Thesaurus of Vibraimage Technology

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Abstract: *The terms analysis of International Open Science Conferences — Modern Psychophysiology, The Vibraimage Technology, VIBRA2018–2022 was provided. Selected terms from different sciences (cybernetics, biology, psychology) are explained by the detail definitions according to vibraimage technology principals. The thesaurus should help beginners and experienced vibraimage users for correctly understanding on vibraimage technology publications and avoid unnecessary errors. Planned the work for expanded vibraimage vocabulary tto other terms. Planned the work for expanding vibraimage vocabulary to the additional terms.*

Keywords: *vibraimage, vibraimage technology, term, definition, thesaurus, vocabulary.*

The problem of a paradigm (a paradigm is a model for posing problems and their solutions, as a recognized standard of scientific achievement, a paradigm includes a law, theory, their practical application, method, equipment, etc.) of any new scientific direction is that in the course of its formation difficulties in using known and creating new terms. Understanding of terms depend on the information provided by the authors about the theory, object, subject, as well as the possibilities of practical application, methods and techniques, especially at the first stage — the stage of awareness of novelty, its scientific and practical application. Most often, this concerns the understanding of seemingly familiar terms, which, given the novelty of the object and subject proposed by the author, suggest a new reading. Such problems are solved during the development of a thesaurus — a systematic set of data about a certain field of knowledge that helps a person navigate it.

Thesaurus (from the Greek θησαυρός "treasure") is a special terminology, which is a dictionary, a collection of information that fully covers the concepts, definitions and terms of a special field of knowledge or field of activity, which should contribute to correct lexical, corporate communication (understanding in communication and interaction of persons related to the same discipline or profession). Thesauri are one of the most effective tools for describing individual subject areas. Unlike an explanatory dictionary, as a source of information, the thesaurus allows you to reveal the meaning not only with the help of a definition, but also by correlating a word with

other concepts and their groups, due to which it can be used to fill knowledge bases, including artificial intelligence systems. Communication theory considers the general thesaurus of a complex system, thanks to which its elements interact.

The purpose of this study is to collect terms and give their definitions that will help users of vibraimage technology to clearly and unambiguously describe the results of research on the possibilities of the method in cybernetics, medicine, psychology, physiology, psychophysiology. The need to develop a thesaurus is confirmed by the study of research materials presented in four International Open Science Conferences: Modern psychophysiology. Vibraimage Technology (Minkin ed., 2018–2021). Readers of this article are invited to familiarize themselves with the results of the search for definitions for terms that are quite often found in published works and, unfortunately, are not always synonymous, and therefore require a certain standardization. The authors propose to join this work, and the results can be discussed at the next conference or on the pages of the journal — Modern psychophysiology. Vibraimage Technology.

The table shows the terms that have already become widespread in the articles of our authors. As definitions of terms, is proposed to use terms available on the past publications, which are most consistent with the meaning, as well as our ideas about the most appropriate reading of them.

Table

Vibraimage technology thesaurus

Term	Definition
Aggression	Behavioral characteristic firstly measured by vibraimage technology in 2005 based on Konrad Lorenz's assumption that aggression is proportional to the frequency of head movements (Lorenz, 1963).
Allostasis	Stability through change. Characterizes the process of achieving stability or homeostasis through physiological or behavioral changes in the parameters of the internal environment, adjusting them in accordance with the requirements of the environment. A sign of allostasis is a high activation of regulatory systems, which corresponds to tension, unstable functioning of the body, including at the behavioral level (Sterling & Eyer, 1988).
Amplitude vibraimage	Vibraimage reflecting the amplitude of the signal change at each frame pixel (Minkin, 2017).
Artificial Intelligence (AI)	Artificial intelligence (AI) software-based ability of a device to learn, make decisions and perform actions, like human intelligence. Technical systems capable of making a new decision after training (Hyakin, 2008).
Artificial neural networks (ANN)	A mathematical model, as well as its software or hardware implementation, built on the principle of organization and functioning of biological neural networks (Hyakin, 2008; Akimov, Minkin, 2021).
Aura	Totality of a person's properties or integral psychophysiological characteristic of an object. In vibraimage technology, the aura or external vibraimage is calculated using mathematical equations based on parameters of a human head micromovement (Minkin, 2017).

Term	Definition
Behavioral characteristics (parameters)	Personality parameters characterized by temporal dependence, such as voice, gait, movement. Behavioral characteristics are physical properties of body parts, physiological and behavioral processes produced by the body, as well as their combinations (ISO/IEC 2382-37-2016).
Biological characteristics (parameters)	Biological and behavioral characteristics are the physical properties of body parts, physiological and behavioral processes produced by the body, as well as their combinations (ISO/IEC 2382–37–2016).
Biomechanics	Mechanical properties of living organisms, individual organs, as well as the mechanical processes occurring in them. A term introduced by Nikolai Bernstein in the first half of the 20th century for the behavioral analysis of movements (Bernstein, 1967).
Biometric data	Biological or behavioral characteristics of a person (ISO/IEC 2382-37-2016)
Chronobiology	The branch of science that studies the periodic change in physiological and behavioral characteristics (Halberg, 1969). Vibraimage technology allows to detect the brain activity rhythm with the period from 10 to 100 seconds (Minkin, Blank M., 2021).
Conformity principle	The period of interframe difference accumulation should coincide with the period of the analyzed physiological process. The mismatch of the interframe difference period accumulation with the analyzed physiological or psychophysiological process leads to the loss of biometric information (Akimov et al., 2022).
Cybernetics	Science of control and communication processes in man and machine (Wiener, 1948).
Discretization	Representation of a continuous function by a discrete set of its values (Nyquist, 1928; Shannon, 1948).
Discretization Cloud	Replacing local discretization by discretization of close time values (Akimov et al., 2022).
Discretization principle	The frequency of converting video to vibraimage parameters should be maximum for the minimum video noise level (Akimov et al., 2022).
Frequency vibraimage	Vibraimage reflecting the frequency of signal change at each image pixel (Minkin, 2017).
Functional state	Integral complex of various characteristics, processes, properties and qualities of a person that directly or indirectly determine the performance of activities (Medvedev, 1993).
Functional system	Organized system of elements activity of various anatomical affiliations, which has the character of "mutual assistance", which is aimed at achieving a useful adaptive result (Anokhin, 1978).

Table *(continuation)*

Term	Definition
Functioning	The interdependence of elements in the system (lat. functio activity), the interaction and subordination of the part and the whole in the living. Functioning is a change, an action aimed at preserving the system. Living system retains quality as long as it is capable of resisting external influences through functional restructuring — Le Chatelier's principle (Le Chatelier, 1898).
Hierarchical thermodynamics	The direction of thermodynamic theory, which studies complex chemical and biological exchanges between themselves and the environment. Thermodynamic principles of regulation in living systems introduced by Gladyshev (Gladyshev, 1978).
Homeokinesis	The process of maintaining dynamic balance in the body, taking into account ongoing chronobiological processes (Der et al., 1999).
Homeostasis	The state of a stationary thermodynamically non-equilibrium state of an organism (Cannon, 1932; Novoseltsev, 1978).
Information	Information — data about the objects under study, regardless of the form of their presentation. Information is information, not matter or energy (Wiener, 1948).
Image	Visual display of optical (light) or physical (thermal, x-ray) properties of an object (Minkin, 2017).
Infinity principle	The amount of information obtained from the final size of a human video can be infinitely increased depending on the solved biometric task (Akimov et al., 2022).
Interframe difference	The difference in signal values between the same pixels of two consecutive frames. The interframe difference format (lines x columns) is equal to the format of successive frames, and the signal value of each pixel in the interframe difference is formed by the difference between the signal values of the corresponding pixels from two consecutive frames (Minkin, 2017).
Microvibration	The medical and physiological causes of constant muscles microvibration of humans and warm-blooded animals were first discovered by Austrian professor Hubert Rohracher (Rohracher, Inanaga, 1969).
Myokinetic diagnostics	Determination of psychological characteristics based on repetitive hand movements (Mira y Lopez, 1957).
Multifactor stimuli	Stimuli having semantic load about various factors for a subject. Multifactor stimulus can cause a psychophysiological response to the type of multiple intelligences simultaneously with the factor under study: aggression, suicide, etc. (Minkin, Nikolaenko, 2020).
Multiple intelligences	Independent abilities that each person has. First were described by Gardner (Gardner, 1983). Vibraimage technology allows to determine the profile of multiple intelligences upon presentation of appropriate stimuli (Minkin, Nikolaenko, 2017).
Neuro-Linguistic Profiling (NLP)	Method of adaptive psychophysiological testing with the presentation of neutral stimuli at the stage of pretesting and multifactor stimuli at the basic testing. Both testing stages are combined into one test and structural tied with each other (Minkin, Nikolaenko, 2020).

Table (continuation)

Term	Definition
Period of behavioral information accumulation	Time equal to period of interframe difference accumulation in vibraimage (Minkin, 2017).
Principle of optimality	The number of measured behavioral parameters should be minimally sufficient to analyze the studied physiological process or response to a presented stimulus (Akimov et al., 2022).
Physiological characteristics variability	Heart rate variability (HRV) informationally reflects the degree of tension of the regulatory systems of the human body (Baevsky et al., 2001). In vibraimage, the variability of each behavioral parameter is determined by the ratio of the standard deviation to the math expectation (Minkin, 2020a).
Psychophysiology	The field of psychology and physiology (Greek psyche soul + physiology), whose task is to study objectively recorded physiological functions, mental processes of perception, memory, thinking, emotions, etc. (Cacioppo, 2007).
Psychophysiological state (PPS)	The result of holistic response of personality to external and internal stimuli (Ilyin, 1987).
Quasi-equilibrium state of a person	The position of a person in which he does not make macro movements (movements) visible to the eye and is in one place, for example, sitting or standing (Polonnikov, 2013).
Random movements	Designation of movements, the causes of which are not explained. Sigmund Freud argued that a person does not have random movements (Freud, 1900). Mikhail Sechenov wrote that every thought has muscular manifestations (Sechenov, 1863). Thus, the great scientists predicted the relationship between human movements and the psychophysiological state.
Resolution	The ability of photonics system to measure the linear distance between nearby objects. In simplified version, is determined by the video format. In reality, resolution can be higher or lower than the video format (GOST 28593-91).
Regulatory systems	Traditionally, there are two regulatory systems: nervous and endocrine. The nervous system is the most important for the body's communication with the environment, but it regulates the internal environment only partially, and hormones completely (Kolesnichenko et al., 2012).
Reflex	The response of the body to external and internal irritation, carried out with the participation of the central nervous system (Pavlov, 1951).
Self-regulation	Self-regulation of a biosystem means its ability to maintain a stationary non-equilibrium state under changing operating and environmental conditions (Novoseltsev, 1978).
Source head image	Human head video capturing according to the requirements of vibraimage technology. Request low level of temporal noise for television camera (less than 0.1 b/s), uniform illumination of the object (at least 500 lux), video frame rate (at least 30 fps), no strangers in the frame, no mechanical vibrations of television camera (Minkin, 2017; 2020a).
Spatial informativeness	Spatial ununiformity of vibraimage reflecting the psychophysiological state of a subject (Minkin, 2017).

***Table** (ending)*

Term	Definition
Standard deviation	Standard deviation (SD) of estimates from mathematical expectation
Test database	Database on which AI is not trained, is used to determine the accuracy of AI training (Hyakin, 2008).
Training database	Database for AI training (Hyakin, 2008).
Vestibular system	The physiological system of a human or animal responsible for maintaining mechanical balance (Tamar, 1976).
Vestibular-emotional reflex (VER)	Reflex maintaining the vertical position of a head in the gravitational field by contracting the neck muscles, depending on the emotional or psychophysiological state of the person (Minkin, Nikolaenko, 2008).
Vibraimage	Image reflecting the parameters of object's movement. Vibraimage of a human head reflects psychophysiological properties due to vestibular-emotional reflex (Minkin, Nikolaenko, 2008). There are internal, external, frequency, amplitude, ideal and real vibraimages (Minkin, 2017).
Vibraimage Primary Parameters	Mathematical characteristics of vibraimage: amplitude, frequency and symmetry of vibraimage (Minkin, 2017).
Vibraimage system	Vibraimage system includes software, processor (PC or mobile) and television cameras (web, IP), possibly connected to a network with a diverse structure (Minkin, 2017; Akimov, Minkin, 2021).
Vibraimage technology	The technology of converting the micromotion of the human head into behavioral parameters, psychophysiological and medical information, convenient for human perception or automatic processing, including vibrapsychology, vibramedicine (Minkin, 2017; Minkin, Bobrov, 2020).
Vibratechnologies	Vibraimage technology using for a certain scientific area. For example, vibramedicine (Minkin, Akimov, 2022) is the use of vibraimage technology for medical diagnostics. Vibrapsychology — the use of vibraimage technology in the field of psychology (Minkin, 2020b).

Conclusion

It is necessary to create national and international standards to harmonize the terms and methods for human behavioral parameters measurement. Only an objective physical, mathematical and cybernetic analysis of person's behavioral parameters make possible to give a scientific meaning to the terms and methods for determining conscious and unconscious characteristics that psychology has operated on until now. Vibraimage technology allows measuring behavioral parameters using physical, mathematical and cybernetic methods.

References:

1. Akimov, V. A., Minkin, V. A. (2021). Determination of significant behavioral parameters on COVID-19 diagnosis by artificial Neural Networks modeling. Proceedings of the 4th International Open Science Conference: Modern Psychology. The Vibraimage Technology, 24–25 June 2021, St. Petersburg, Russia. pp. 281–291. https://doi.org/10.25696/ELSYS.VC4.EN.06

2. Akimov, V. A. et al. (2022) Methods of COVID-19 Diagnosis Accuracy Improving by Human Head Micromovement Video Processing Using Vibraimage Technology and Artificial Intelligence, Proceedings of the 5th International Open Science Conference: Modern Psychology. The Vibraimage Technology, 23–24 June 2022, St. Petersburg, Russia, pp. 52–69. https://doi.org/10.25696/ELSYS.VC5.EN.04

3. Anokhin, P. K. (1978) Philosophical Aspects of the Theory of Functional Systems. Academy of Sciences of the USSR, Institute of Psychology. Moscow: Science. (In Russ.).

4. Baevsky, R. M. et al. (2001) Analysis of Heart Rate Variability Using Various Electrocardiographic Systems, Bulletin of Arrhythmology, 2001, No. 24. (In Russ.).

5. Bernstein, N. A. (1967) The Co-Ordination and Regulation of Movements. Pergamon Press, Oxford.

6. Cacioppo, J. T. (2007) Handbook of Psychophysiology. 3rd Edition. Cambridge University Press.

7. Cannon, W. B. (1932) The Wisdom of the Body. New York: W. W. Norton.

8. Der, R. et al. (1999) Homeokinesis: A New Principle to Back up Evolution with Learning. Max Planck Institute fur Mathematik in den Naturwissenschaften Leipzig.

9. Freud, S. (1900) The Interpretation of Dreams. Science Odyssey: People and Discoveries. PBS, 1998.

10. Gardner, H. (1983). Frames of Mind. The Theory of Multiple Intelligences. New York: Basic Book.

11. Gladyshev, G. P. 1978. On the Thermodynamics of Biological Evolution. J. Theoret. Biol. 75, pp. 425–441.

12. GOST RU 28593–91 (1991) Photosensitive Devices with Charge Transfer. Methods for Measuring Parameters (In Russ.).

13. Halberg, F. (1987) Perspectives of Chronobiologic Engineering, NATO ASI Series, Vol. 120, pp. 1–46.

14. Haykin, S. (2008) Neural Networks and Learning Machines Third Edition, Pearson Education, Inc., Upper Saddle River, New Jersey 07458.

15. ISO/IEK 2382–37–2016 (2016) Information Technology. Vocabulary. Part 37, Biometrics.

16. Ilyin, E. P. (2005) Psychophysiology of Human States. St. Petersburg: Peter.

17. Kolesnichenko, L. S. et al. (2012) Hormones: Mechanisms of Action, Private Hormonology, textbook; State Budgetary Educational Institution of Higher Professional Education ISMU of the Ministry of Health and Social Development. Irkutsk: IGMU.

18. Le Chatelier, H., Boudouard, O. (1898) Limits of Flammability of Gaseous Mixtures, Bulletin de la Société Chimique de France (Paris), Vol. 19, pp. 483–488.

19. Lorenz, K. (1963) Das Sogenannte Böse zur Naturgeschichte der Aggression. Original edition, Verlag Dr. G. Borotha-Schoeler.

20. Medvedev V. I., Leonova A. B. (1993) Functional States of a Person. St. Petersburg: Nauka.

21. Minkin, V. A. (2017) Vibraimage. St. Petersburg: Renome. https://doi.org/10.25696/ELSYS.B.EN.VI.2017

22. Minkin, V. (2020a). Vibraimage, Cybernetics and Emotions. St. Petersburg: Renome. https://doi.org/10.25696/ELSYS.B.EN.VCE.2020

23. Minkin, V. A. (2020b) Vibrapsychology as Independent Branch of Science, Proceedings of the 3rd International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 25–26 June 2020, St. Petersburg, Russia, pp. 197–203. https://doi.org/10.25696/ELSYS.01.VC3.EN

24. Minkin, V. A. ed. (2018) Proceedings of the 1st International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 28–29 June 2018, St. Petersburg, Russia. http://psymaker.com/downloads/conf_1_2018.pdf

25. Minkin, V. A. ed. (2019) Proceedings of the 2nd International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 25–26 June 2019, St. Petersburg, Russia. https://doi.org/10.25696/ELSYS.B.EN-RU.VIC.2019

26. Minkin, V. A. ed. (2020) Proceedings of the 3rd International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 25–26 June 2020, St. Petersburg, Russia. https://doi.org/10.25696/ELSYS.B.EN-RU.VIC.2020

27. Minkin, V. A. ed. (2021) Proceedings of the 4th International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 24–25 June 2021, St. Petersburg, Russia. https://doi.org/10.25696/ELSYS.B.EN-RU.VIC.2021

28. Minkin, V. A., Nikolaenko, N. N. (2008) Application of Vibraimage Technology and System for Analysis of Motor Activity and Study of Functional State of the Human Body, Biomedical Engineering, 2008, Vol. 42, No. 4, pp. 196–200. https://doi.org/10.1007/s10527-008-9045-9

29. Minkin, V. A., Bobrov, A. F. (2020) Health Diagnostics Using Assessment of Physiological Systems Signals Desynchronization. First Results of HealthTest Program Practical Applications, Proceedings of the 3rd International Open Science Conference: Modern Psychology. The Vibraimage Technology, 25–26 June, St. Petersburg, Russia. pp. 292–300. https://doi.org/10.25696/ELSYS.14.VC3.EN

30. Minkin, V. A., Blank, M. A. (2021) Psychophysiology and Homeokinesis. Synchronization of Stimuli Presentation to Chronobiological Processes, Proceedings of the 4th International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 24–25 June 2021, St. Petersburg, Russia, pp. 269–280. https://doi.org/10.25696/ELSYS.VC4.EN.05

31. Minkin, V. A., Akimov, V. A. (2022) COVID-19 Diagnosis by 5-second Facial Video Processing Using Vibraimage and Artificial Intelligence, Proceedings of the 5th International Open Science Conference: Modern Psychology. The Vibraimage Technology, 23–24 June 2022, St. Petersburg, Russia, pp. 7–24. https://doi.org/10.25696/ELSYS.VC5.EN.01

32. Minkin, V. A., Nikolaenko, Y. N. (2020) Adaptive Psychological Testing. Combination of Pre-Testing and Basic Testing in Neuro-Linguistic Profiling, Proceedings of the 3rd International Open Science Conference: Modern Psychophysiology. The Vibraimage Technology, 25–26 June 2020, St. Petersburg, Russia, pp. 204–212. https://doi.org/10.25696/ELSYS.02.VC3.EN

33. Mira y Lopez, E. (1957) Psychodiagnostico Miokinetiko. Buenos Aires: Paidos.

34. Novoseltsev, V. N. (1978) Theory of Control and Biosystems. Moscow: Science.

35. Nyquist, H. (1928) Certain Topics in Telegraph Transmission Theory, Trans. AIEE, 1928, Vol. 47(2). doi: 10.1109/t-aiee.1928.5055024

36. Pavlov, I. P. (1972) Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex, Transl. and Ed. by G. V. Anrep. London: Oxford University Press, p. 142.

37. Polonnikov, R. I. (2013) Selected Works. St. Petersburg: Anatolia (In Russ.).

38. Rohracher, H., Inanaga, K., (1969) Die Microvibration. Ihre biologisher Function und ihre klinish-diagnostische Bedentung. Verlag Hans Huber Bern, Stuttgart, Wien.

39. Sechenov, I. (1863) Reflexes of the Brain. Cambridge, Mass.: The MIT Press, p. 1965.

40. Shannon, C. E. (1948) A Mathematical Theory of Communication, Bell System Technical Journal, Vol. 27, pp. 379–423.

41. Tamar, H. (1972) Principles of Sensory Physiology. Springfield, Il.: Charles & Thomas Publishers.

42. Sterling, P., Eyer, J. (1988) Allostasis: A New Paradigm to Explain Arousal Pathology. In S. Fisher & J. Reason (Eds.), Handbook of life stress, cognition and health, Wiley & Sons, pp. 629–649.

43. Wiener, N. (1948) Cybernetics: Or Control and Communication in the Animal and the Machine. Paris, (Hermann&Cie) & Camb. Mass. MIT, 2nd revised ed. 1961.