ALTERED S\TATES OF CONSCIOUSNESS:
REVIEW OF EXPERIMENTAL DATA OBTAINED WITH A MULTIPLE TECHNIQUES APPROACH

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ABSTRACT

Abstract

Objectives: To investigate the psycho-physiological mechanisms of an Altered State of Consciousness (ASC) produced through systematic mental training by correlating the results of multiple computerised bioelectrographic measurements.

Design: All subjects were tested using a set of modern computerized techniques comprising: digital electroencephalography; measurement of the low-frequency bi-lateral activity of the brain; evoked bioelectrographic signals measured by computerised Kirlian photography [otherwise called Gas-Discharge-Visualisation (GDV)]; self-reporting by subjects; linguistic testing; profiling of mood states.

Location: Sweden and Russia from 1996 to 1999.

Subjects: Young volunteers (61) undergoing systematic mental training for not less than 7 weeks. The control group (56) were not engaged in mental training.

Results: All participants involved in the systematic mental training showed significant positive changes in their psycho-emotional status after 7-weeks of mental training. All the techniques showed specific changes which might be associated with an Altered State of Consciousness in the subjects. The Kirlian (GDV) patterns showed a form of 'explosive activation' which was stable, reproducible and correlated with an Altered State of Consciousness. This led the authors to introduce the concept of short-term activation of the induced bioelectrographic processes and enabled the properties of this Altered State of Consciousness to be determined for the first time. There were practically no changes in the Control Group.

Conclusion: Altered State of Consciousness activation took place with harmonisation of the biopotential field of the brain, the psychic state and the bio-energy fields. This is attributed to changes in both the psychosomatic and psycho-energetic autoregulation. This conclusion is of vital importance for understanding what happens in systematic mental training and, the fundamentals of bio-energetic and psychosomatic medicine.

INTRODUCTION

The main objective of this research carried out within the international project "Mental Training for Sport and Life", was to study the bioelectrographic correlates and the psycho-physiological mechanisms of an Altered State of Consciousness (ASC) during a systematic mental training. Topicality of the ASC study is explained by the fact that the ASC is a peculiar "window" for learning mental activity mechanisms, solving problems of traditional and alternative medicine and, at the same time, for interpreting a number of social and cultural phenomena. It is agreed nowadays, that many of the mental training modalities widely used in healing and creative work are based on the hetero-induction or self-induction of ASC. (Ferguson, 1975; Grof and Bennett, 1992; Wright, 1995; Tiller, 1997; Volkov, 1999).

Taking into account existing psycho-physiological and phenomenological ASC classifications (Krippner, 1972; Gowan, 1978; Spivak, 1996) and our own experience in studying ASC (Unestahl and Bundzen, 1996; Korotkov, 1998), in the present research work we proceeded from the thesis that the ASC represents either spontaneously arising or purposefully formed consciousness states which differ quantitatively in the human behavior pattern and energy-informational mechanisms from ordinary consciousness states.

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The study of the brain mechanisms of ASC and the development of new practical techniques for this purpose seems to be a very important task. It may be solved by using complex Bioelectrography approach which is based both on different brain mapping methods (EEG, PAT-scan, etc.) and techniques which measure the distribution of bioelectrography parameters throughout the body (computerised versions of the Kirlian Effect – Gas Discharge Visualisation (GDV) Technique (Korotkov, 1998)). Taking into consideration the long periods of preparation and training required for every participant on the one hand, and the individual character of a particular person's reaction on the other hand, we are not expecting a high level of statistical repeatability of the quantitative data but are rather looking for the common trends in bioelectrography patterns and activity. These trends are best revealed using computer processing and modelling.

MATERIALS AND METHODS

Mental training, modelling and control of ASC. The experiments were performed in Sweden and Russia from 1996 to 1999. Audio-programs from the Swedish mental training program, including the stages of body relaxation, mental relaxation-1 and mental relaxation-2, were used for this study. The sessions were carried out three times a week for seven weeks. The basic audio-program «Mental relaxation –2» included a series of the following fragments: body relaxation - 4'30"; attaining ASC (ASC-Rx), - 4'; mental activity while in ASC (ASC-Act) - 4'50", leaving ASC or mental relaxation -1'30". All exercises were backed by musical pieces from "AVSLAPPINGSMUSIK" by L-E. Unestahl.

During a given session the subjects practiced active mental imagination following the audio-program contents. The specific goal of the mental imagery was to merge with nature and to absorb solar energy. The participants in the control group were listening to the stereo-recording of the ocean waves sound for 14'50".

The temperature was kept in the interval $22,0° — 22,5°C$; humidity was kept in the interval 42% — 44%.

The participants of the study consisted of 61 healthy volunteers ranging in age from 17 to 23. The control group included 56 subjects not engaged in mental training. The ASC self-induction training technique (independent of the language version of the mental training audio-program) took approximately 7±2 weeks. The time required and the depth of the altered state was related to the degree of hypnotisability which was measured using the Stanford scale. Healthy people engaged in mental training for at least 2 years are capable of acquiring ASC rapidly and maintain the state for extended periods of time.

As a criterion of ASC formation QDCP registration method (see below) was used. ASC depth criterion was the reduction of QDCP values to 20 ± 5 mV, and ASC formation criterion was the disappearance of QDCP bilateral asymmetry, typical of ordinary consciousness state.

Psychological evaluation. To monitor the psychological state of the participants and the process of obtaining ASC, self-reports of the subjects, linguistic test (Spivak, 1986) and "Profile of Mood States" (POMS) diagnostic test (McNair, 1992) were used. The parameter, characterizing relative psycho-energetic readiness (hereinafter PER) was determined by a formula:

$$PER = \frac{V}{\dfrac{\sum \left(A_n + D + A + F + C \right)}{5}},$$

where: A – Aggression, A_n – Anxiety, C – Confusion, D – Depression, F – Fatigue, V – Vigor – standard scales of POMS.

Psychological tests for all the participants were conducted three times during the mental training course: before the beginning of the course, after the basic course (three weeks), and upon the whole course completion (seven weeks).

Computerised electroencephalography. Computerized encephalograph "Nixon Coden", magnetograph EAM-500 (Tesla), and encephalograph by "Biophyspribor" company (Russia) were applied for the investigations.

Spectral analysis of electroencephalograms (EEG), analysis of the spectral coefficients of local activation and fractality analysis of EEG spectra were used for 29 participants. Recording of EEG was carried out using 16 cup electrodes, connected with loop electrodes and settled strictly according to the 10/20 system. Each subject was reclining in a comfortable chair with the eyes closed. Visual control was carried out on a video monitor to remove artefacts before processing the EEG fragments. 12-channel digital EEG recordings with 256/sec digitalisation were used. EEG measurements were taken both during heteroinduction and selfinduction of ASC.

During the first stage of processing, Brain Electrical Activity Mapping (BEAM) was carried out using the following EEG characteristics: F_3, F_4, F_7, F_8, F_3, C_3, C_4, C_Z, T_3, T_4, T_5, T_6, P_3, P_4, P_Z, O_1, O_2.

For the spectral analysis at least 15 non-artefact, two-second EEG recordings were selected. Absence of motive artifacts and relative stationarity of biorythmics was a criterion for the experts-neurophysiologists to choose the analyzed epochs. The standard frequency bands of EEG analysis - delta, theta, alpha, beta-1 and beta-2 – were used. After Fourier-processing, based on two-second recordings, matrixes of the averaged power according to the EEG frequency components for each band zone were built. Each matrix included data on intensity variations of the mentioned above EEG frequency components for 15 analysed epochs. For each subject the following stages were analysed: background, body relaxation, mental relaxation (ASC-Rx), mental activity (ASC-Act) and post-action. Both individual data and average data of the experimental (15 subjects) and control (14 subjects) groups were studied.

Statistical analysis of the averaged power matrixes according to the EEG frequency components was carried out for the following parameters:

1.   changes in the average power of the EEG spectrum components during the mental state transformations.

2.   changes in the absolute value of the spectral coefficients of local activation during the mental state transformations. Coefficients of spectral activation were calculated according to the method proposed in (Pavlova and Romanenko, 1988). Patterns of cortical activation were determined which reflect the distribution and relationships between local activation coefficients in the analysed brain regions (Bundzen et al, 1996).

3. fluctuations and fractality attractors in the EEG power spectrum as a punctuation of the mental state: passive state (D-mode) and ASC (A-mode) (Yoshida, 1991).

Quasi-DC Potential (QDCP). The QDCP recording method was developed in Neurophysiology department of the Experimental Medicine Institute of Russian Academy of Medical Science and is widely used nowadays in fundamental and applied study (Iluchina and Zabolotskich., 1993). Digital recording of the QDCP of the milli-Volt range was carried out with two disposable silver-chloride electrodes from "Medico Teknik" (Denmark) positioned in the upper part of the forehead four centimetres apart. Bipolar leads had frontal leads on the right and left forehead sides and corresponding hand tenor. Two-channel microprocessor "Omega-tester" device, produced by "NIIF" Company (Russia) was used. Input resistance of the constant current amplifier was 100 MOhm, the range of the registered potential ±100 mV. Quantification of QDCP recordings took 3 seconds per recording channel. Polarisation of the electrodes did not exceed 2.2 mV per hour. Information was decoded using either a digital display tester or an IBM computer.

Evoked by Electromagnetic Field Emission with Gas Discharge Visualisation (EEE GDV technique). Image formation in gas discharge around objects of different nature initiated by strong impulsive electromagnetic field (also called Kirlian effect) is known for more then two centuries (Boyers and Tiller, 1973; Mandel, 1986; Korotkov, 1998). So far the main direction of investigation of the effect was purely practical: it turned out that gas discharge pictures around bio-

logical objects could provide substantial information about the internal state of the object. In particular, physicians in many countries actively use the gas discharge images of human fingers and toes nowadays for screening and monitoring of human state (see (Korotkov, 1998) for review).

The scheme of experiment is shown in Fig.l. By vacuum photo-galvanoplastic process a thin metal grid with 10 micron wires is evaporated on the bottom surface of the glass plate 2. The train of duration 0.ls of triangle 10 microseconds electrical impulses of amplitude *3kV,* steep rate 10^6V/s and repetition frequency 10^3Hz are applied to this grid generating electromagnetic field around the subject 1 (finger). Under the influence of this field the subject produces a burst of electron-ion emission and optical radiation light quanta 4 in visual and ultraviolet range. These particles and photons initiate electron-ion avalanches, giving rise to the sliding gas discharge 3 along dielectric surface (Boyers and Tiller, 1973). Spatial distribution of discharge channels is registered via glass plate by the optical system 6 with Charge Coupled Device TV camera 7 and digitized in the computer 9 using videoblaster 8. In short this technique is called BEO GDV Technique and images after processing are called GDV-grams (Korotkov, 1998).

A set of specialised GDV software programs allowed the following operations: observation of GDV-grams in a real time scale; storage in the computer memory; image filtration and processing of GDV-grams which involved calculation of the parameters and creating dynamical diagrams of complex GDV parameters distribution. Image processing allowed calculation of the following quantitative parameters (Korotkov, 1998; Korotkov and Korotkin, 2001):

- integral parameters: glow area, normalised glow area, number of fragments, spectral distribution, background level of noise;
- fractality parameters: form coefficient and fractality according to Mandelbrot;
- probability parameters: entropy, an autocorrelation function;
- statistical parameters.

Together with computer image processing time dependence of integral intensity of the discharge was measured using standard secondary emission photocell. System photosensitivity in 215-650 nm wavelength ranges was no less than 97 mcA/lm.

GDV Technique was found to be effective in human health state evaluation (Bevk et. al., 2000; Korotkov, 1998), monitoring of individual reactions to different trainings (Howell, 1999; Dobson and O'Keffe, 2000), study of energy properties of liquids (Korotkov, 1998; Korotkov and Korotkin, 2001). The GDV Camera is certified in Russia as a medical instrument.

"GDV Camera" instrument produced by the "Kirlionics Technologies International", Saint-Petersburg, Russia, utilized in experiments had the following parameters: single impulse duration – 10 microseconds; repetition frequency – 1000 Hz; induction interval – 0,5-1 s; electrode voltage – 3-15 kV. Measurements were done for all participants before, in the process and after submitting to ASC.

Statistical processing. Data of all measurements were processed statistically by means of standard software package "STATISTICS 5.0". Parametric inter-correlations were studied with multiparametric factor analysis, in particular, unrotated method with extraction of principal components.

EXPERIMENTAL RESULTS AND DISCUSSION

INDIVIDUAL PSYCHO-EMOTIONAL STATUS CHANGES UNDER SYSTEMATIC MENTAL TRAINING INFLUENCE

For all participants involved in mental training significant positive changes in psycho-emotional status after 7 weeks of training was found with practically no changes for control group. Averaged data of POMS scales values diversity for the experimental group are represented on fig.2. The POMS profile is getting close to so named "iceberg" model as the "Vigour" parameter is dominant and the PER parameter is ever changing (p<0,001) in statistically reliable

manner. The "Iceberg" model indicates reduction of aggressiveness and anxiety with increase of vigor and self-reliance (McNair, 1992). According to POMS modifications, we can conclude also that the mental training course results in individual statistically reliable stress-tolerance development. Moreover, not only stress-tolerance factors, but also psychosocial adaptation values are under positive change. Testees' self-reports completely confirmed the discovered POMS modifications by emphasising the development of such qualities as "Cheerfulness", "Alertness", and "Vigor". For the control group no significant changes in the POMS curve profile were found during the same period of seven weeks.

It is important to point out, that as was found in previous studies (Bundzen et al,1998) similar POMS factors variations were accompanied by reliable stress-hormone (cortisole, dehydroepiandrosteron) level modifications and immune improvement.

BRAIN BIOELECTRIC ACTIVITY

EEG Power

Statistical analysis of the averaged power values of the EEG spectral components demonstrated that experimental subjects in an ASC revealed the following statistically significant distinctive features absent at the control group:

1.   in the process of mental relaxation while in the ASC (ASC-Rx) statistically reliable increases in theta and alpha activity in the following regions of the frontal cortex were registered: F_3, F_4, C_3, C_4, T_6, O_1 ($p < 0,05$);

2.   during active imagination (ASC-Act) the decrease in power of alpha-activity power in the retrocentral zones of the cortex was observed: T_5, T_6, P_3, P_4, O_1, O_2 ($p < 0,05$-$0,01$). Simultaneously beta-1 activity increased in the right-lobe zones F_4 and F_8 ($p < 0,05$). These changes lead to the levelling off of alpha-activity with a frontal-occipital trend. Besides, among the majority of the subjects the given changes were followed with splitting the peak of the dominant alpha-rhythm frequency in P_3, P_4, O_1, O_2 into two peaks: low frequency ($6,8\pm0,3$ Hz) and high-frequency ($11,0\pm0,4$ Hz). The dominant frequencies occurred in the ratio $1,61\pm10\%$.

It is noteworthy, that during active imagination in ASC-Act the EEG power spectrum profile, both of the anticentral and retrocentral zones, statistically followed the function l/f. The attractor of the spectrum subdominant frequencies (delta, theta, alpha and beta-1) had a ratio of $1,61\pm10\%$ (fig.3). This ratio is well known in the literature as the "golden mean". It should be noted, that a similar structure of the EEG spectrum was discovered previously during modelling of positive mental states (Yoshida et al, 1991), and fractal l/f fluctuations in the EEG spectrum were considered as the reflection of a general biological integration and harmonisation mechanism of the functional cortex systems (Korotkov and Krizanovsky, 2000).

The above-mentioned, as well as the fact that the EEG spectrum in ASC-Act was characterised by the polyharmony of frequency components, contribute to the hypothesis of a possible increase in "harmonic resonance" in the process of activity in ASC (Oschman, 2000). Most probably decrease of alpha-activity is directly connected with active mental activity under ASC-Act in contrast to ASC-Rx. This fact brings together EEG of ASC-Act correlates and EEG of the so called Shamanic-ASC correlates (see Wright, 1995).

Spectral Activation Coefficients (EEG-SAC)

The second stage of the study of ASC neurodynamic correlates was the analysis of the dynamics of system-structural transformations of cortical activation, based on the application of a method, well-known in applied psychophysiology – calculation of the spectral activation coefficients (SAC – fig.4).

The mapping of the dynamics of changes in cortical activation according to the SAC values testified to the statistically reliable transformation of both frontal–occipital and bilateral asymmetry of the brain in the process of ASC-Act (fig.4, fragment 3).

It was found that stability of the given processes was determined, mainly, by the duration and systematic character of mental training and was not dependent on the hypnotizability of a subject. Thus, in the process of ASC, transformation of the brain's dominant system-structural or-

ganisation, typical for the ordinary state of consciousness and transition into a state of "non-dominant activation" (ASC-mode), characterised by the symmetry of brain lobe activation, took place. With this, leaving ASC, the restoration of the dominant system-structural organisation was observed, although, maximum activation was shifted to the anticentral and central structures of the right lobe (fig.4 , fragment 4).

Quasi-DC Potentials

The analysis of quasi-DC potential (QDCP) during consciousness transformation in ASC-Act revealed the disappearance of bilateral asymmetry in the mV region. This allowed the assumption for the participation of a super-slow controlling system in the system-structural reorganisation processes of brain activity during transformation into ASC (fig.5). In the control group no statistically reliable changes in the spatial organisation patterns of spectral activation coefficients (SAC) and QDCP were observed. For some participants the decreases in SAC absolute values and levelling of QDCP bilateral asymmetry were observed within 7-10 minutes of listening to the ocean waves sound. However, these changes were statistically unreliable.

It is noteworthy, that the disappearance of asymmetry between the brain lobes was also observed in ASC induced by drugs, in particular, in the case of "dissociative states of consciousness" provoked by ketamine, and in hypnotic states (Cherednechenko, 1997, Koekina, 1997).

All the discussed above together with published data allowed the assertion that consciousness transformation into ASC was associated with a system reorganisation of brain activity. According to the data obtained, the change in the interaction of thalamus-cortical and limbic-reticular systems took place. This conclusion was supported by the results of study of the dynamics of amplitude-time dependences of middle-latent evoked responses under the influence of ketamine (phencyclidine) (Koekina, 1997), as well as by the calculations of doublet sources of slow waves in C_Z and F_Z areas generated in ASC. With this, the fact that the subjects described their mental state in ASC-Act not only as the state of positive psycho-energy activation, but also as the state of "inner euphoria" allowed the assumption that in ASC activation of "self - rewarding" brain systems took place. The later is likely as phencyclidine brain receptors belong to the positive self-reinforcement systems of the brain (Bundzen and Saad, 1984).

In general, we can assume that in ASC the measure of brain dissipative functions as an informational system changes considerably. In this case, the most favourable conditions for the reproduction of centrally determined reactions and memory activation can be formed (Terner and Poppel, 1995). In addition, retardation of reflective processes results in vivid mental images in ASC.

EVOKED BY ELECTROMAGNETIC FIELD BIOLOGICAL EMISSION (EEE-GDV)

The research revealed changes in the EEE GDV characteristics in ASC. These changes were registered by applying various physical principals: photography, integral light intensity measurements and computer pattern recognition techniques. Digital processing of the GDV patterns were found to be most informative. Parameters calculated in the GDV programs demonstrated follow-up of the person's state in different phases of mental training. Most important, statistically significant GDV spatial patterns were found specific to transformation into ASC-Act.

Integral light intensity of the EEE GDV in 215-650nm wavelength range increased steadily with statistically reliable upper limits at the 7th Course Week. It was correlated with discussed above psycho-energetic readiness dynamics, defined by POMS parameters.

Statistical analysis of the GDV-grams for experimental group participants in ASC-Rx and ASC-Act states demonstrated reliable difference of the GDV parameters for these states compared with the ordinary state (Table.1). Correlative and factorial analyses of these data testified high level of correlation for the participants after 7-weeks course of mental training between GDV patterns area of the fourth (4L) and fifth (5L) fingers of the left hand and fourth finger of the right hand (4R), from one hand, and POMS psychological test parameters, from the other hand. The most significant correlations were as follows: positive one with "Vigor" parameter (R

= + 0.80) and negative correlations with parameters "Anxiety" (R = - 0.53), "Depression" (R = - 0.69), "Aggression" (R = - 0.88) and "Fatigue" (R = - 0.61).

Hence, GDV patterns parameters, from one hand, allowed differentiation between ASC-Rx and ASC-Act states, that demonstrated significant difference of the evoked energy processes in these states, and, from the other hand, revealed interconnection with increase of psycho-energy personal potential under the influence of systematic mental training ("Vigor" parameter – see fig.2).

As a matter of fact, the maximum EEE GDV parameters changes were observed in ASC-Act. They coincided in time with the levelling of bilateral functional asymmetry of the brain. During intense mental activity in ASC-Act (subject concentrating on mental images or ideomotor reproduction of psycho-motor attainment) these changes may be described as a **short-term explosive activation** in the EEE GDV processes. Considering the functional loading specificity, e.g. concentration of attention, memory activation, or fanciful imagination, it is fair from our viewpoint to describe the given phenomenon in terms of **short-term explosive psycho-energy activation (EPEA)**. It is possible to single out the following functional features of EPEA:

1. specific for EPEA EEE GDV patterns were revealed as the two types of spatial patterns: either strong changes of the EEE intensity within the specific topographic zones or in the form of separated fragments of concentrated emission (fig.6);

2. most often (80% of cases) specific for EPEA EEE GDV patterns were registered selectively on the ring fingers, where according to Mandel (1987) and Korotkov (1998) the reflexogene zones corresponding to the neuro-endocrine regulation centres were situated;

3. particular for EPEA generation features of the Bioelectrography characteristics were as follows: first, the bilateral balance of quasi-DC potentials, which was described earlier as the differential diagnostic feature of forming ASC-Act, and second, peak values of the EEE integral intensity for a given subject (fig.7);

4. in the ASC-Act GDV patterns of different people lost their distinctive features characteristic for the particular person and have been transformed to very similar patterns with high fractality and "openness"; this fact corresponded to the data of R. Beck (1986) who revealed similar brain wave patterns for a big group of healers transformed to their "altered state" during healing;

5. EPEA was regularly revealed only among people who had completed all sessions of the mental training program for at least 7 weeks;

6. the particular trait of forming EPEA was mental relaxation followed by active mental imagination, i.e. transition from ASC-Rx to ASC-Act.

Thus, EPEA had a short-term character and was directly connected with mental activity in ASC-Act. Taking into account the character of the altered GDV patterns we could assume that at the given conditions the physical nature of the registered glow also have been transformed and the hypothesis of "quasi–coherence behaviour" (Korotkov, 1998; Oschman, 2000) might be taken into consideration.

The phenomenon of EPEA was statistically reliable and was measured in different experiments: in hypnotic states, for top athletes in the process of competition imagination, for actors during theatrical performance, and for healers in the healing mode. Sharp decreases in GDV-gram areas and increases in the number of fragments, i.e. increase in image fractality, were registered for a lot of professionals in these fields in Russia, Sweden, Finland and USA.

S U M M A R Y

To summarize research results and progress, it is sound to infer that psycho-dynamic modifications under mental training influence are of complex energy-informative nature, whose interpretation might be of vital importance for the cognition of both mental training and "bio-energetic therapy" fundamentals of psychosomatic medicine.

EEE-GDV explosive activation effect caused by mental functioning in ASC was first discovered in this research. It requires further detailed study. Experimental data however, confirms

psycho-energetic self-regulation transitions in the state of consciousness transformation. It may be practically applied as a criterion of mental training, meditation and healing efficiency.

In general, the revealed correlates and phenomena lead to the conclusion that in ASC, changes in both psychosomatic and psycho-energetic autoregulation takes place. With this, special attention should be paid to the following revealed features:

1. harmonisation of the biopotential field of the brain, which appeared both in ASC-Rx and ASC-Act;

2. a psycho-energetic activation directly correlated with mental activity in ASC-Act, revealed as a GDV explosive activation and, seemingly, correlated with the change in the physical nature of the EEE GDV parameters.

A problem on the functional role of the discovered phenomena arises, in particular, the relationship between the processes of interaction of brain activity and the energy-informational space, i.e. the energy-information homeostasis of the bio-energy and bio-field (Syldona and Rein, 1999; Tiller, 1997). No doubt this problem needs to be carefully studied further. However, from our viewpoint, the data obtained allows the claim that bioelectrographic correlates of the mechanisms of mental activity in Altered States of Consciousness do not refer just to the electro-chemical level of the brain.

Coming to this conclusion, we would like to stress that at the turn of the XXI century, the study of psychophysiological mechanisms of Consciousness and Altered States of Consciousness with considering psycho-energetic approaches may be quite useful. Our research required a great deal of complex bioelectrography technology, thus unifying analytical aspects of psychophysiological and psychophysical methods of research.

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CAPTIONS

Fig.1. The experimental scheme of the Gas Discharge Visualization Technique. 1 – subject under study; 2 - optical glass with coating underneath; 3 - gaseous discharge; 4 – optical radiation; 5 -impulse generator; 6 - optical system; 7 - CCD camera; 8 - video digitizer; 9 - IBM PC; 10 - Device box.

Fig.2. Modifications of the Profile of Mood States and psycho-energetic readiness parameter (PER) under influence of the integrative mental training.
ANX – Anxiety, DEP – Depression, AGG – Aggression, VIG – Vigor, FAT – Fatigue, CON – Confusion

Fig.3. Averaged profiles of EEG spectrum for the rest state (eyes closed) 10 min before mental relaxation (dotted line) and ASC-Act (firm line). Abscissa axis – frequency in Herz, ordinates axis – relative power of spectrum components. Number of participants N=11. Reliability of frequency difference: delta $p < 0.001$; theta $p < 0.001$; alpha $p < 0.05$; beta $p < 0.05$. Smooth descending curve corresponds to 1/f dependence of the flicker noise. Arrows indicate projection of the spectrum peaks in ASC-Act to the function 1/f. Relation between function values in the points 1,2,3,4,5,and 6 supports idea of the polymodal harmonization of EEG spectrum in ASC.

Fig.4. Averaged patterns of spectral coefficients of cortical activity for the studied psychic states: 1 – state of calm awakening (background); 2 – state of muscle relaxation; 3 – state of mental relaxation (ASC-Rx); 4 – state of active imagination (ASC-Act); 5 – state of calm awakening (10 min after submerging to ASC).
Diameter of dots corresponds to the values of activation coefficients in EEG zones in accordance with 10/20 system. Number of participants N=11.

Fig.5. Time dependence of the averaged QDC potential for different states of consciousness.
1 – muscle relaxation; 2 – mental relaxation (ASC-Rx); 3 –active imagination (ASC-Act); 4 – after-state. R and L – right and left side measurements. Number of participants N=15.

Figure 6. Modification of the patterns of the GDV energy emission of left ring finger for four testees in conditions of mental work - active imagination in the process of transformation to ASC-Act.
A and B – patterns before and in the process of immersion to the ASC-Act, correspondingly.

Figure 7.Time dependence of the averaged QDC potential and current of the energy emission during immersion to ASC and active imagination in ASC-Act.
1 and 2 - QDC potential of the left and right sides of the body, correspondingly; 3 - GDV current; ---- time of the mental relaxation and imagination (8-16 min); images on top – examples of GDV patterns in different states.