M. Rouzeré, K. Badawi, R. Hartmann, *High Amplitude Fronto-Central Alpha and Theta Activity During the Transcendental Meditation Technique*, Dept. of Neurophysiol., MERU, Seelisberg, 1979.
 40. J. P. Banquet, M. Sailhan, EEG analysis of spontaneous and induced states of consciousness, in: D.W. Orme-Johnson, J. T. Farrow (eds.), *Scientific Research of the Transcendental Meditation Program - Collected Papers*, MERU Press, Seelisberg, Vol. 1, 1977, 165-172, and *Revue d'Electroencephalographie et Neurophysiol. Clinique* 4 (1974) 445-453.
 41. A. C. Mundy-Castle, The electroencephalogram and mental activity, *EEG Clin. Neurophysiol.* 9 (1957) 643-655.
 42. J. Forem, *Transcendental Meditation: Maharishi Mahesh Yogi and the Science of Creative Intelligence*, Dutton, New York, 1973.
 43. N. Alexander, W. E. Larimore, *Distinguishing Between Transcendental Meditation and Sleep According to Electrophysiological Criteria*, Dept. of Psychol. & Soc. Relat., Harvard Univ., Cambridge MA, and The Analytic Sciences Corporation, Reading MA, 1981.
 44. J. M. Davidson, The physiology of meditation and mystical states of consciousness, in: D. H. Shapiro, R. N. Walsh (eds.), *Meditation: Classic and Contemporary Perspectives*, Adline, New York, 1984, 376-395.

45. N. N. Lyubimov, S. N. Lyubimov, Dual reactivity of cerebrum during application of the special form of psychological training – transcendental meditation, in: Lj. Rakić, G. Kostopoulos, D. Raković, Dj. Koruga (eds.), *Brain and Consciousness: Proc. ECPD Workshop & Symposium*, ECPD, Belgrade, 1997.
46. S. A. Elias, S. Grossberg, Pattern information, contrast control, and oscillations in the short-term memory of shunting on-center of surround networks, *Biol. Cybern.* 20 (1975) 69-98.
47. J. G. Roederer, Physical and neuropsychological foundations of music: The basic questions, in: M. Clynes (ed.), *Music, Mind, and Brain: The Neuropsychology of Music*, Plenum, New York, 1982, and refs therein.
48. D. Raković, Tesla and quantum-coherent states of consciousness: Case study for understanding quantum-holographic nature of creativity, in: D. Mirjanić (ed.), *Ideas of Nikola Tesla*, ANU RS, Banja Luka, 2006.
49. F. Holmes, *The Life of Mozart Including his Correspondence*, Chapman & Hall, 1878, 211-213.
50. G. Rouget, *La Musique et la Transe*, Gallimard, Paris, 1980; R. Jourdain, *Music, the Brain, and Ecstasy*, Avon, New York, 1997.
51. R. Monroe, *Journeys Out of the Body*, Doubleday, Garden City NY, 1971.
52. M. Talbot, *The Holographic Universe*, Harper Collins, New York, 1991, and refs therein.
53. R. G. Jahn, The persistent paradox of psychic phenomena: an engineering perspective, *Proc. IEEE*, 70 (1982) 136-170; R. J. Jahn, B. J. Dunne, *Margins of Reality: The Role of Consciousness in the Physical World*, Harcourt Brace Jovanovic, New York, 1987; and many PEAR (Princeton Engineering Anomalies Research) archive publications and technical communications www.princeton.edu/~pear.
54. V. P. Kaznacheev, A. V. Trofimov, *Cosmic Consciousness of Humanity*, Elendis-Progress, Tomsk, 1992, and refs therein.
55. W. A. Tiller, W. E. Dibble, Jr., M. J. Kohane, Exploring robust interactions between human intention and inanimate/animate systems, Ditron Preprint, *Int. Conf. Toward a Science of Consciousness - Fundamental Approaches*, May 1999, UN Univ., Tokyo, and refs therein.
56. M. A. Persinger, E. W. Tsang, J. N. Booth, S. A. Koren, Enhanced power within a predicted narrow band of theta activity during stimulation of another by circum-cerebral weak magnetic fields after weekly spatial proximity: Evidence for macroscopic quantum entanglement?, *NeuroQuantology* 6(1) (2008) 7-21 (www.NeuroQuantology.com).
57. L. Dossey, *Healing Words: The Power of Prayer and the Practice of Medicine*, Harper, San Francisco, 1993.
58. *Miracles on Lord's Grave*, Orthodox Missionary School of St. Alexander Nevskiy Church, Belgrade, 1998, Serbian transl. from Russian.
59. L. McTaggart, *The Field: The Quest for the Secret Force of the Universe*, Harper Collins, New York, 2002; and refs therein.
60. R. Targ, H. Puthoff, *Mind-Reach: Scientific Look at Psychic Ability*, Delacorte, New York, 1977.
61. D. Chopra, *Quantum Healing: Exploring the Frontiers of Mind/Body Medicine*, Bantam, New York, 1989.
62. K. C. Markides, *The Magus of Strovolos*, Arkana, New York & London, 1985; K. C. Markides, *Homage to the Sun*, Arkana, New York & London, 1987; K. C. Markides, *Fire in the Heart. Healers, Sages and Mystics*, Paragon, New York, 1990.
63. D. Zohar, *The Quantum Self*, Flamingo, London, 1991.
64. F. Capra, *The Tao of Physics: An Explanation of the Parallels Between Modern Physics and Eastern Mysticism*, Flamingo, London, 1991; F. Capra, *The Turning Point: Science, Society, and the Rising Culture*, Flamingo, London, 1997.
65. E. Laszlo, *The Interconnected Universe Conceptual Foundations of Transdisciplinary Unified Theory*, World Scientific, Singapore, 1995.
66. B. Rubik, *Life at the Edge of Science*, Institute for Frontier Science, Oakland CA, 1996.
67. D. Radin, *The Conscious Universe: The Scientific Truth of Psychic Phenomena*, HarperEdge, New York, 1997.
68. S. Ostrander, L. Schroeder, *Psychic Discoveries*, Marlowe, New York, 1997, and refs therein.

69. R. Broughton, Human consciousness and sleep/waking rhythms, in: B.B. Wolman, M. Ullman (eds.), *Handbook of States of Consciousness*, Van Nostrand Reinhold, New York, 1986.
70. Group of authors, *Anti-Stress Holistic Handbook: With Fundamentals of Acupuncture, Microwave Resonance Therapy, Relaxation Massage, Aeroionotherapy, Autogenic Training, and Consciousness*, IASC, Belgrade, 1999, in Serbian.
71. L. L. Vasilyev, *Theory and Practice of Aeroionic Therapy*, Leningrad, 1951, in Russian; L. L. Vasilyev, *Influence of Aeroions on Organism*, Leningrad, 1960, in Russian; A. A. Minkh, *Air Ionization and Its Hygienic Significance*, Medgiz, Moscow, 1963, in Russian; A. A. Shilkin, Yu. D. Gubernskii, A. M. Mironov, *Aeroionic Regime in Buildings*, Stroyizdat, Moscow, 1988, in Russian; H. Johari, *Breath, Mind, and Consciousness*, Destiny, Rochester, 1989.
72. A. P. Krueger, R. F. Smith, Effects of gaseous ions on tracheal ciliary rate, *Proc. Soc. Experim. Biol.* 98 (1958) 412-414; A. P. Krueger, Preliminary consideration of the biological significance of air ions, *Scientia* 104 (1969) 1-17.
73. Y. Omura, T. L. Lin, L. Debreceeni, B. M. Losco, S. Freed, T. Muteki, C. H. Lin, Unique changes found on the qi gong (chi gong) master's and patient's body during qi gong treatment: Their relationships to certain meridians & acupuncture points and the re-creation of therapeutic qi gong states by children & adults, *Acup. & Electro-Therap. Res., The Int. J.* 14 (1989) 61-89.
74. In: A. Rechtschaffen, A. Kales (eds.), *A Manual of Standardized Terminology, Techniques and Scoring System for Sleep Stages of Human Subjects*, U.S. Public Health Service, U.S. Government Printing Office, Washington DC, 1968.
75. N. Ilanković, V. Ilanković, M. Jašović-Gašić, *Sleep Disorder – Diagnostics and Curing*, Cibif, Belgrade, 1995, in Serbian.
76. J. Hasan, Past and future of computer-assisted sleep analysis and drowsiness assessment, *J. Clin. Neurophysiol.* 13 (1996) 295-313.
77. E. Basar, *EEG Brain Dynamics*, Elsevier, Amsterdam, 1980.
78. K. P. Wright, P. Badio, A. Wauquier, Topographical and temporal patterns of brain activity during the transition from wakefulness to sleep, *Sleep* 18 (1995) 880-889.
79. T. Jung, S. Makeig, M. Stensmo, T. J. Sejnowski, Estimating alertness from the EEG power spectrum, *IEEE Trans. BME* 44, 1997.
80. M. Matoušek, I. Petersén, A method assessing alertness fluctuations from EEG spectra, *EEG Clin. Neurophysiol.* 55 (1983) 108-113.
81. A. Belyavin, N. Wright, Changes in electrical activity of the brain with the vigilance, *EEG Clin. Neurophysiol.* 66 (1987) 137-144.
82. M. Nakamura, T. Sugi, A. Ikeda, R. Kakigi, H. Shibasaki, Clinical application of automatic integrative interpretation of awake background EEG: Quantitative interpretation, report making, and detection of artifacts and reduced vigilance level, *EEG Clin. Neurophysiol.* 98 (1996) 103-112.
83. B. Streitberg, J. Röhm, W. M. Hermann, S. Kubicki, COMSTAT rule for vigilance classification based on spontaneous EEG activity, *Neuropsychobiol.* 17 (1987) 105-117.
84. C. Cajochen, D. P. Brunner, K. Kräuchi, P. Graw, A. Wirz-Justice, Power density in theta/alpha frequencies of the waking EEG progressively increases during sustained wakefulness, *Sleep* 18 (1995) 890-894.
85. *MATLAB 4.0 User's Guide*, The MathWorks Inc., Natick, 1994.
86. D. Raković, A. Škokljević, D. Djordjević, *Introduction to Quantum-Informational Medicine, With Basics of Quantum-Holographic Psychosomatics, Acupuncture and Reflexotherapy*, ECPD, Belgrade, 2009, in Serbian.
87. S. E. Li, V. F. Mashansky, A. S. Mirkin, Low-frequency wave and vibrational processes in biosystems, in: K. V. Frolov (ed.), *Vibrational Biomechanics. Using Vibrations in Biology and Medicine*, Part I: *Theoretical Bases of Vibrational Biomechanics*, Nauka, Moscow, 1989, Ch. 3, in Russian; D. Djordjević, *Electrophysiological Investigations of the Mechanisms of Reflexo-therapeutics*, M.S. Thesis, Medical Faculty, Belgrade, 1995, Ch. 1.2, in Serbian.

88. W. R. Adey, Frequency and power windowing in tissue interactions with weak electromagnetic fields, *Proc. IEEE*, 68 (1980) 119-125.
89. R. Voll, Twenty years of electroacupuncture diagnosis in Germany. A progress report, *Am. J. Acup.* 3 (1975) 7-17; R. Voll, *Topographische Lage der Messpunkte der Elektroakupunktur*, Medizinisch Literarische Verlagsgesellschaft MBH, Uelzen, 1976; H. Leonard, *Basics of Acupuncture after Voll*, Imedis, Moscow, 1993, in Russian.
90. B. Pomeranz, Acupuncture research related to pain, drug addiction and nerve regeneration, in: B. Pomeranz, G. Stux (eds.), *Scientific Bases of Acupuncture*, Springer, Berlin, 1989.
91. Contemporary critical review of technologies in the wider field of quantum-informational medicine could be found on the sites *Inergetix* (www.energy-medicine.info) and *Energetic Medicine Research* (www.energetic-medicine.net).
92. D. Raković, Scientific bases of quantum-holographic paradigm, in: I. Kononeko (ed.), *Proc. Int. Conf. Measuring Energy Fields*, Kamnik, Slovenia, 2007, Invited lecture; D. Raković, A. Vasić, Classical-neural and quantum-holographic informatics: Psychosomatic-cognitive implications, in: B. Reljin, S. Stanković (eds.), *Proc. NEUREL-2008*, IEEE Serbia & Montenegro Section, Belgrade, 2008.
93. D. Raković, M. Dugić, Quantum and classical neural networks for modeling two modes of consciousness: Cognitive implications, in: B. Reljin, S. Stanković (eds.), *Proc. NEUREL-2004* (IEEE Yugoslavia Section, Belgrade, 2004); D. Raković, M. Dugić, Quantum-holographic and classical Hopfield-like associative nrets: Implications for modeling two cognitive modes of consciousness, *Opticheskii J.*, 72(5) (2005) 13-18 (*Special Issue on Topical Meeting on Optoinformatics 'Optics Meets Optika'*, Saint-Petersburg, 18-21 Oct. 2004).
94. S. Petrović, *Tibetan Medicine*, Narodna knjiga - Alfa, Belgrade, 2000, in Serbian; On contemporary global holistic experiences of the similar type, see S. N. Lazarev, *Diagnostics of Karma (first book). System of Field Selfregulation*, DI Konstanta, Belgrade, 1995, Serbian transl. from Russian.
95. R. J. Callahan, J. Callahan, *Thought Field Therapy and Trauma: Treatment and Theory*, Indian Wells, CA, 1996; R. J. Callahan, The impact of thought field therapy on heart rate variability (HRV), *J. Clin. Psychol.*, Oct. 2001, www.interscience.Wiley.com
96. D. Raković, Ž. Mihajlović Slavinski, Phenomenology of meridian (psycho)therapies and quantum-holographic psychosomatic-cognitive implications, in: M. Pelizzoli, W. Liimaa (eds.) *Proc. 1st Symp. Quantum Health & Life's Quality*, in Portuguese (Editora Universitaria UFPE, Recife, Brasil, 2009), Invited lecture.
97. S. Milenković, *Values of Contemporary Psychotherapy* (Narodna knjiga-Alfa, Beograd, 1997), in Serbian.
98. K. Wilber, *The Atman Project*, Quest, Wheaton IL, 1980.
99. J. Vlahos, *Orthodox Psychotherapy: Holy Fathers Science*, Missionary School of St. Alexander Nevskiy Church, Belgrade, 1998, Serbian transl. from Greek.
100. D. Giulini, E. Joos, C. Kiefer, J. Kupsch, I. -O. Stamatescu, H. D. Zeh, *Decoherence and the Appearance of a Classical World in Quantum Theory*, Springer, Berlin, 1996.
101. Fundamentally-theoretical reasons for this *out-of-body displacement of consciousness* lays in necessity that consciousness must have, at least in (quantum-coherent) altered/transitional states, *sufficiently isolated relevant macroscopic quantum degrees of freedom* – in order to have indeterministic characteristics of *free will* – which is *otherwise not possible in strong body's environment* which causes quick quantum decoherence of consciousness into (classically-reduced) normal state [1,13,86,91,92].
102. Ć. Hadži-Nikolić, Therapeutic significance of altered states of consciousness in hallucinogenic shamanistic rituals, in: D. Raković, Dj. Koruga (eds.), *Consciousness: Scientific Challenge of the 21st Century*, ECPD, Belgrade, 1995; B. J. Øverbye, The divided self as understood by shaman natural healers! An effort of transcultural research to understand altered states of mind, in: M. Sovilj, S. Jovičić (eds.), *Proc. 3rd Int. Conf. Fundam. & Appl. Aspects of Speech & Language*, IEPSP, Belgrade, 2009.
103. Swami Prabhavananda, Ch. Isherwood (tr.), *The Yoga Sutras of Patanjali. How to Know God*, New American Library, New York, 1969; P. Vujićin, States of consciousness in esoteric practice, in: D.

- Raković, Dj. Koruga (eds.), *Consciousness: Scientific Challenge of the 21st Century*, ECPD, Belgrade, 1995, and refs therein.
104. N. Berdyaev, *Philosophy of Freedom*, Logos Ant, Belgrade, 1996, Serbian transl from Russian.
 105. D. Raković, M. Dugić, M. Plavšić, The polymer conformational transitions: A quantum decoherence approach, *Mater. Sci. Forum* 453-454 (2004) 521-528; M. Dugić, D. Raković, M. Plavšić, The polymer conformational stability and transitions: A quantum decoherence theory approach, in: A. Spasić, J-P. Hsu (eds.), *Finely Dispersed Particles: Micro-, Nano-, and Atto-Engineering*, CRC Press, New York, 2005, Ch. 9; D. Raković, M. Dugić, M. Plavšić, Biopolymer chain folding and biomolecular recognition: A quantum decoherence theory approach, *Mater. Sci. Forum* 494 (2005) 513-518; D. Raković, M. Dugić, M. Plavšić, G. Keković, I. Cosic, D. Davidović, Quantum decoherence and quantum-holographic information processes: From biomolecules to biosystems, *Mater. Sci. Forum* 518 (2006) 485-490.
 106. Kandel ER. A new intellectual framework for psychiatry. *Am J Psychiatry* 1998;155:457-469.
 107. P. Ch. Vu, *Su Jok Self-Healer*, Balkan Su Jok Therapy Center, 2003, Serbian transl from Russian, 2001.
 108. P. P. Garyaev, *Wave Genetic Code*, Moscow, 1997, in Russian; P. P. Garyaev, U. Kämpf, E. A. Leonova, F. Muchamedyarov, G. G. Tertishny, *Fractal Structure in DNA Code and Human Language: Towards a Semiotics of Biogenetic Information*, Dresden, 1999.
 109. D. Raković, Tesla and quantum-coherent states of consciousness: Case study for understanding quantum-holographic nature of creativity, in D. Mirjanić (ed.), *Ideas of Nikola Tesla*, ANU RS, Banja Luka, 2006.
 110. F. Holmes, *The Life of Mozart Including his Correspondence*, Chapman & Hall, 1878, 211-213.
 111. D. Witztum, E. Rips, Y. Rosenberg, Equidistant letter sequences in The Book of Genesis, *Statistical Science*, 9 (1994) 429-438; M. Drosnin, *The Bible Code*, Simon & Schuster, New York, 1997; M. Drosnin, *Bible Code II: The Countdown*, Viking Penguin, New York, 2002.
 112. D. Bohm, *Wholeness and the Implicate Order*, Routledge & Kegan Paul, London, 1980, and refs therein.
 113. K. Pribram, *Brain and Perception: Holonomy and Structure in Figural Processing*, Lawrence Erlbaum, Hillsdale NJ, 1991; K. Pribram, *Languages of the Brain: Experimental Paradoxes and Principles in Neuropsychology*, Brandon, New York, 1971, and refs therein.