ESSAY IN BIOELECTROGRAPHY OF MUSICAL ENVIRONMENT

Khannanov* I., Korotkov** K., Orlov** K.

*John Hopkins University, ikhanna1@jhmi.edu;
** SPb University, kk@korotkvo.org

Despite the wealth of information on structure of musical composition gathered in musicology, music theory, cognitive musicology, theory of musical performance and ethnomusicology, the most essential aspects of music remain in darkness. It is worthy to remember the aphorism of Heraclites: "Nature likes to hide" (physeos cryptestai phylei). Emotional and pictorial content is, undoubtedly, a hidden level of musical expression/communication. There are two aspects of this hidden stratum: a psychological (dependent on the character of an individual) and an environmental (dependent on physical qualities of music as such). While psychological aspect can be studied on the body of a performer, composer or listener, the physical requires measuring and analyzing the wave-particle environment of musical performance.

Both these aspects can be researched by a variety of methods, including computerized tomography, analysis of EEC and ECG during the performance, and direct statistic study involving test groups. However, all these methods yield results of partial importance. They do not cover the crux of musical activity which is the interaction between the body of the performer as a whole and acoustic environment as such.

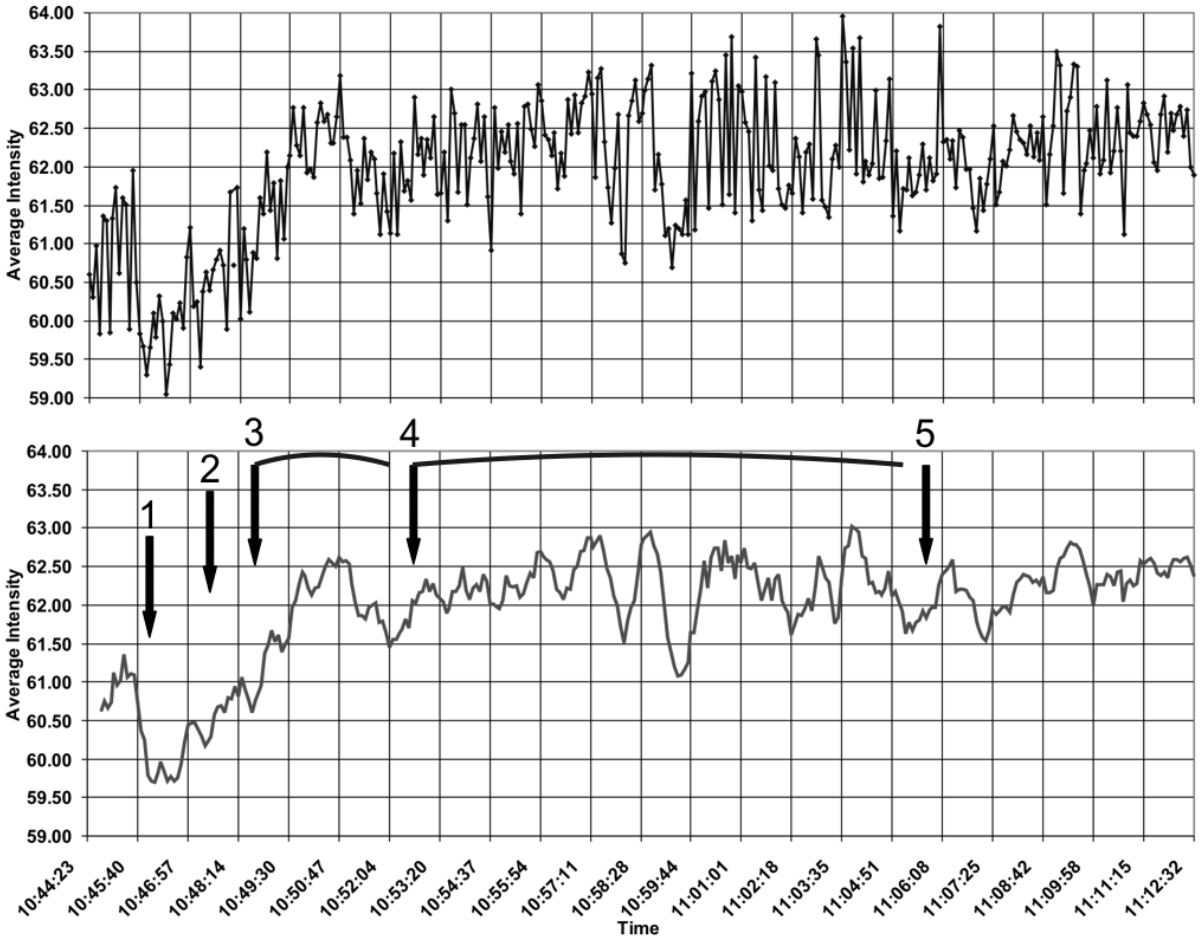
In the recent development of a century-old technology of Kirlian luminescence, Dr. Konstantin Korotkov has created a clear and straightforward approach to measuring and interpreting the environmental effects of the bodies introduced into electro-magnetic field. His approach supports itself on a universally acknowledged phenomenon: luminescence of any physical body placed in the electro-magnetic field. Even without a detailed analysis of the spectrum, one can witness luminescence of human body, as well as inanimate objects, under certain environmental conditions. It is assumed that human body is capable of emitting electrons, photons, and other particles and this ability varies under both external and internal circumstances. By using the camera placed under the transparent dielectric screen covered by transparent metallic electrode one can measure the short bursts of evoked optical radiation from the fingers of a human, as well as from the so-called test-object—an inanimate sample with given electro-magnetic characteristics. The same camera, test-object and an external sensor can detect fine variations in the wave condition of the environment, induced by any physical processes. Moreover, it can register the presence of human bodies and their activity as related to the chemical and wave-particle condition of the room.

Based upon these premises, a series of experiments with musical performance were conducted under the supervision of Dr. Korotkov. The one discussed in this paper took place at the Children' Music School named after N. A. Rimski-Korsakov in St. Petersburg on May 22, 2009. The Tchizhevsky sensor connected to the test-object on a GVD camera has been used to register the fluctuations of the wave environment. The experiment lasted from 10.44.23am to 11.11.54am. A selection of pieces from four stylistic periods (Baroque, Classical,

Romantic, and 20th-Century) has been performed by Dr. Ildar Khannanov. Dr. Korotkov organized the setting of the experiment; Mr. Dmitry Orlov provided the Tchizhevsky sensor and registered the exact time of performances.

The goal of this experiment was to detect fluctuations of the human energy field (HEF) in a closed environment of a classroom during the performance. In addition, the BEO GDVgrams were taken off the fingers of the performer before and immediately after the performance. The particular musical objectives of this experiment were numerous, ranging from the study of emotional conditions of a performer (main objective) to testing the emotional-energetic aspects of musical styles, the levels of entropy of each performance, and the environmental characteristics of musical forms. In musical terms, the level of entropy can be interpreted as the level of dissonant saturation and the quality of form of the aura on GDV-gram can be related, without significant modifications, to musical form and formal organization.

It has become apparent from the first graph, received from the GDV processed in SciLab program that the levels of HEF distinctly vary from style to style. On the Graph of Intensity one can clearly see the gradations appropriate for each of the four styles:



The first work which has been played was a Theme from the Goldberg Variations by J.S. Bach. It lasted from 10.46am to 10.47am. On the graph it has been registered first as a sudden decrease of intensity from the background levels of 60.00-62.00 to 59.00 and then slowly rose up to 61.00. In a number of GDV experiments, including medical diagnostic, it has been noted that the lower degree

of intensity is related to the ultimate concentration during the performance, including the altered states of consciousness. This geometry is very characteristic of Baroque style. The main idea of Bach's music is a gradual ascending motion, from the Earth to Heavens. Some Cantatas, such as no. 54 "Wiederstehe doh der Sünde," are even called "anabasis cantatas" (ascending cantatas). The temporal aspect of musical forms of Baroque is also such that the body of music is not segmented. Rather, it begins with an impetus which is followed by the endless unfolding (as in many fugal themes). The time of Baroque music runs endlessly toward the *eschatos*.

At 10.48, a Theme of the opening movement of Mozart's Piano Sonata K.331 has been performed. Its level of intensity occupied the middle position, almost coinciding with the background level registered in the beginning of the experiment. This is the most important characteristic of the Viennese Classical style. It is often dubbed as "normative aesthetics" and its purpose has been not to create an unusual, individual, unique works of art, but to repeat the same genre and form with the goal of reaching perfection. Since Nicolas Boileau-Despreau's treatise "L'art poétique" classical music had been following the norm and the ideal. The level of entropy in this style is minimal, as we will see on the graph of entropy later. The shape of the graph here is also very characteristic of Classical style: it swings all the way down and back to the middle, then swings all the way up and down to the middle. This fits well with the treatment of emotions in Classicism: the positive and negative emotions must be in perfect balance. Classical style prefers black-and-white presentation of emotional states with less gradation than, say in the Romantic style.

From 10.48.14am to 10.52.00am two Chopin's Mazurka's were played. Again, the trend line for the Romanticism has shown, as it was expected, the overall higher level than the background. In fact, at one point it has reached the level or 63.00. Next, a fragment from a longer Romantic work, Robert Schumann's *Kreisleriana*, has been performed, from 10.53am to 11.05am. The equipment has detected the famous opening passage, a stumbling block for many performers, as sharp rising segment on a graph. Famous Schumann's sudden changes of mood are clearly seen on all graphs as unexpected, non-gradual shifts.

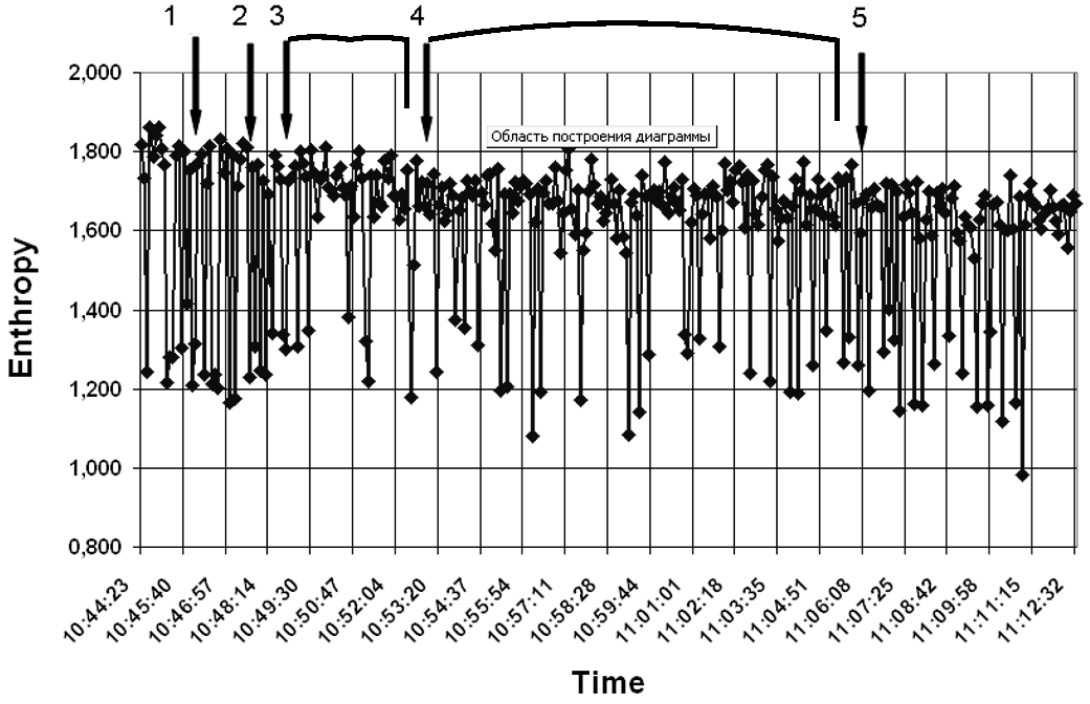
The last example played during the experiment was Alexander Scriabin's *Guirlandes* Op 73 No.1. The Two Dances op. 73 crown Scriabin's oeuvre. The piece is so out this world that it does not fit even into most abstract contexts of the 20th-century music. And, as one could expect, the graph of intensity shows the position above the normal together with a very narrow bandwidth. Indeed, Scriabin's music offers a different kind of emotional specter, in which the most refined intuitions are combined with the most grandiose.

Thus, we have come up with four levels and for characteristics of the main periods of Western music history, from early 18th century to the beginning of the 20th. The graph above does not contradict the knowledge gathered by music theorists and music historians and fully supports theirs observations.

One question of critical importance arises from the analyses above: does the graph present the dynamic profile, the frequencies range, or attaca variations? If so, the Tchizhevski sensor may have registered simple acoustic parameters. However, the fluctuations and trend lines on the graph clearly demonstrate that they measure neither of these acoustic dimensions. For example, the Theme of Goldberg variations is played in forte dynamics, yet its position on the graph is lower than that of Chopin's Mazurkas; Mozart's piano sonata is played softer than Bach's

Theme, yet is occupies the higher region on a graph. In terms of frequencies, Schumann's Kreisleriana begins lower than Bach's Theme, yet its graph is located higher. Therefore, neither of simple acoustic parameters has had any effect on the actual graph above.

What has had an effect on the intensity graph is musical-emotional intensity. The term has ben known since the time of Aristoxenus, the pupil of Aristotle. In his treatise Harmonikon stoikheion, Aristoxenus suggested measuring musical intervals in degrees of tension (ho tonos). In the most recent study of tension in Fred Lehrdal's *Tonal Pitch Space* the category of tension occupies the central place. In physical terms, musical-emotional tension can be interpreted as the tendency to temporary disorientation of the wavelengths and frequencies coherence with their ensuing re-harmonization. Since Greek antiquity music has been defined as tension-relaxation pattern. In our case, the GDV camera registers the levels of entropy:



The role of dissonance in creating entropy is significant, but it is not its only means. The sound itself may stirr the HEF. It is seen on this graph in the areas of music in which the deep classical touchée is used, namely in performance of music of Bach, Mozart, and Scriabin. For music of Chopin, a pianist chooses a lighter touch, as seen in the intervals 10.49.10-10.50.21 and 10.50.40-10.51.40. In Schumann's Kreisleriana there are two wide-open gaps which correspond to the Piece No. 2 and to the Middle Section of the Piece No. 3. The latter presents one of the most romantic examples of meditation in music. However, other section of musical form present steady high level of entropy. Music of Chopin, Schumann and Scriabin reach the highest levels (close to 1,000) in the outbursts of entropy. This fact confirms the idea that Romantic and Late-Romantic music had entropy as one of its goals. Contrary to common sense, harmony in this style works not in the direction of an agreement, but toward poetization of death.

It is intresting to compare elements of musical form with the segments of the GDV-gram. For example, the graph of area presents the following trend for the opening page of Piece No. 1 in Kreisleriana:

It is clear that the Graph of Area of the GDV mirrors the melodic directionality. The higher the melody reaches, the more intense is musical condition, the smaller is the area of GDVgram. This comes in strict agreement with other observations of gas-discharge visualization.

Conclusions. The GDV method allows to unveil the inner workings of emotional-tensional component of music. It also suggests the tool for the research of physical characteristics of musical wave environment—something which has been acknowledged for centuries but has never been presented in a scientific form until the use of GDV method.