EXPERIMENTAL APPROACH TO STUDY MIND-MATTER INTERACTIONS

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Abstract

Physical principles and experimental results of application of the Gas Discharge Visualization system (GDV) in conjunction with a "GDV Eco-sensor" special antenna which allows the monitoring both of non-selective characteristics of the environment and the functional state, in particular emotional state, of groups of people, are presented. The method was tested during theater performances and concerts, workshops and lectures, as well as in group meditation. In many cases, the correlation of GDV parameters variations and emotional state of the audience was recorded. The lowest values of the standard deviation of a signal corresponded to quiet functional state of people. Accordingly, the larger the standard deviation, the higher functional stress of people in the room. The system presented has two sensitive elements: antenna "GDV Eco-sensor" and the gas discharge itself, which makes it non-selectively sensitive to changes in chemical and physical characteristics of the surrounding space. The challenge was to develop a methodology and a low-cost device for informative, comprehensive evaluation of the consciousness interaction with the physical reality, which can be used both in a professional environment and by the civilian population.

Key words: Quantum theory of mind and consciousness, mind-matter interactions, emotions, meditation, environment.

Introduction

Objective of this paper is presenting physical principles and experimental results of application of the Gas Discharge Visualization system (GDV) in conjunction with a "GDV Eco-sensor" special antenna, which allows to study different aspects of mind-matter interactions.

One of the key questions of the consciousness study is the following: is consciousness a property of the individual mind solely governing activity of a person, or is it expanding into the environment, having the property to influence other people and physical reality? To answer this question we need both to develop conceptual ideas explaining consciousness from the modern scientific paradigm, and create new experimental approaches. The most potential conceptual ideas was offered by quantum theories of mind and consciousness. The original motivation in the early 20th century for relating quantum theory to consciousness was essentially philosophical [1]. Quantum theory introduced an element of randomness standing out against the previous deterministic worldview. Other features of quantum theory, which were found attractive in discussing issues of consciousness, were the concepts of complementarity and entanglement. In particular, relations between the two can be conceived in terms of dual aspects of one underlying “reality”. This conception, drawing on the philosophy of Spinoza, has been considered attractive by 20th century scientists such as Bohr, Pauli, Bohm, Primas, d'Espagnat, and others. There are quite a number of accounts discussing quantum theory to consider intentional conscious acts as intrinsically correlated with physical state reductions. Another idea dating back to Ricciardi and Umezawa in the 1960s is to treat mental states, particularly memory states, in terms of vacuum states of quantum fields [2]. A prominent proponent of this approach at present is Vitiello [3]. Several other ideas trying to explain different aspects of consciousness was developed by different research groups [4,5].

Experimental approach to study interactions of consciousness with the environment and, in particular, with different physical sensors was developed by many research groups in the last century (survey of different results may be found in [6]). Many experiments in this field were conducted in Russia [7], China [8] and Japan [9]. At the same time, scientific community still keeps very skeptical attitude to all experimental evidences of the consciousness influence to the physical reality.

A complex set of parameters of the bio-sphere and techno-sphere determines the ecological state of the environment and its influence on the health and well-being of people. These include among many factors the features and climate of the area, particularly, level of solarization, level of air pollution, and distribution of electromagnetic fields of natural and anthropogenic origin. Recent research has shown that a significant contribution is also made by the heterogeneity of the earth’s crust structure as discontinuous zones of tectonic disturbances and tensions, in particular, ancient buried rivers[10],[11] . During 1992-2005 a large scientific team took a number of geological, geochemical, geographical and ecological surveys in St. Petersburg, looking for correlations between them and the health status of the population. The investigation revealed a statistically significant correlation between the level of disease in different areas of St. Petersburg and the presence of underground anomalies[12]. The influence of the electromagnetic field on human health has been widely studied[13], including the effect of artificial electromagnetic radiation on the overall balance of the Earth's own microwave radiation and the response of biological systems to perturbations of the electromagnetic field in the high frequency (HF) and very high frequency (VHF) bands through human activities[14]. The variety of factors and their dynamic nature requires the use of complex specialized methods which are not always available even in well-equipped research centers. This makes the evaluation of hazards difficult even for large companies, not to mention individual citizens. A similar assessment is important both at the design phase of new construction and in the analysis of the causes of poor health and the increased incidence of poor health in certain climatic and geographical areas.

The challenge for engineering is therefore is to develop a methodology and a low-cost device for informative, comprehensive evaluation of the consciousness interaction with the physical reality, which can be used both in a professional environment and by the civilian population. As these effects are strongly dependent on the subtle influence of the environmental factors, this device should be sensitive to the integral parameters of the ecological environment.

The purpose of this paper is to show that the GDV technique meets these challenges.

Materials and methods.

EPI/GDV Technique. The Human Energy Field (HEF) is a highly sensitive reflection of the physical, emotional, and in some instances, the spiritual assessment of an individual. To measure the energy field, the fingers of both hands are subjected to electrical current one finger at a time for a millisecond the data so obtained is converted into an HEF image using sophisticated proprietary software. This technology is based on the Gas Discharge Visualization (GDV) principle. The results obtained are interpreted on the basis of the energy connections of the fingers with different organs and systems via meridians as in acupuncture and traditional Chinese medicine. The application of computer technology in the processing of electrophysiological information significantly accelerates data-processing time, to standardize the procedure, and to reduce the influence of the subjective factor.

Electro-diagnostic techniques such as Electro-encephalogram and Electro-cardiogram are widely used in medical practices worldwide[15]. A promising method already utilized in sixty-two countries to great success is Bioelectrography based on the Kirlian effect. This effect occurs when an object is placed on a glass plate and stimulated with current when a visible glow occurs, i. e., a gas discharge. The Kirlian effect is quantifiable with an EPI/GDV electro-photon-imaging-through gaseous-discharge-visualization Bioelectrography camera and is reproducible. The images of all ten fingers on each human subject (BIO-grams) provide detailed information about an individual's psycho-somatic and physiological state[16]. The EPI/GDV camera system and the accompanying software is the most effective and reliable instrument in the field of Bioelectrography[17,18,19,2021]. The application of EPI/GDV in other areas are under development[22,23,24,25,26,27,28,29,30].

The fluorescent fingertip images dynamically change with emotional and health states. The investigation of these images identifies the areas of congestion or ill-health in the whole system. Every fingertip photograph is analyzed by sector division, according to acupuncture meridians. Dr. Peter Mandel, in Germany[31], and Dr. Voll developed this intricate and well-defined method of seeing into the entire body through the fingertips over many decades. The EPI/GDV researchers have created a diagnostic table based on many years of their own clinical field-testing, the sector basis of which differs slightly from that of Dr Mandel[32].

The parameters of the image generated from photographing the finger surface under electrical stimulation creates a neurovascular reaction of the skin which is influenced by the nervous-humoral status of all organs and systems. Thus, the images captured on the EPI/GDV register an ever-changing range of states[33]. However, for most healthy people the EPI/GDV readings vary only 8-10% over many years of measurements indicating a high level of precision in this technique. A specialized software registers these readings into parameters which elucidate the person's state of wellbeing at the time of the investigation[34].

Monitoring the Environment

The GDV device with a specially designed sensor called the "Eco-sensor antenna" is used to monitor the Energy of the Environment and its effects on the emotional status. The “Eco-sensor antenna" is a specialized Bio-Well device that measures the energy of the environment in a room and may be used to study if and how the energy varies when people meditate, pray or listen to a presentation. The physical principle is based on the measurement of the electrical capacitance of a space by using two connected resonance contours. An image of the GDV device Bio-Well is shown in Figure 1. A schematic representation of the experimental setup is shown in Figure 2.

Fig. 1. GDV "Bio-Well" device with "Eco-sensor "

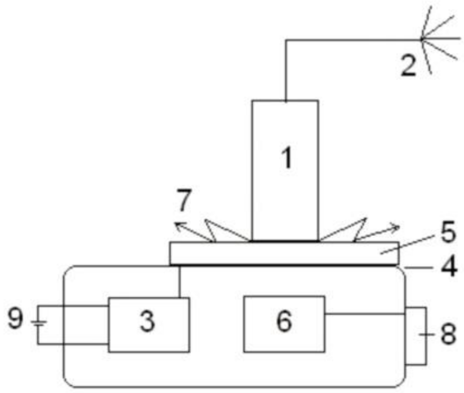


Fig. 2. The experimental setup. 1 - Metal cylinder; 2 Antenna "GDV Eco-sensor"; 3 - high-voltage pulse generator; transparent conductive coating; 5 - transparent quartz electrode; 6 - video converter; 7 - gas discharge; 8 - USB-drive; 9 - Power Supply.

A 15-mm diameter Titanium cylinder connected to the antenna 2 is positioned on the quartz surface of the electrode 5, the reverse side of which is covered with a transparent conductive coating 4. From the generator 3 every 5 seconds a voltage in the form of a pulse sequence of up to 7 kV amplitude, 10 microsecond duration at a frequency of 1 kHz is applied to the coating. The gas discharge 7, light, is transformed by the optoelectronic system 6 in a series of images, and analyzed in a computer. The outcome files are time-stamped, allows their comparison with the sequence of registered events.

The experimental system being in the room can be represented as an equivalent circuit of the connected LC circuits shown in Fig.3.

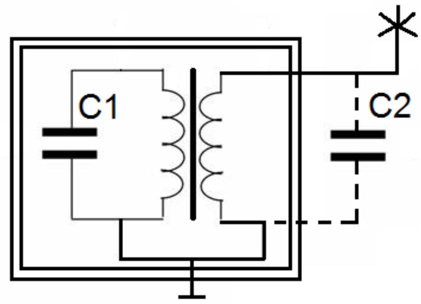


Fig. 3 Equivalent circuit diagram of the experimental setup, where C1 corresponds to the capacity of the electronic circuit of the GDV device, C2 - the equivalent capacitance of the antenna in the premises.

A discharge develops due to the displacement currents between the antenna 2 and grounded or conductive objects in the environment. The conditions of electromagnetic wave propagation in the space change depending on the presence of different fields in the environment, chemical composition of air, and the state of the conductive objects (which includes humans) and therefore the currents in the system are redistributed, thus influencing parameters of the glow. Thus, the experimental system can react to changes in the electrical capacitance of the space surrounding it and the presence of the conductive objects. The changes in the functional state of a human body changes in the impedance of the body, the field distribution around the body, chemical composition of the ambient air due to exhaled air, and emissions of endocrine substances through the skin. The data processing in these experiments is carried out in a specially designed software. For the analysis both the absolute values of the GDV parameters and their standard deviations in the series are taken into consideration.

During the measurements the control of the environment parameters: relative humidity, temperature and pressure was undertaken. In some cases, available through the Internet geophysical parameters: phases of the moon, geomagnetic situation on the day of measurement and a number of other parameters were taken into account as well.

The Eco-sensor may be used for the following purposes:

1. Testing different places in the search for locations that are calm or contain turbulent energy.
2. Testing the energy status of different sites that are significantly affected by the position of the sun, moon, season or time of the year, etc.
3. Measuring the energy in the Places of Power – both natural and man-made, such as temples and other houses of worship, sacred places, ancient cities, etc.
4. Testing Geoactive Zones, in particular, Geopathic Stress Zones[35].
5. Detecting the influence of emotions and focused attention on the environment.

The influence of environmental factors such as temperature, humidity, atmospheric pressure and geographic location on how we feel is well known. There are places where it is possible to sleep like a baby, have wonderful dreams, and wake up full of energy. Then there are places where sleep is disrupted, fatigue is frequent, and there is an increased susceptibility to illness. There is no explanation for this other than the likelihood that a confluence of geomagnetic influences, subterranean anomalies, hollows, water streams, natural and industrial atmospheric gases; gases, electromagnetic fields, and solar and cosmic emanations. It is nearly impossible to distinguish among these factors or to determine what each contributes. The knowhow for measuring the cumulative effect of these complex factors at any particular place is primitive and rudimentary.

The equivalent circuit of the device for registration of GDV-grams. To identify the dependence of the optimal range of GDV instrument parameters the capacity of the connected capacitor in the range 8 - 220 pF was determined, as a variety of materials and GDV parameters are within the limits of this range. Below 8 pF, the gas discharge was either not formed or was unstable. An example of the experimental curve is shown in Fig. 4. The optimal sensitivity is observed on the increasing part of the curve due to the circuit elements of the device and the parameters of the environment.

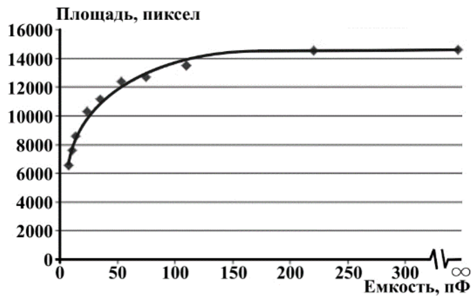


Fig. 4. Dependence of the GDV image area on the capacitance**.**

Many years of research, including expeditions to Peru, Colombia, Ecuador, India, Myanmar, Siberia, and other locations have demonstrated the sensitivity of the GDV device to assess the local environmental conditions and idiosyncrasies. Sensor signal variations during sunrise and sunset or just prior to a thunderstorm have been seen. The measurements conducted during religious ceremonies, yoga exercises, group meditation, public lectures, and musical performances have also shown statistically significant changes in the signal of the Sensor during these activities that correlate with the duration of the event. The signal of the sensor depends on complex environmental parameters, many of which are not directly measurable. We can say that the sensor "GDV Eco-sensor" (Figure 5) is an integral environment analyzer.

Method of data processing. Figure 5 shows the image of the glow of the metal test object.

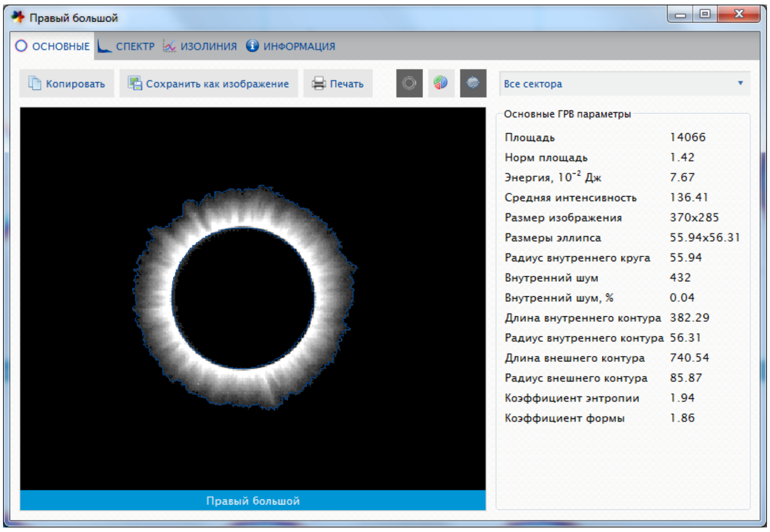


Fig. 5. The screen of the "Bio-Well" software with images of the emission of the metal test object and a list of the main parameters.

It has been shown that the basic informative parameters for analysis are:
1 Area: the number of pixels of the image after program noise removal, proportional to the number of photons forming the image at a given time.
2 Intensity: The average intensity of the radiation.
3 Energy: the energy level of the radiation.
4 Standard deviation of parameters estimated in the mode of the sliding window.

The radiation energy is calculated as the product of the intensity of the glow area, with the experimentally determined coefficient depending on the sensitivity of the CCD device. Coefficient is calculated based on the following data. As shown in[36], the sensitivity of the CCD, S is determined according to:

$$1/S = W/I = E/(s*I) = (4P*t*T)/(\pi*d^2*I) \quad (1)$$

Where,

W = Energy density of the radiation source [J/cm^2],
I = Magnitude of the response (signal),
E = Energy of the radiation source [J],
s = Illuminated area of the CCD [cm^2],
P = Power of radiation source [W],
t = Shutter speed set of the camera [s],
T = Total transmittance of filters used in the detection of radiation,
d = Diameter of the illuminated area of the CCD, cm.

The sensitivity has been experimentally shown to decrease with increasing wavelength and for $\lambda = 424$ nm it is of the order 10^{-10} J/cm^2. This parameter also depends on the type of the CCD and the optical path used. Therefore, the experimental evaluation of the GDV device's CCD camera parameters is made using incandescent bulbs with known parameters. For this purpose, a calibrated 10W lamp with relatively uniform flow of radiation in the visible range is used. For this lamp, the illumination corresponded to the area S = 61000 pixels at a spectrum range from 55 to 255 with maximum of 160 and an average of 220. Therefore, the equivalent power source can be calculated as:

$$P (W) = Pcalibr*S*I/(S*I)calibr = S*I*10 /61000*220= S*I*8*10^{-7} \quad (2)$$

and

$$\text{Energy } E (J) = P (W) * t \text{ (seconds)} \quad (3)$$

The GDV impulses have 10^{-4} s duration with a frequency of 1000 Hz applied for 0.5 s. Consequently, the signal acquisition time on the CCD matrix is $5 * 10^{-2}$ s, and this leads to $E = 5 * 10^{-2}$ P. Thus, the formula for the energy of the radiation GDV signal takes the form:

$$E (J) = S*I*4*10^{-8} \quad (4)$$

With Equation 4, the results of both the BIO-grams processing and dynamic data can be represented in terms of the radiation energy.

Studies have shown that not only the absolute values of the parameters are informative, but also their variability over time. The absolute values of the parameters are associated with both different physical and chemical characteristics of the environment and the presence of conducting and polarizable objects in close proximity of a few meters of the antenna, since these characteristics determine the capacitance between the antenna and the "ground". The standard deviation of the "area" and "energy" is associated with the stability of these parameters over time. Therefore, a method of calculating of the GDV parameters variability is proposed.

To meet our research requirements, the standard deviation (SD) of the entire population (All the measurements), is not used but rather a change in the standard deviation over time is used instead. Accordingly, the method of calculation in sliding window mode is chosen, i. e., each standard deviation value is calculated for a certain number of previous values of the GDV parameter. The key is to determine the number of values which are calculated in the standard deviation calculation. On the basis of experimental data, the base interval to calculate standard deviation has been identified - a half to two minutes, that is within a five second interval between each digit, there are 18 to 24 values of the parameters. In order to standardize procedures for data processing the size of the sliding window was chosen to be 20 digits. Consequently, the following formula for SD calculating was accepted:

$$SD = \sqrt{} \sum (x_i - \bar{x})/20 \quad (5)$$

Where, x_i = ith element of a sample of 20 values, $\bar{x}$ = Arithmetic mean value of the parameter.

With an increase of the sliding window the sensitivity of SD index is lost while with a decrease the noise level increases, as the weight of a single value becomes too large. The software performs the statistical analysis of time series data automatically. The program calculates the mean and standard deviation for each interval and statistical comparisons of adjacent intervals subjected to the Student's t and Mann-Whitney tests. All the input data are stored in a file for further processing in the statistical programs.

Studies have shown that in an indoor environment the parameters of the sensor reach steady-state values after 15 - 45 minutes of operation after which the change in the variability of the signal for 5 - 6 hours is less than 10%. Significant changes in the signal are seen when the relative humidity changes more than 5% and the temperature changes by +/- 5 ° C.

Results

A large number of studies and field trials in Russia, Venezuela, Colombia, England, during 2008 - 2014 have showed that the instrument is sensitive to changes in the environmental parameters. As an illustration, during a total solar eclipse on August 1, 2008 a series of measurements were made in Novosibirsk, Berdsk, Irkutsk and Abakan using seven independent GDV devices. All experimental curves were found to have two distinct phases: before and after the eclipse (Figure 6). Before the eclipse, all the graphs revealed long-wave oscillations of two types: Decreasing (for two devices) and increasing (for five devices). After the eclipse the signal stabilized with the variability of less than 1%.

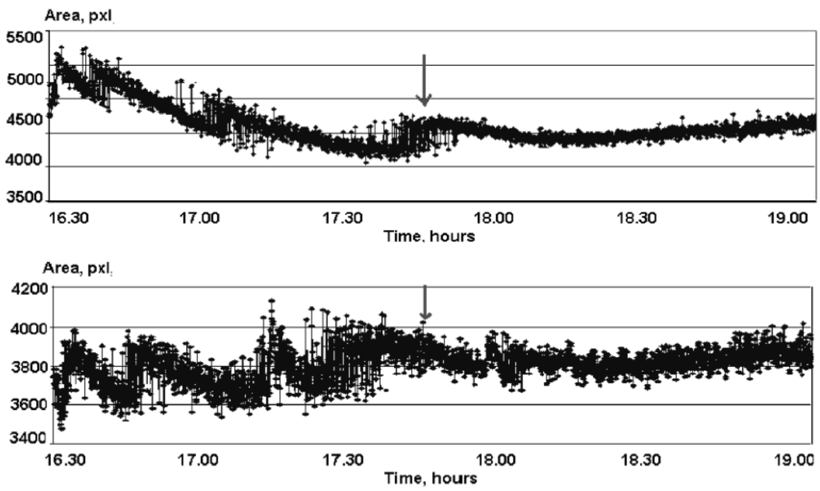


Fig. 6. Temporal dynamics of changes in the area of the signal of "GDV Eco-sensor" during a total solar eclipse in Novosibirsk 01.08.2008 at two measurement points. The arrow shows the moment of complete coverage of the Sun's disk by the shadow of Moon.

Measurements have shown that the device responds to the phases of the moon, sunrise and sunset in the southern countries where this process has a distinct character; variability of the signal increases significantly in Geoactive areas[37].

Vadim Seyidov conducted measurements with "GDV Eco-sensor" at the same time in Berlin. He found that the amplitude of the signal varied significantly during the full moon phase[38]. Of particular interest is the measurement of subliminal psycho-emotional reactions of groups of people.

In 2012, several experiments were conducted to investigate the impact of low-intensity sound on the human operators. These studies were conducted in a classroom environment with controlled parameters. In a first step, the GDV device was installed in the empty auditorium and one hour after the background recording, a sound generator was turned on. There were no change in the signal. In the second stage, after recording the background in an empty auditorium, ten students were invited to the room to work on the computers. Fifteen minutes after they begin to work, the low intensity sound was turned on for thirty minutes with the parameters at the border of the human hearing range, below 20 Hz, and above 20 kHz. Recording was continued for fifteen minutes after the sound was turned off. In addition to the measurements of "GDV Eco-sensor", the participants filled out a questionnaire at the beginning and at the end of the experiment to assess their mental and emotional state (health, activity, mood)[39]. All participants consented to participate in the study but did not know at what point in time the low-intensity sound would be turned on.

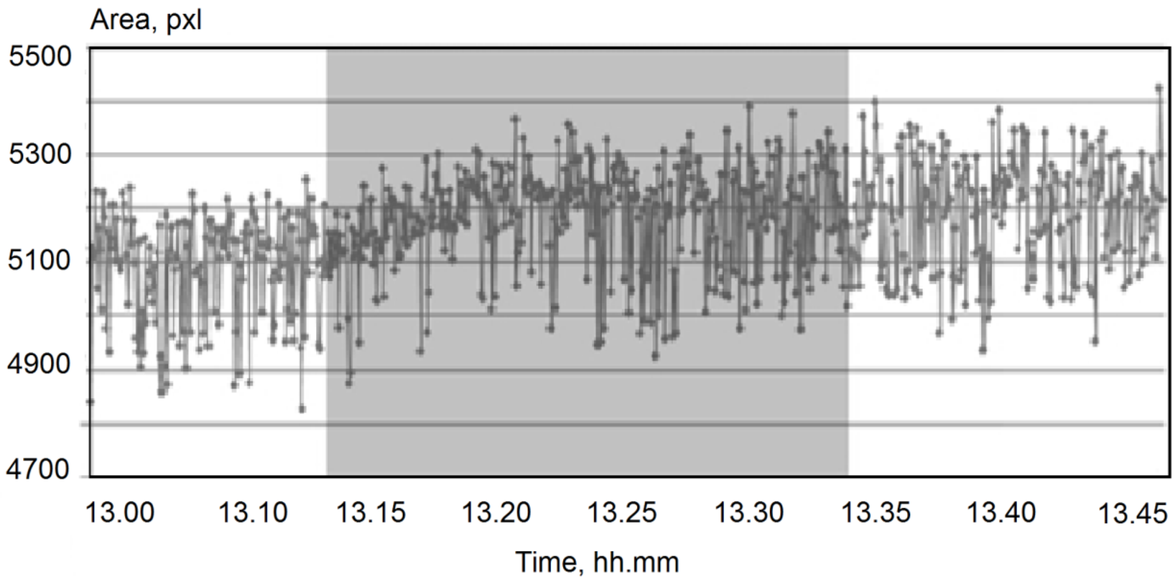


Fig. 7. Change in GDV signal during the experiment; red area covers the duration of low-intensity sound 20Hz frequency operation.

The variance analysis of data in Table I shows that the differences between the background signals, signal in the time of the sound and after switching sound off are statistically significant at 99% confidence level.

Table 1: Results of calculating the area and SD area during the experiment.

Parameter/Time	**Background**	**First ten minutes of sound**	**Last ten minutes of sound**	**Sound off**
Area	5080	5191	5178	5198
Std. Deviation	95.1	73.6	194	101.1

$P < 0.005$ comparing intervals 1 – 2; 1 – 3; 1 – 4; 2 – 3.

The exposure time can be divided into two distinct phases: In the first phase there was an increase in the area of the GDV signal and a reduction in the standard deviation. In the second phase, the area stabilized and the standard deviation more or less reduced to the original background level. The data may interpreted as follows: Immediately after the sound was turned on, the computer operators succumbed to stress (minimum standard deviation - minimum activity), but after some time their systems adjusted to the influence, which resulted in the return of standard deviation to the background value. Accordingly, the work in this mode should lead to accelerated depletion of the body reserves which was confirmed by psychological tests (see Table 2).

Table 2: Mean group psychological parameters

Wellbeing		**Activity**		**Mood**		**Averaged values**	
Before	after	Before	after	Before	After	Before	after
5.54	4.5*	4.78	3.7*	5.36	4.7*	5.23	4.3*

*$p < 0.05$

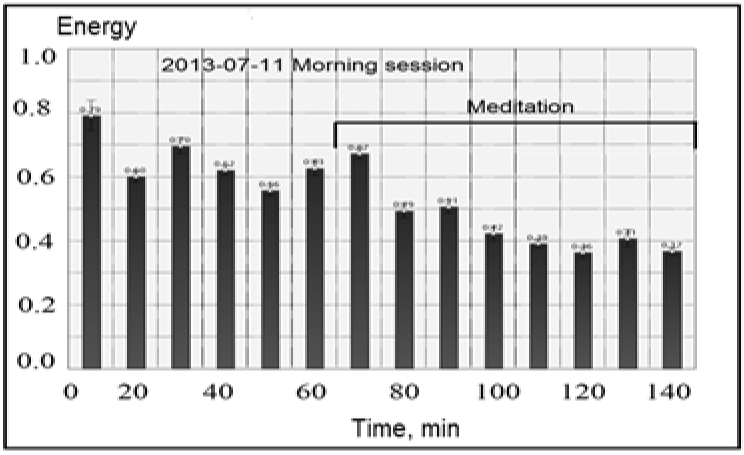
This method is expected to give normal values in the range 5.0 - 5.5 points. The analysis of the data of table 2 shows that initially all parameters were within the normal limits, while after the operation there was a significant decline. The control experiment with no sound or "GDV Eco-sensor" revealed no statistically significant psychological reactions of participants. Furthermore, there were no changes in the signal of "GDV Eco-sensor" in an empty room to the 20 Hz sound.

Based on these data it may be concluded that the system and the methodology presented can be used to study the change of mental and emotional states of groups of people. The psycho-emotional state is closely associated with the functional activity of the various systems of the human body, such as the nervous system, the endocrine system, and the cardiovascular system. Establishing a direct connection of the signal with the functional activity of the various systems of the human body requires additional research.

In 2009-2014, various researchers in Russia, USA, India, Italy and the Netherlands have held more than 100 measurements during social events, and in all cases reaction to the change of mental and emotional state of the members of the study group was recorded. Studies have shown that the higher the standard deviation of the GDV area, the higher functional activity of groups of people in the test room.

As an additional example, consider the results of measurements in a workshop conducted by Joe Dispensa in the United States during July 11-14 2013. One hundred thirteen participants attended the workshop which consisted of lectures and collective meditation for 80-90 minutes twice a day that Joe guided with calm music. "Bio-Well" device with "Eco-sensor" sensor and a computer were installed in one corner of the room and the data recorded automatically with real-time data processing on the server every day before and during meditation in the morning and afternoon session continuously for 6-8 hours. The day before the seminar the sensor signal was recorded for 4 hours in the empty workshop room. After the stable signal was established 20 minutes after the start of measurement. Thereafter, the variability of the signal did not exceed 10-15%.

The analysis of the resulting data showed a decrease in the signal of the sensor in the process of meditation (Figure 8). Signal processing data were broken up into 10 minute intervals, allowing for the calculation of the sample averages and standard deviations. Statistical comparisons of adjacent intervals with parametric and non-parametric method was made.



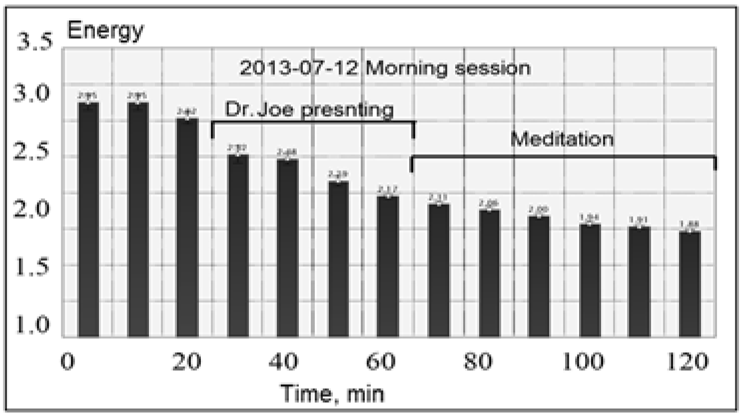


Fig. 8. A signal processing example during a morning session on 11 and 12 July 2013.

Noise that there is a decrease in the signal in the process of meditation for all 4 days of the workshop. During the break, the signal level increased. There was also an increase in the signal from day to day (Figure 9). This effect was not observed in carrying out control measurements in different areas in the absence of the public,

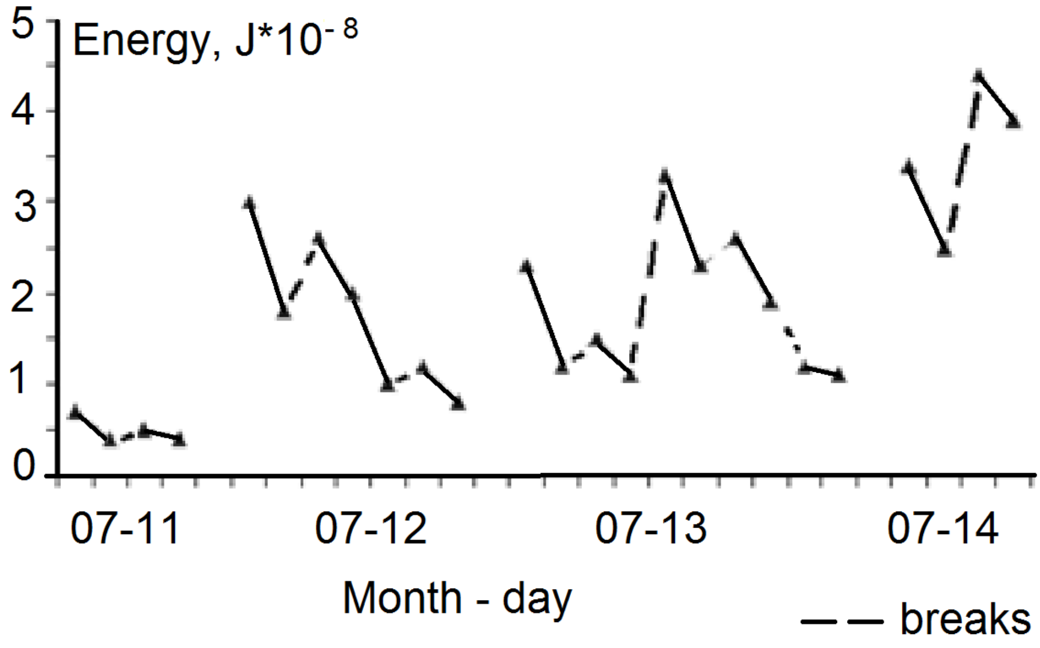


Fig. 9. The mean values of the signal energy at the beginning and end of each session during the 4 days of Joe Dispensa seminar.

Similar measurements were carried out repeatedly at various seminars. Both the analogous effect of reducing the signal and no statistically significant changes were observed. An interesting trend is the measurement during musical performances. Numerous experiments have shown that in most cases the output signal of the device changes significantly at the "live" musical performances.

Conclusions

The use of GDV in conjunction with a "GDV Eco-sensor" special antenna allows the monitoring both of non-selective characteristics of the environment and the functional state, in particular emotional state, of groups of people. The method presented was tested during theater performances and concerts, workshops and lectures, as well as in group meditation. In many cases, the correlation of GDV parameters variations and emotional state of the audience was recorded. The lowest values of the standard deviation corresponded to quiet functional state of people. Accordingly, the larger the standard deviation, the higher functional stress of people in the room. The system presented has two sensitive elements: antenna "GDV Eco-sensor" and the gas discharge itself, which makes it non-selectively sensitive to changes in chemical and physical characteristics of the surrounding space.

Correlational investigations are planned to link the signal of the experimental system with the changes of physiological parameters such as EEG, ECG, GSR, etc.., as well as the changes in the level of infrasound, ultrasound, noise pollution, radiation, electromagnetic fields of different range and amplitude.

Several devices that work in conjunction with the sensor have been developed. Currently, researchers are using more than 100 devices with a "Eco-sensor". Data processing may be carried out either on the computer and on a remote server in real time. A Russian Company, *www.avdspb.ru* is offering services in the comprehensive analysis of environmental parameters as in the open air and indoors. It would be interesting to carry out additional measurements in crowded place such as theaters, concert halls, lecture halls, churches during the service. Additional investigations will pave the way for the use of the sensor in education, security services, geophysics, and study of geo-active zones.

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