DOI: 10.25696/ELSYS.VC2.EN.15

CUSTOMER SATISFACTION LEVEL MONITORING BY VIBRAIMAGE TECHNOLOGY

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Abstract: *Experimental studies of changes in the parameters of the psychophysiological state (PPS) of a person using vibraimage technology have been carried out. Proposed equation for assessing the satisfaction level of a person's PPS as the difference between the next and previous PPS. A psychophysiological explanation of the research results is given. A cybernetic model for assessing the current level of happiness is proposed.*

Keywords**:** *vibraimage, satisfaction level, level of happiness, psychophysiological state, cybernetic model of emotions.*

Currently, quite often there are tasks that require an objective assessment of changes in the psychophysiological state of a person. For security systems, it is necessary to assess the negative characteristics of a person, such as the level of aggression, anxiety, stress, as well as the general level of danger that this person represents to others now [Minkin, Tseluiko, 2014]. However, the tasks that require an assessment of the positive characteristics of a person are not less, but even more than the tasks that require the assessment of negative qualities. Moreover, each emotion or psycho-physiological characteristic can only be conditionally divided into positive and negative. The great Darwin claimed that all emotional states were of evolutionary origin [Darwin, 2001], and the Nobel laureate Lorenz [Lorenz, 1966] believed that aggression is the most necessary characteristic of any biological species for its survival. Since the development of cybernetics, as Control and Communication in the Animal and the Machine [Wiener, 1946, Bernstein, 1967], it has been proposed to use physical and informational parameters to assess the psychophysiological state (PPS) of a person. Before the advent of vibraimage technology [Minkin, 2000, 2007, 2018], such a cybernetic approach to man was more theoretical, although many researchers of the 20 th century came close enough to the possibilities of its practical application [Wiener, 1946; Anokhin, 1966; Simonov, 1986; Polonnikov, 2013]. The task of determining the level of happiness is quite popular in the east, and it was not by chance that the Ministry of Happiness appeared in OAU in 2015. As is customary in classical psychology, an attempt was initially made to estimate the level of happiness using questionnaires [Lambert L., Pasha-Zaidi N., 2015]. However, psychological questionnaires assess only the conscious response of a person to the stimuli presented, and a conscious reaction is not always objective. The development of the second generation of vibraimage systems with synchronous control of conscious and unconscious responses of a testee [Minkin, Nikolaenko, 2017] created prerequisites for developing psychophysiological systems capable of solving the problems of parameters measuring for any psychophysiological state, conditionally positive and conditionally negative.

The aim of this work was to study changes in the PPS and to determine the level of person satisfaction, depending on the known influencing stimuli or in the absence of acting stimuli.

Materials and methods

To study free changes in the PPS in a quasi-stationary human state, we consider the results of 200 tests during the work of 5 programmers (40 tests of each operator) for asynchronously generated stimuli. Programers were monitored by VibraMed10 program [VibraMed10, 2019], the age of the operators was 21–25 years old, testing was conducted in 2019. Testing was conducted on computers with IntelCore I7 processor, by Microsoft LifeCam Studio webcam with image format of 640×480. The illuminance of the testees was within (500–700) lux, the head of the testee horizontally was at least 200 elements on webcam, the image quality indicator in the VibraMed10 software exceeded 60%. The duration of each test was approximately 380 seconds.

To study PPS changes under the influence of external stimuli, let us examine the results of testing the group of 200 first-year students of the St. Petersburg Electrotechnical University, LETI (age 17–23 years old, M: G-80; 20) to questions from VibraMI programs with the Gardner12T questionnaire [Minkin, Nikolaenko, 2017; VibraMI, 2019]. Testing was conducted on a computer with an IntelCore I7 processor, with a Microsoft LifeCam Studio webcam with an image format of 640×480. The illuminance of the test subjects was within (500–700) lux, the head of the test horizontally was at least 200 elements, the image quality indicator in the VibraMI and PsyAccent programs exceeded 80%. The duration of each test was approximately 380 seconds.

The main measured parameters of a person are information efficiency of physiological systems and energy consumption, the calculation formulas of which were proposed earlier [Minkin, 2018; VibraMed10, 2019, Minkin et al., 2019]. The parameter of PPS changing ($dP = P_2 - P_1$) in this work is considered to be the parameter of person satisfaction level, a positive value of said parameter indicates positive changes in PPS, and a negative value of said parameter indicates negative changes in PPS.

Results

Typical results of PPS changing, measured by the vibraimage technology when testing subjects without the influence of external stimuli, are shown in figure 1.

Typical results of PPS changing, measured by the vibraimage technology and line-opposite questionnaire presented to testee, are shown in figure 2.

VibraStat [VibraStat, 2019] program was calculated the average level of PPS changes during the testing for the first and second groups of testees. For the first group of tested $dP_1 = 0.000\%$. For the second group of subjects $dP_2 = +6.12\%$

Results discussion

The studies carried out were of a comparative nature, they were carried out by the same equipment and identical software on approximately the same age of testees and identical sample size data. At the same time, the results of the first sample showed a zero change in state between the first and second halves of the testing time, and the results of the second group showed a significant positive change in the psychophysiological state.

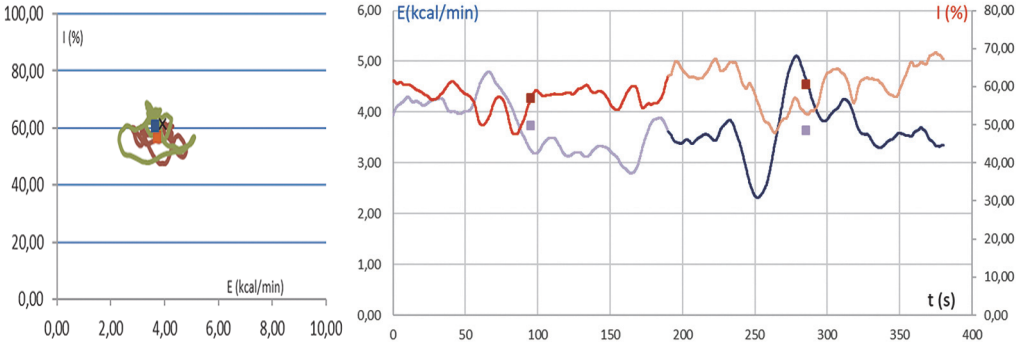

Fig. 1. Typical free changes of information and energy parameters without external stimuli

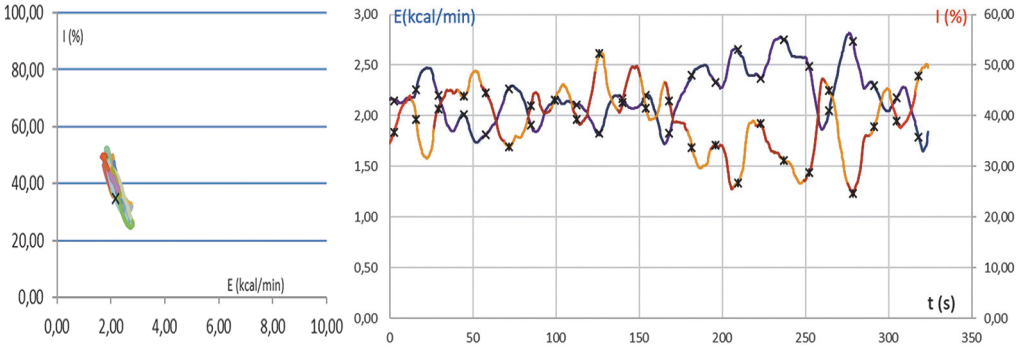

Fig. 2. Typical changes of information and energy parameters during presentation of line-opposite questionnaire to testee

It is logical to assume that there is an objective reason explaining the difference in the results obtained. The fact that the averaged state of programmers does not change during the testing time is quite understandable, since, despite the constantly emerging external stimuli and reactions to them, on average and statistically they should be differently directed, therefore, a significant change in the PPS is observed on a significant sample. A similar result was obtained with less testing time for the free state of a person [Minkin, 2019].

With regard to testing the multiple intelligences of students, then most likely, students were apprehensive about the testing being conducted; this is the same natural fear of any new ordeal. At the same time, in the process of testing, students began to understand that in fact nothing terrible happens, the questions are of a general nature and their mood and the PPS began to improve in the process of this understanding. Thus, the second half of testing, again, on average, took place in a better mood and psychophysiological state, which showed a positive change in the PPS by 6.12%.

It can be said that the students left satisfied with the test results, therefore, the proposed method can be considered applicable to various tasks, for example, determining customer satisfaction during short conversations. At the same time, the

following factors should be taken into account. Firstly, the evaluation of the PPS should not be less than 3 minutes, otherwise the natural mechanism of regulation of brain activity will affect the result [Fleishman, 1999; Minkin, 2019]. With considerable testing time (more than 10 minutes), other factors (fatigue, loss of concentration, and others) may influence the process of determining the result; therefore, the proposed method should be recommended for testing in the range of 3–10 minutes. In the work [Minkin, 2019] it was shown that during the time studies of the subject, the drift of individual psycho-physiological parameters could reach 10%. The evaluation of PPS used by the level of information efficiency and energy expenditure of the subject allows to evaluate not only the relative change in the parameters of PPS in percent, but also the absolute values of the measured parameters in conventional or physical units of measurement. From the point of view of Darwin's evolutionary theory, any organism tends to spend less energy, while maintaining maximum information efficiency. Therefore, the measured informational efficiency of the physiological systems of a person and the energy consumed by a person are the main indicators of a person's current level of happiness at the time of the study.

Conclusions

The results of this study show the ability to control changes in PPS and the measurement of the human satisfaction level using the vibraimage technology.

References:

1. *Anokhin P. K.* (1966). Cybernetics and Integrative Brain Activity // Vopr. Psychology. № 10. P. 10–33.
2. *Bernstein N. A.* (1967). The co-ordination and regulation of movements. Oxford: Pergamon Press.
3. *Darwin Ch.* (1872). The Expression of the Emotions in Man and Animals. London: John Murray.
4. *Fleishman A. N.* (1999). Slow hemodynamic oscillations. Novosibirsk.
5. *Lambert L., Pasha-Zaidi N.* (2015). Happiness in the United Arab Emirates: conceptualisations of happiness among Emirati and other Arab students. DOI: 10.1504/IJHD.2015.067590
6. *Lorenz K.* On Aggression [Das sogenannte Böse. Zur Naturgeschichte der Aggression]. Verlag Dr. G Borotha-Schoeler.
7. *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. Vol. 42, No. 4. P. 196–200. DOI: 10.1007/s10527-008-9045-9.
8. *Minkin V. A., Tseluiko A. V.* (2014). Practical Results of Using Technical Profiling Systems for Ensuring Safety in Transport // Transport Law. No. 3. P. 27–32.
9. *Minkin V. A.* (2017). Vibraimage. St. Petersburg: Renome. DOI: 10.25696/ELSYS.B.EN. VI.2017.
10. *Minkin V. et al.* (2019). Conscious and Unconscious Responses as Independent Components of a Person's Current Psychophysiological State // Current Psychiatry Reviews. Vol. 32, Iss. 3.
11. *Minkin V. A., Blank M. A.* (2019). Psychophysiological formation of brain activity period // Modern Psychophysiology. The Vibraimage Technology: Proceedings of the 2nd International

Open Science Conference, June 25–26, 2019, Saint Petersburg, Russia. St. Petersburg: ELSYS Corp. P. 232–239.
12. *Simonov P. V.* (1986). The emotional brain. N. Y., Plenum Press, 1986.
13. Patent US 7346227, IPC G06K 9/36. Method and device for image transformation / *V. A. Minkin, A. I. Shtam*, ELSYS Corp. Filed 19.12.2000; Publ. 18.03.2008.
14. Patent RU 2017109920, IPC A61B 5/11. A method for assessing a person's psychophysiological state / *V. A. Minkin*, ELSYS Corp. Filed 24.03.2017; Publ. 24.09.2018, Bul. № 27.
15. *Polonnikov R. I.* (2013). Selected works. St. Petersburg: Anatolia. (In Russian)
16. VibraMed (2019). Emotion Recognition and Behavior Detection system. Version 10 [Electronic resource]. St. Petersburg: ELSYS Corp. URL: http://www.psymaker.com/downloads/VibraMedEng10.pdf (access date: 06.05.2019).
17. VibraStat (2019). VibraStat Manual. Vibraimaging analysis of MED psychophysiological parameters statistics [Electronic resource]. St. Petersburg: ELSYS Corp. URL: http://www.psymaker.com/downloads/VibraStatAdvEng.pdf (access date: 06.05.2019).
18. *Wiener N.* (1948). Cybernetics: Or Control and Communication in the Animal and the Machine. Paris: Hermann & Cie; Cambridge, Mass.: MIT Press. (2nd revised ed. 1961).