

Emotion Recognition and Behavior Detection System

VibraMA

MANUAL

Version Mobile

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1 Introduction

Welcome to the **VibraImage** World! Thank you for your purchase of **VibraMA** system. This Manual written to help you enjoy **vibraimaging** and open new features in well-known objects!

VibraImage technology measures micromovement (micro motion, vibration) of person by standard digital, web or television cameras and image processing. Human head microvibration linked with the vestibular-emotional reflex (VER) of a person and reflects emotion status and personality traits. **VibraMA** system detects human emotions by the control of three dimensional (3D) head-neck movements and fluctuations, accumulated as frame difference in several video frames.

1.1 Basic applications

VibraMA software solves the following targets:

- Psychophysiological parameters monitoring and detection;
- Emotion recognition;
- Monitoring of person physiological parameters;
- Video surveillance in real time by vibraimage and suspicious person detection;
- Psychological testing.

1.2 Smartphone requirements

- | | |
|-----------------------------------|------------------------------------|
| • Operation System | Android 6.0 or later |
| • Processor | 600 MHz or better |
| • Internal RAM | 128Mbyte or better |
| • Installed software | Microsoft Office Excel for Android |
| • Camera | front or/and back |
| • Frame rate, frame/sec, not less | 25 |
| • Internet connection | Access on HTTP protocol |

2 VibraMA software installation

To install VibraMA please follow steps below:

- 1 Check smartphone connection to Internet
- 2 Go to Web page www.psymaker.com/support/downloads/
- 3 Load file setupVibraMedA.exe www.psymaker.com/downloads/VibraMedA.apk
- 4 Run file setupVibraMedA.apk from archive file
- 5 Answer “Install” to smartphone question and start installation (fig. 1).

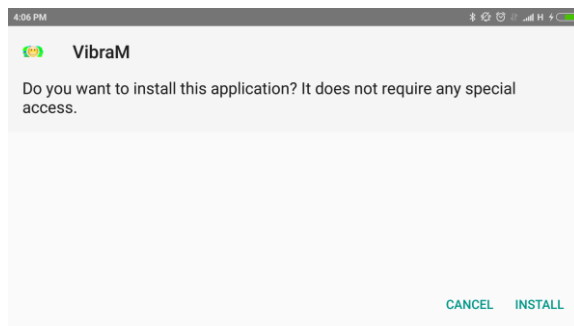


Fig. 1 Installation start.

- 6 After you will see process of installation (fig.2)

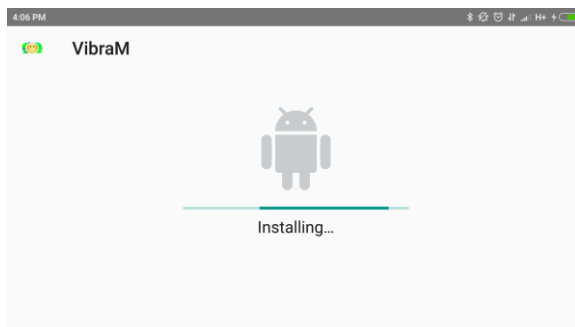


Fig. 2 Installation process.

- 7 After successful installation you should press “Open”

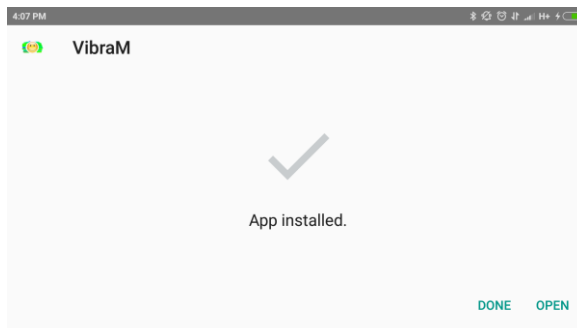


Fig. 3 Installation end.

If you want to open program later you should press “Done” and later you should press



appeared pictogram on your smartphone.

- 8 On first program start you should allow with permissions (fig. 4).



Fig. 4 Permissions for good program process.

- 9 Enter license code into appeared window into field “Private key” (fig. 5) and press “Get answer via HTTP”.

Please enter license code

Private key:

Hardware hash: 2EEC199F04CB0AC0DD3

License:

GET ANSWER VIA HTTP

CHECK
CANCEL

Fig. 5 Permissions for good program process.

- 10 Enjoy using VibraMA.

3 VibraMA. User's manual

After start of VibraMA in the main window, there is an image from camera.

3.1 Main window

In the main window of the program, you can see an additional six windows that display information about the parameters of mental and emotional state of a person, and program settings (on fig 3.1 the windows labeled corresponding numbers):

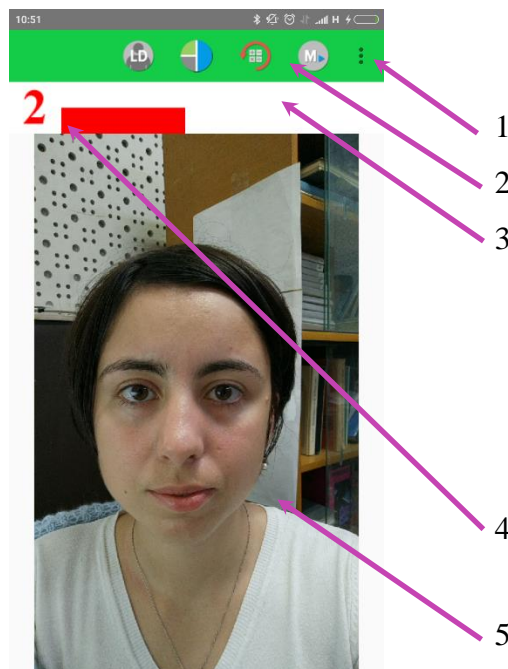


Fig. 6 Main window VibraMedA

1. Camera, Preset, View, Reset, Measure, Defaults – main menu;
2. Toolbar;
3. Progress – measurement time line;
4. QT – image quality window;
5. Images window for displaying vibraimage (VI).

Note, double click in the image field makes **RESET** of all saved up information and statistics about frames and start new cycle collection of information.

3.2 Main menu

The main menu contains the following items:

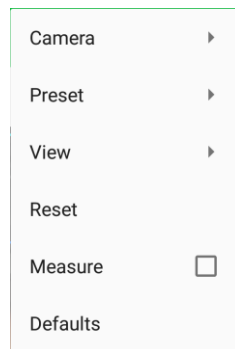


Fig. 7 Main menu

Item «**Reset**» – reset all saved up information and statistics about frames and start new cycle collection of information.

Item «**Measure**» – the system makes accumulation, averaging and a display of parameters for the specified time period. The results display is made in menu «View» => «M». In the same place in seconds value of the averaging period «**Duration**» is set.

Item «**Defaults**» – set all parameters by defaults.

3.2.1 Submenu «Camera»

Submenu «**Camera**» (fig. 8) allows choose back or front camera:

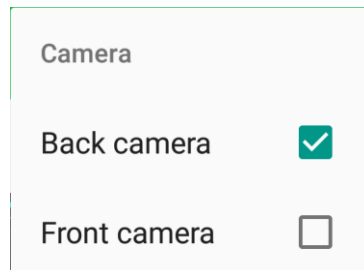


Fig. 8. Submenu «Camera»

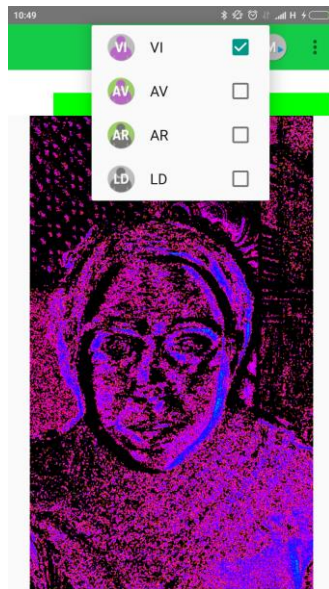
3.2.2 Submenu «Preset»

Submenu «**Preset**» defines the type of the display image (fig. 9).

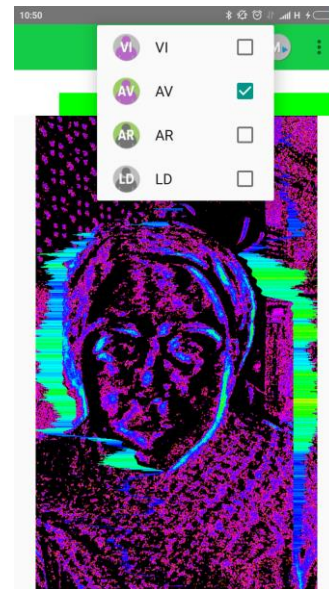
- In «**VI**» mode [«VibraImage mode»] displays vibraimage of person. Color for every image pixel depends on its amplitude or frequency of vibrations (fig. 9a).
- In «**AV**» mode [«Aura - Vibraimage mode»] the contour of the object allocated around the vibraimage. Vibra-aura line size depends on medium line vibration

amplitude. Vibra-aura line color depends on maximum line vibration frequency inside vibraimage contour (fig. 9b).

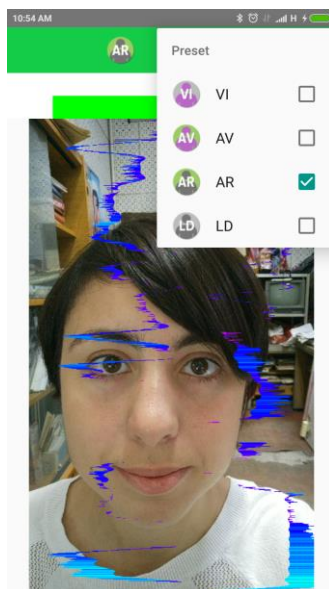
- In «AR» mode [«Aura on the Real image»] the vibra-aura of the person is shown around his real image (fig. 9c).
- In «LD» mode [«Lie Detector mode»] image area shows real object image(fig. 9d).



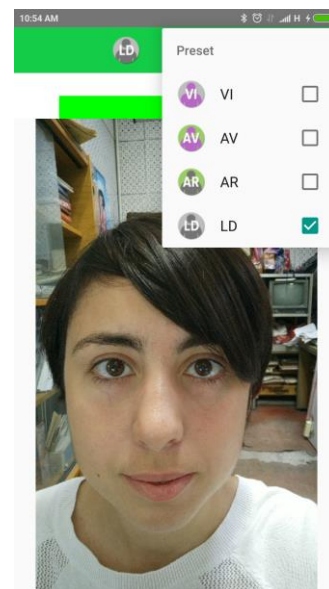
9a Режим VI



9b Режим AV



9c Режим AR



9d Режим LD

9 Image area in different modes

3.2.3 Submenu «View»

Submenu «**View**» (fig. 10) defines visible in the basic window information and contains the following items:

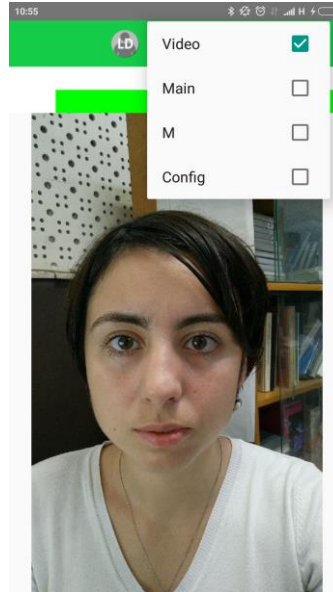


Fig. 10. Submenu «View»

Item «**Video**» - displays video from camera in modes (“Preset”) (fig. 9).

3.2.3.1 Submenu «Main»

Menu «**Main**» - displays information about adjustments of system and results of data vibraimage processing (fig 11).

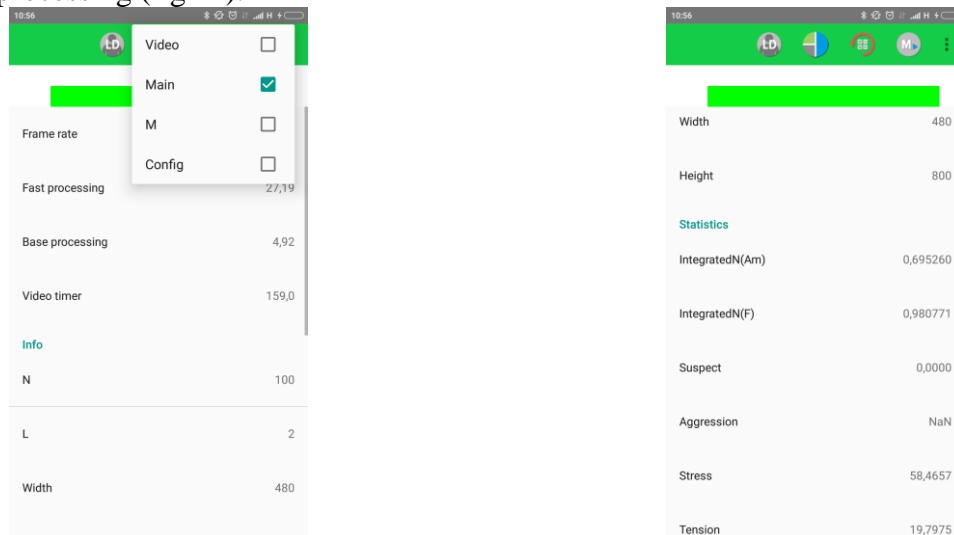


Fig. 11. Menu «Main»

- «**Frame rate**» – Number of the frames per second, received from the video source;

- «**Fast processing**» – Maximum number of the processed frames per second used for calculation. Selected by user;
- «**Base processing**» – Number of the processed frames per second used in base algorithm. Selected by user;
- «**Video Timer**» – For camera mode-displays time of supervision. For recorded video - time of current video-file record. For viewing a video-file - time from the file beginning);

Info:

- **N** – Number of the frames for accumulation. Selected by user;
- **L** – Palette Threshold. Defines a threshold in the displayed image, value of brightness less threshold is considered «black». Selected by user;

Width and Height – Displays the current video camera or avi file resolution;

Statistics:

- **IntegratedN(Am)** – Average frame amplitude vibraimage intensity processed for the N frames;
- **IntegratedN(F)** – Average frame frequency vibraimage intensity processed for the N frames;
- «**Suspect**» – Calculated level of suspect for object in frame;
- «**Aggression**» – Calculated level of anger for object in frame;
- «**Stress**» – Calculated level of stress for object in frame;
- «**Tension**» – Calculated level of tension for object in frame;

Menu «**M**» - displays the average values of vibraimage parameters which have been calculated and are average for the certain period (fig. 12).

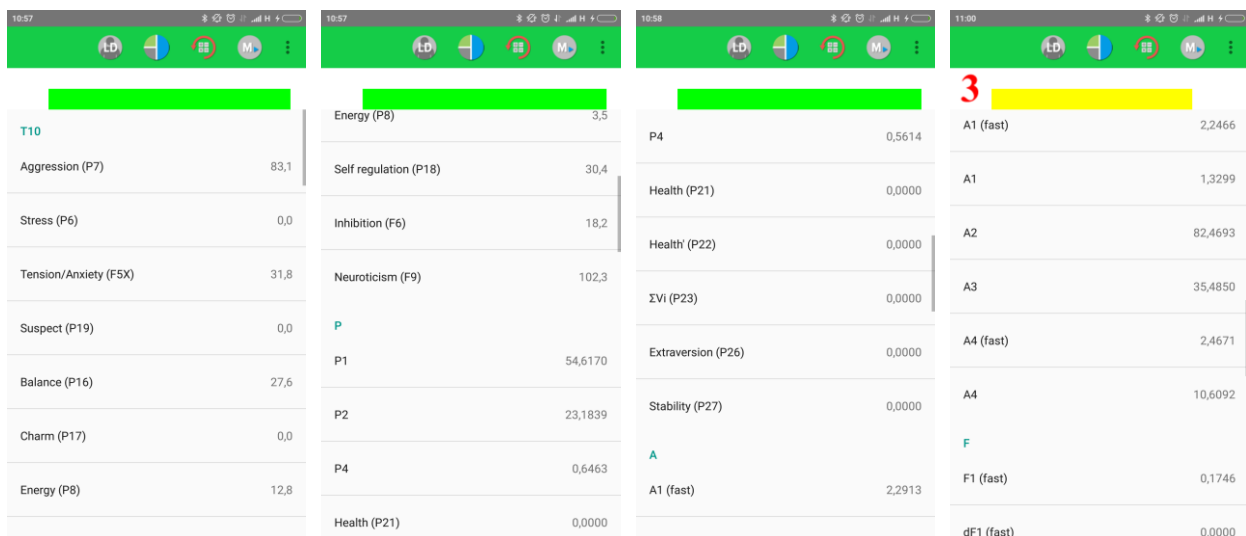


Fig. 12. Menu «M»

Value of the averaging period is set in seconds in a field «**M length**» (menu “Config”). Start of the beginning of information accumulation is made by a choice of item «**Measure**» in the “Main



menu” or pressing of the toolbar button . After start of an accumulation and averaging mode in the top of an information column there is a running line «Progress», displaying a course of data accumulation process.

3.2.3.2 Submenu «M»

Menu «**M**» shows following information:

- Basic parameters describing psycho-emotional condition of the person T10: Aggression (P7), Stress (P6), Tension/Anxiety (F5fast), Suspect (P19), Balance (P16), Charm (P17), Energy (P8), Self-regulation (P18), Inhibition (F6), Neuroticism (F9). See more information in p. 3.4.
- Configuration of measurement:
Line «Progress», displaying a course of data accumulation process and «Duration» – testing period in seconds.

Note, for correct diagnostics psycho-emotion conditions of the person speed of data input from the camera should be within the limits of 25-30 frame/sec.

- The group of parameters **P** registers features of mathematical Processing of vibrations:

P1 –	Dispersion of vibration density for frequency distribution at 10 processing frames
P3 –	Center density distribution displacement of frequency at 10 processing frames
P4 –	Center density distribution displacement of frequency at N processing frames
P21 –	Parameter « Health » (Health level for general oncology);
P22 –	Parameter « Health' » (Health level for prostate oncology);
P23 –	$\sum V_i$ – the average of the « Health » (Mean value of health level);
P26 –	Extraversion level
P27 –	Stability level

- The group of parameters **A1-A4** registers amplitude of vibrations:

A1 –	Frame difference between two consecutive frames
A2 –	Frame difference accumulated in 10 consecutive frames
A3 –	Frame difference accumulated in N consecutive frames

- A4 – Value of parameter A1 filtered on 10 frames
- The group of parameters **F1-F9** registers frequency of vibrations (amount of changing points):
 - F1 – Calculated value of changed signal pixels amount in 2 consecutive frames
 - F1 (fast) – Calculated value of changed signal pixels amount in frames difference in fast processing mode
 - dF1 (fast) – The average value of changes in the quantity of elements (the increment) for F1 (fast) parameter
 - F2 – Averaged value of changed signal pixels amount in 10 consecutive frames
 - F3 – Average value of elements quantity which have changed for the period of N frames
 - F4 – Changed pixels maximum frequency during N processed frames
 - F5 – Current **tension level** (%). Ratio of «high» frequency density to «low» frequency for parameter F1. Its speed of element changing in frames difference.
 - F5 (fast) – The average value of the rate of elements change in the fast processing mode calculation
 - F6 – **Inhibition parameter**. Average value of the F1 parameter period (in seconds), determined during period F6N. Value of parameter F6N is set in section [Filters] an “S” information panel and defines quantity of the frame processed in Fast Processing mode
 - F7 – Root-mean-square deviation for F6 parameter
 - F8 – Not average (current) value of F6 parameter (in seconds), showing the current time period of F1 parameter changing
 - F9 – **Neuroticism parameter**
- The group of parameters **S1-S7** registers symmetry of vibrations between left and right parts of person body:
 - S1 – Ratio (symmetry) of amplitude left to the right changed pixels inside the object in 2 consecutive frames
 - S2 – Difference between the left and right average amplitude of object vibration in 10 frames
 - S3 – Difference between the left and right average amplitude of object vibration in N frames
 - S4 – Ratio of the changed pixels quantity in the left part of object to the changed pixels in the right part in 2 consecutive frames
 - S5 – Ratio of the changed pixels quantity in the left object part to the changed pixels quantity in the right object part calculated in 10 frames

- S6 – Ratio of the changed pixels quantity in the left object part to the changed pixels quantity in the right object part calculated in N frames
- S7 – Difference between the maximal frequency of vibrations of the left and right object parts in N frames

3.2.3.3 Submenu «Config»

Menu «**Config**» – allows adjusting vibraimage parameters and displays the following information (fig. 13).

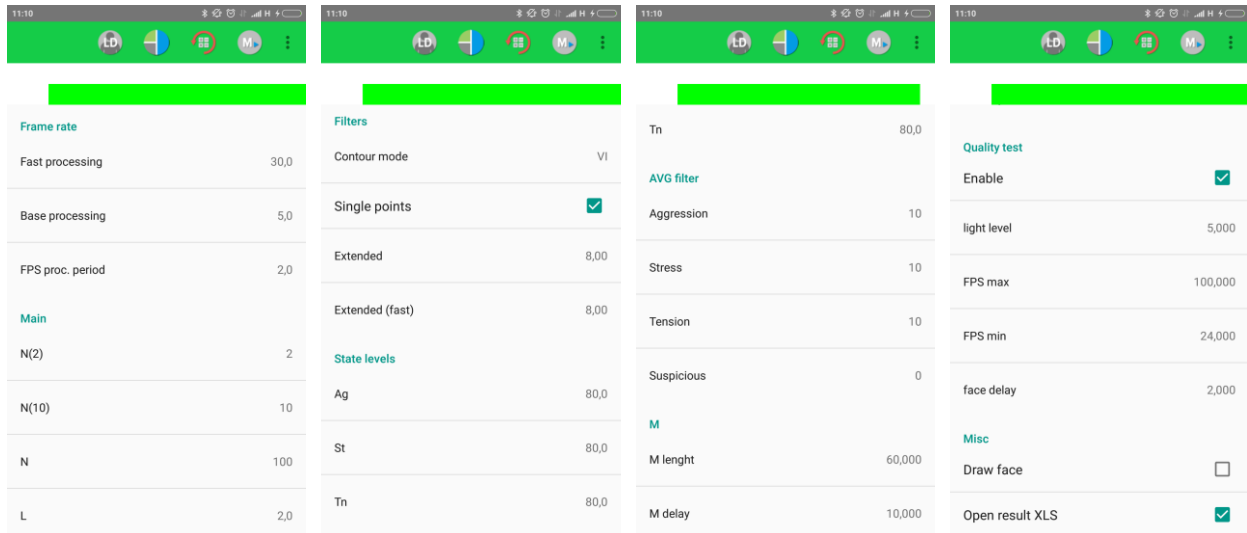


Fig. 13. Menu «Config»

Frame Rate Settings

- Fast processing Frequency (fps) for processing «fast» parameters of vibraimage, noted by a word «fast»
- Base processing Frequency (fps) for processing «base» parameters of vibraimage, noted by a word «base»
- FPS proc. period Frequency of the frames (fps) during calculation period

Main settings

- N(2) Minimum number of accumulated frames. By default, 2
- N(10) Average number of accumulated frames. By default, 10
- N Maximum number of accumulated frames. By default, 100
- L Threshold of a palette. Defines a threshold of displayed image, value of less brightness considers as «black»

Filters

Contour mode	Calculation whole vibraimage (VI), on fixed contour or face only.
Single points	Removes single points, surrounded by black
Extended	It is intended for reduction of noise of a video camera. Delete video noise in bit. This filter is important, when the object is motionless, and values changed because of camera noise.
Extended (fast)	Delete video noise for fast processing.
State levels Ag, St, Tn	Suspicious level in the Aggression parameters (Ag), «Stress» (St), «Tension» (Tn) is set. When exceeding level of danger the system gives out a sound signal and fixes a frame.
AVG filter	
Aggression	Number of frames for aggression level averaging
Stress	Number of frames for stress level averaging
Tension	Number of frames for tension level averaging
Suspicious	Number of frames for suspect level averaging
M	
M length	duration of measurement
M delay	delay before measurement after press button “Measurement”
Quality test	
Enable	Switch on mode of automatical check of image quality (see p. 2.4.5)
Light level	Parameter use for define image noise level when illumination is low.
FPS max, FPS min	Maximum and Minimum allowable input frame rate.
Face delay	This parameter determines how long (in seconds) the program can not recognize a human face in the frame before you will get an error message.
Misc	
Draw face	No – not draw rectangle around face, Yes – draw rectangle around more danger single person. For non-danger person rectangle draw green color, but if person suspect level more than «Critical level», than rectangle draw red color.
Open result XLS	Opens results in XLS in Microsoft office Exel after end of measurement

3.3 Toolbar

VibraMA toolbar (fig. 14) contains following buttons:



Fig. 14. **VibraMA** toolbar.



All toolbar buttons (fig. 3.17) duplicated the corresponding items in the menu system. When the tool tip determines the assignment of toolbar buttons. Note, the selected toolbar button is highlighted in color or volume, depending on the main window style.




– choice of video “Preset”.



– external vibraimage (vibra-aura) around real video

image mode (AR),  – choice of internal vibraimage mode (VI),  – choice of

external vibraimage (vibra-aura) around internal video image mode (AV),  – choice real video image mode (LD);



– opens menu “View”;



– reset all saved up information and statistics about frames and start new cycle collection of information



– start of measurement;



– open main menu.

3.4 Video quality auto checking function

The **VibraMA** program has quality control function image quality control during the test. Since the calculation of human reaction using the video image, the quality control for the processed video is necessary to obtain a correct test result. Error message and the low quality of video will appear on top of the window (4 on fig. 6), but only if the “**Quality test**” mode in menu “Config” is enable.

Program gives error indication if the image quality is lower than standard vibraimage requests:

Error 1 – indicates when facial image is lower than necessary. For cancel this error is need to move checked person near to camera or start zoom function on camera.

Error 2 – indicates when camera noise level is higher than necessary. The reason of this error could be low illumination, incorrect camera settings or camera vibration.

Error 3 – indicates when computer input frame rate is lower than necessary. Requested norm for processed frame rate is more than 24 f/s. This errors indication was done for deleting unqualified Med influence during results control.



Fig. 15. Quality test indication stands “Enable” in “Config” and Error 1 shows in the image window. Head image size is lower than requested.

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Error 1 – indicates when facial image is lower than necessary. For cancel this error is need to move checked person near to camera or start zoom function on camera.

Error 2 – indicates when camera noise level is higher than necessary. The reason of this error could be low illumination, incorrect camera settings or camera vibration.

Error 3 – indicates when computer input frequency rate is lower than necessary. Requested norm for processed frame frequency is more than 24 f/s. This errors indication done for deleting unqualified Med influence during results control.

The size of the person's head image in the picture elements (pixels), which determines the accuracy of recorded vibrations, requires constant monitoring during testing. When tested with a video image analysis there are no severe restrictions on the movement of the test person, as required by the contact method. This person feels natural, which increases the accuracy of test results.

However, the natural behavior can lead to the fact that during the test response deviates from the camera and the size of the human head image becomes less than required. To resolve this issue vibraimage system constantly monitors a person's head size of the image and displays an error message (1) in the window «QT» in the case of reducing the size below the limit. In addition, vibraimage program includes a permanent face detection algorithm, which ensures elimination of errors from a lack of a real image of the person in the frame during testing.

Temporary noise signal from the video camera includes a video camera noise and illumination instability and can significantly affect the test results. In this case, at the slightest noise, level exceeds the specified threshold, the system automatically displays an error message (2) in «QT» window (see. Fig. 2.5).

Despite the fact that the television camera may transmit to 30 f/s with the set resolution, it does not guarantee that the computer receives and processes the incoming video data in real time. Any deviation from the information processing in real time resulting in a loss of information and hence reduce the reliability of the test. By reducing the actual input frames frequencies and processing frequencies below the set limit, the system automatically displays a warning error (3).

Window «**Quality Test**» (QT) indicates the time in %, for which the image quality of 100 %. When the quality test indicates 43 % means that only 43 % of the testing time have no errors, and the 57 % of test time the image quality contained 1, 2 or 3 errors.

Note, before the start of the test should ensure that the program processed the image of a human without errors.

Note, for deleting errors you should fix the phone, for example, as in the holder for the phone (fig. 16). When you place the tripod on a table during measurements, you should not lean or touch the table to reduce external vibrations.



Fig. 16. Tripod with phone.

4 **VibraMA**. Emotion Recognition and Behavior Detection System

In medical imaging and biometrics, **VibraImage** is psychologically-based, emotional-recognition visual imaging technology that measures pixels microvibrations in terms of digital frequency and amplitude parameters. The visualization of a 3-dimensional object fluctuation, based on vibration parameters, can thus be correlated to various mental states, such as anger, tension, aggression, etc., as well as mood, normal states, and subconscious reflections. Vibraimage characterizes as one of primary images as visible spectrum, such as infrared, x-ray, MRI or ultrasound imaging. Vibraimage technology is operating in areas such as terrorist recognition, emotional recognition, interpersonal video-dating interactions, as well as for personal use. Visualization of every pixels vibration became possible only in 21st century with the development of digital cameras and high power computers. Long ago, past scientists, such as Aristotle, had realized that biological object movement parameters characterize emotions; thus vibraimage technology is a potential realization of this goal. **VibraMA** system realizes remote and auto monitoring of emotions levels, such as stress, aggression and tension, and detects lie in a real time mode. **VibraMA** also allows to register and analyze human activity characteristics from recorded video files (AVI format) and to analyze medical, psychological and emotional human state for different applications.

VibraMA goals

- Cognitive control of emotions;
- Psychological and medical monitoring;
- Psychophysiological detection;
- Training and relax control for fitness and sport applications;
- Meditation and aura control;
- Live and recorded video processing.

The direct link between reflex movement and brain activity was discovered in 1863 by the famous Russian physiologist Ivan Sechenov in his publication «Reflexes of Brain». Charles Darwin in his book «The expression of the emotions in man and animals», 1872, also declared that reflex movements associated with emotions. Nobel laureate and the famous researcher of aggression Konrad Lorenz claims, that amplitude and intensity of reflex movements characterized the aggression. (On Aggression, 1966). According to the action of vestibular system functions and mechanical movement, person stands with the head in a balanced vertical position, continuously and reflexively performing three-dimension micromovements or vibrations. The dependence between head vibration parameters and emotional state characterized by the vestibular-emotional reflex (VER) or vestibular-energy reflex.

Vibraimage technology is the realization of medicine, psychology, modern computers and television sciences for human emotion recognition. **Vibraimage** plans to do human emotion control so precise, like physics measurements!

4.1 M mode. T1-T10 parameters

The average values of personal psychophysiological parameters, their deviation and variability are measuring in the «**M**» mode. The main goals of this mode are application of vibraimage system for accuracy security checking, medical diagnostics and psychological testing and researches. M mode based on measurement and calculation of psychophysiological parameters T1–T10 and checking its math variability during testing period. For vibraimage visual control in this chapter are given the pictures characterizing changes of said psychophysiological parameters T1–T10.

The mathematical expectation M , standard deviation (SD) S and variability V (S are calculating for the following human psychophysiological parameters:

T1 – Aggression (P7)

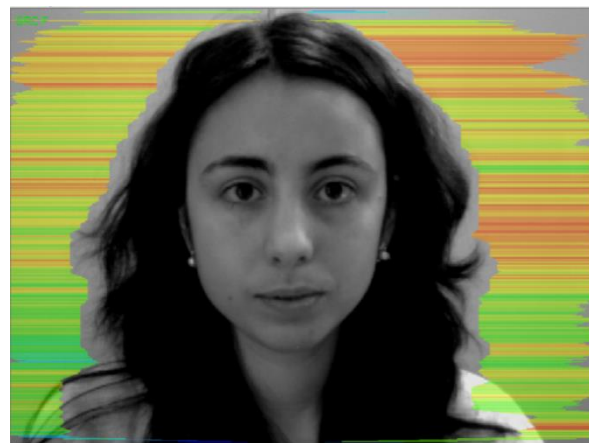
The parameter determines by the frequency histogram and represents the maximum allocation of the frequency and SD vibration frequency of the human face. The higher value of the maximum distribution and higher SD value gives the greater value of the parameter T1.

Aggressive state is not every time coordinates with tension, and tension state is not always coordinates with aggression. However, often these two emotions accompany each other. Aggressive state obligatory characterized by high frequency vibrations and red colors in aura. Aura size is more than normal and gaps could absent, but color and form non uniformity must present (fig 4.1b). Stress level could be low, less than 0,3. Anger level more than 0,7 and tension level more than 0,4.

Frequency histogram distribution has maximum in right part of the range and distribution has amount dispersion. High speed signals spectrum envelope looks like uniform distribution.



a)



b)

Fig. 4.1 Aggression a) T1 = 18 %, b) T1 = 60 %

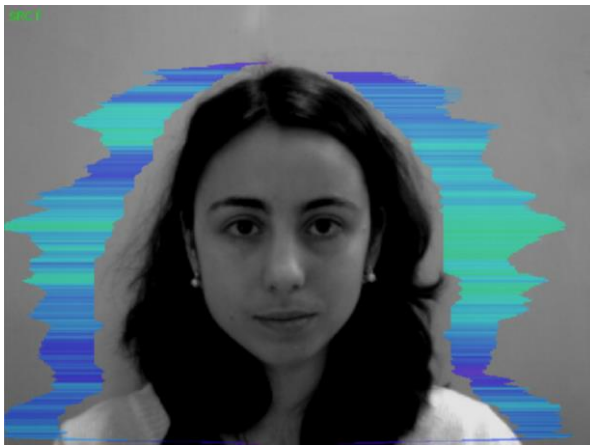
T2 – Stress (P6)

Parameter determines by degree of the external vibraimage (vibra-aura) asymmetry, means asymmetry of micromovements from the left and right parts of the persons head. The great

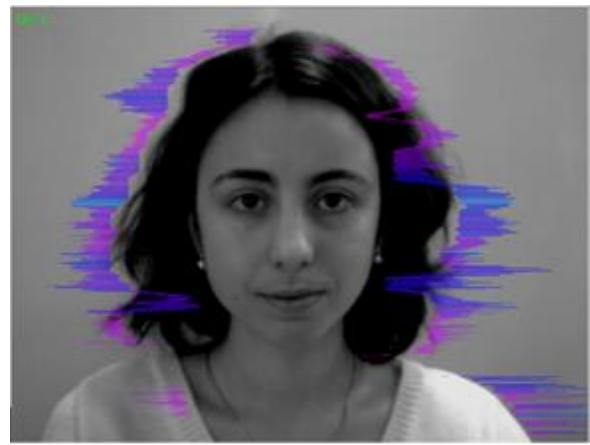
difference in amplitude and frequency movements for the left and right parts of the face (head) characterizes the increased T2 parameter level.

Stress state characterized by amount gaps in aura form and greatly aura colors non uniformity. Aura includes every scale colors and sharp color transfer, like red color could transfer to blue (fig 4.2b). Stress level more than 0,7. Aggression or activity level is low, not more than 0,5 and tension level is high and usually more than 0,4.

Frequency distribution histogram has several modes and high speed vibraimage signals spectrum presents superposition of exponential and uniform distributions.



a)



b)

Fig. 4.2 Stress a) $T2 = 17\%$, b) $T2 = 45\%$

T3 – Tension/Anxiety (F5X)

Parameter is determined by the relation of high-frequency part of a range of vibrations to the general power in a range of micromovements frequency for human head. High value of high-frequency vibrations density characterizes high value of the T3 parameter.

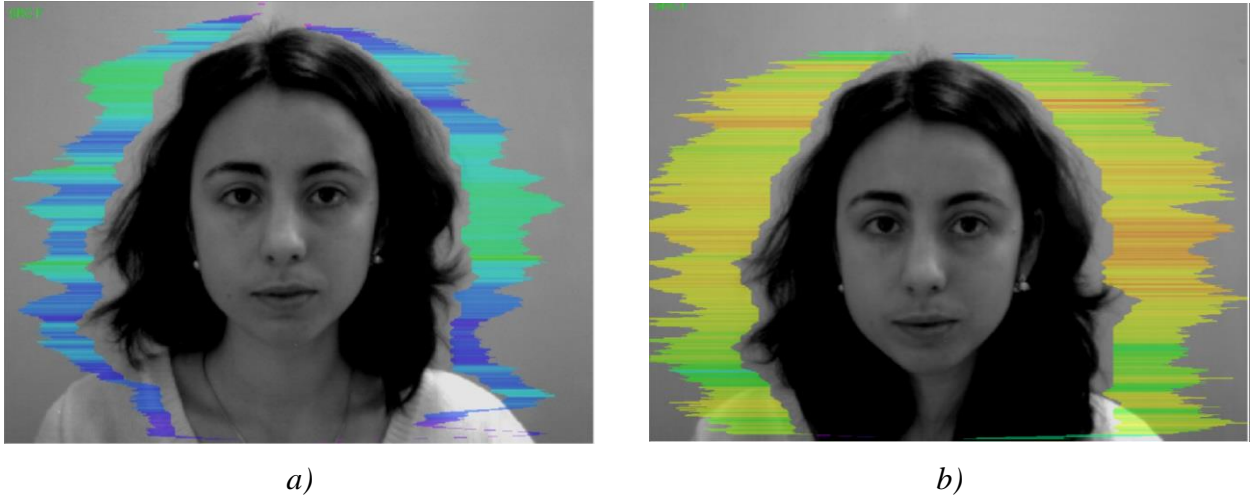


Fig. 4.3 Tension a) $T3 = 28\%$, b) $T3 = 48\%$

T4 – Suspect (P19)

The parameter is determined as the sum average of the first three conditionally negative emotions (T1, T2, T3) and characterizes the general level of conditionally negative emotions in a person status.

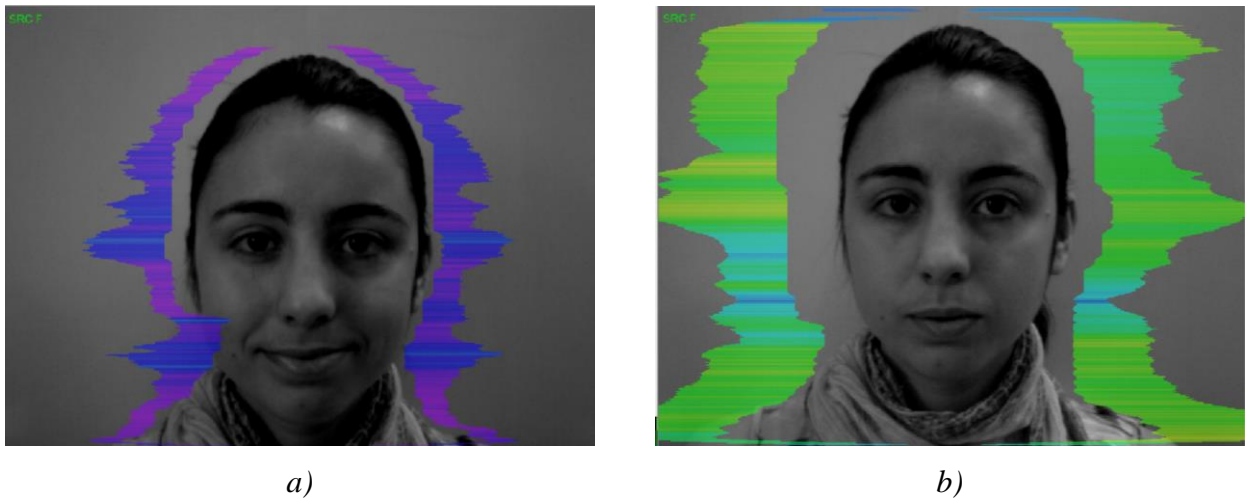


Fig. 4.4 Suspect a) $T4 = 20\%$, b) $T4 = 65\%$

T5 – Balance (P16)

The parameter determines by the frequency histogram and characterizes the level of similarity of the current frequency histogram to the Gaussian distribution law. The high level of frequency histogram similarity to the normal law characterized by a high level of balance, and significant deviation from the Gaussian distribution characterized by a low level of the parameter T5.

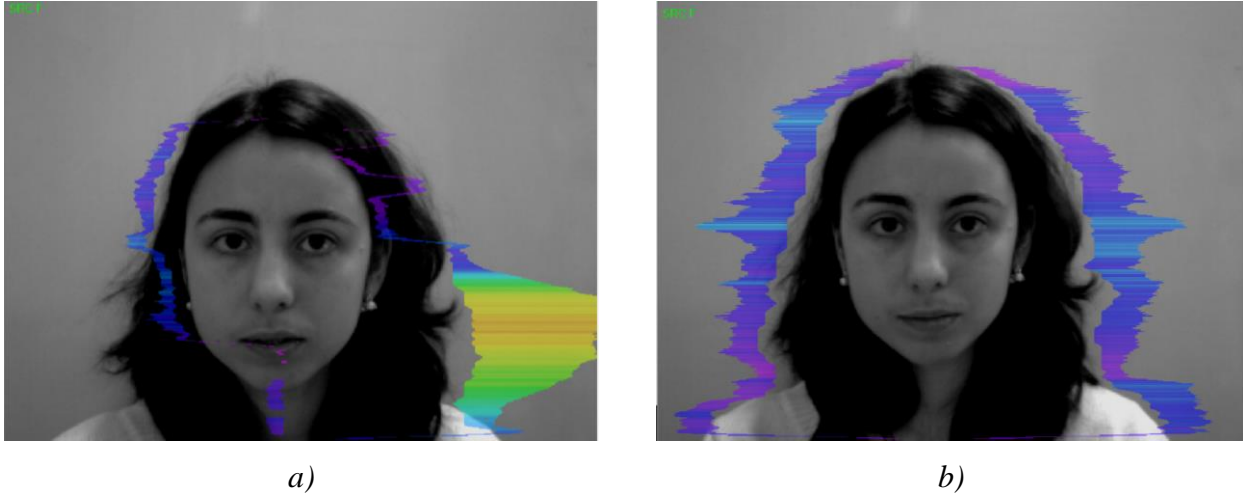


Fig. 4.5 Balance a) $T5 = 10\%$, b) $T5 = 80\%$

T6 – Charm (P17)

The parameter is determined by the symmetry (left-right) of the head and face micromovements, the maximum symmetry of movements (including frequency and amplitude) represents a high level of charm T6.

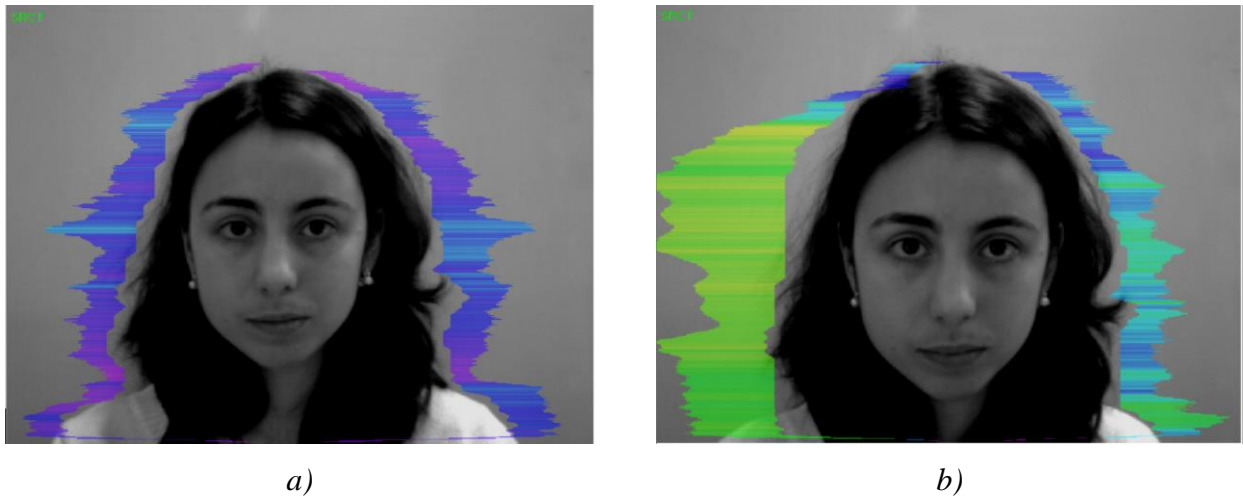


Fig. 4.6 Charm a) $T6 = 85\%$, b) $T6 = 40\%$

T7 – Energy (P8)

The parameter determines by the frequency histogram and characterizes the difference of the maximum density of the vibration frequency and vibration frequency SD for the face and human head. The higher value of the maximum density and lower SD or variation of vibration gives the higher value of energy T7.

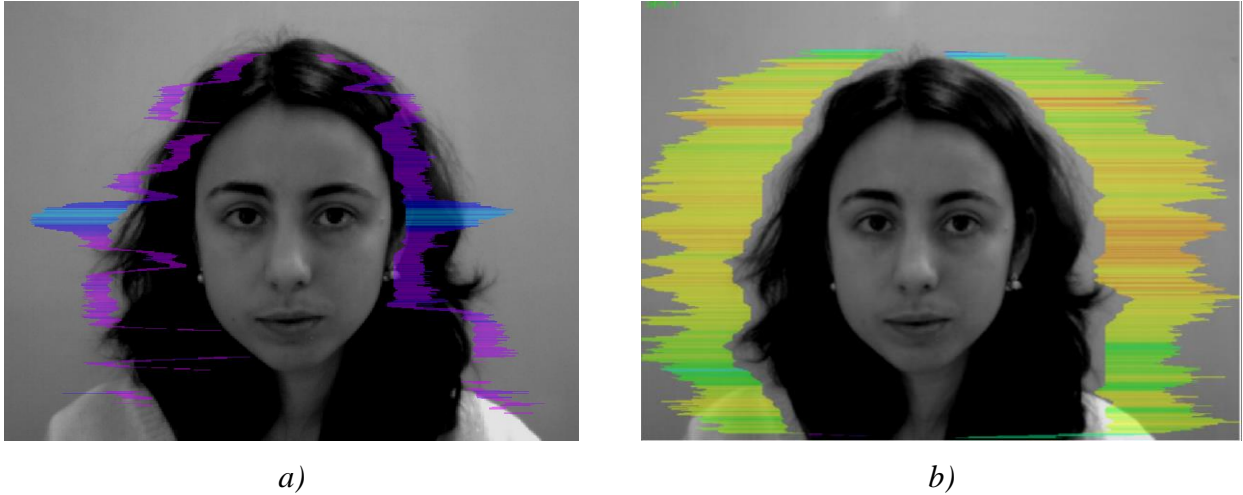


Fig. 4.7 Energy a) $T7 = 3\%$, b) $T7 = 70\%$

T8 – Selfregulation (P18)

The parameter is determined as the sum average for conditionally positive emotions (T5, T6) and characterizes the general level of conditionally positive person emotions at the measurement time.

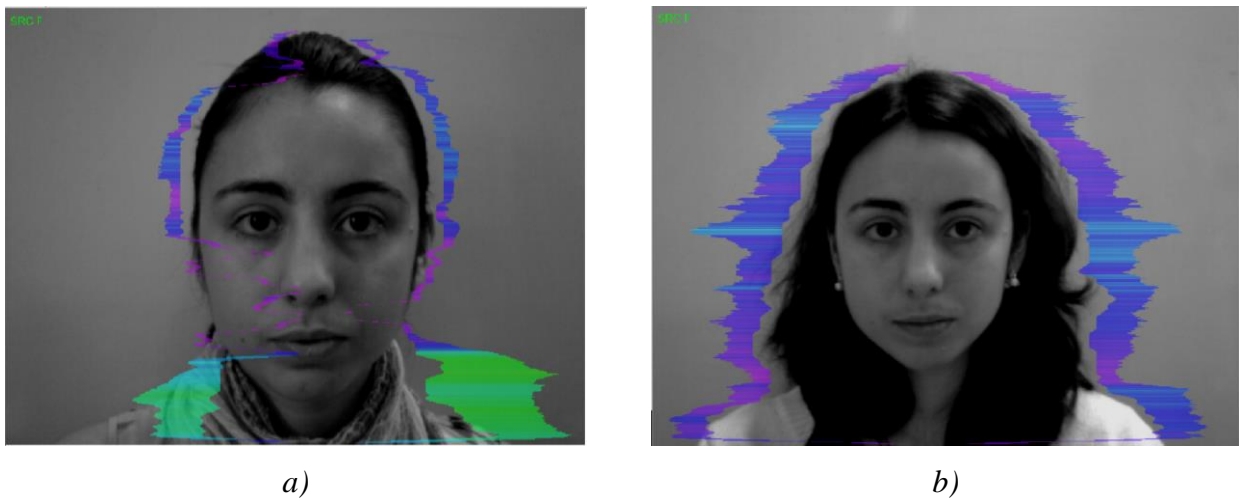


Fig. 4.8 Selfregulation a) $T8 = 30\%$, b) $T8 = 80\%$

T9 – Inhibition (F6)

It has a real physical dimension (time in seconds) and characterizes the minimum time of the person reaction for the shown event (the stimulus). The value of the parameter $T1 = 0,1$ means that the reaction time is 0,1 s. The greater the reaction time corresponds to a higher level of inhibition.

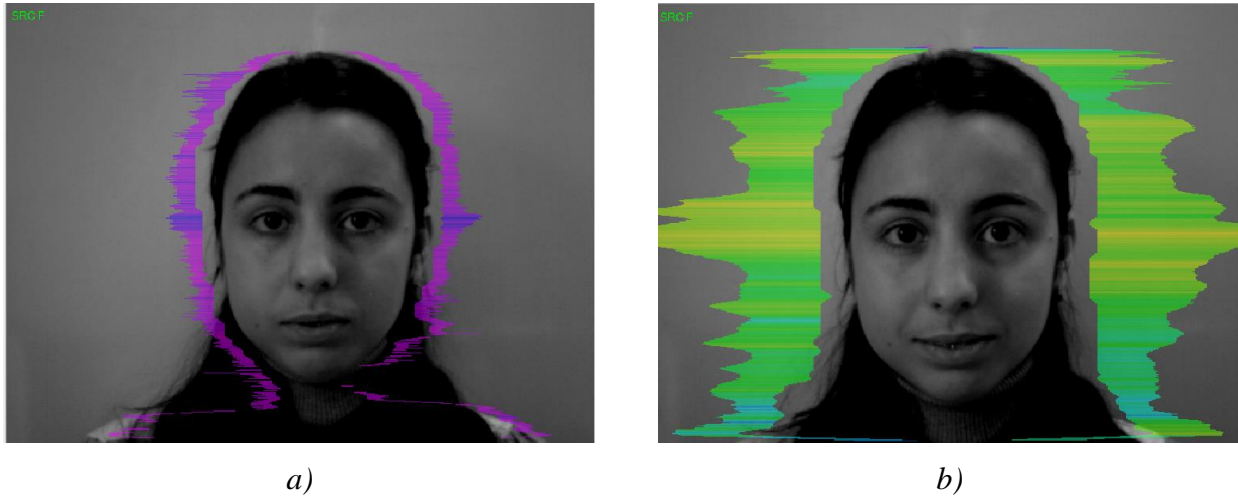


Fig. 4.9 Inhibition a) $T9 = 12\%$, b) $T9 = 25\%$

T10 – Neuroticism (F9)

The parameter characterizes the SD measured value of the inhibition level ($T9$) at the measurement time (default 60 seconds). High level for inhibition SD of psycho-physiological state characterized by instability and indicates high level of neuroticism $T10$.

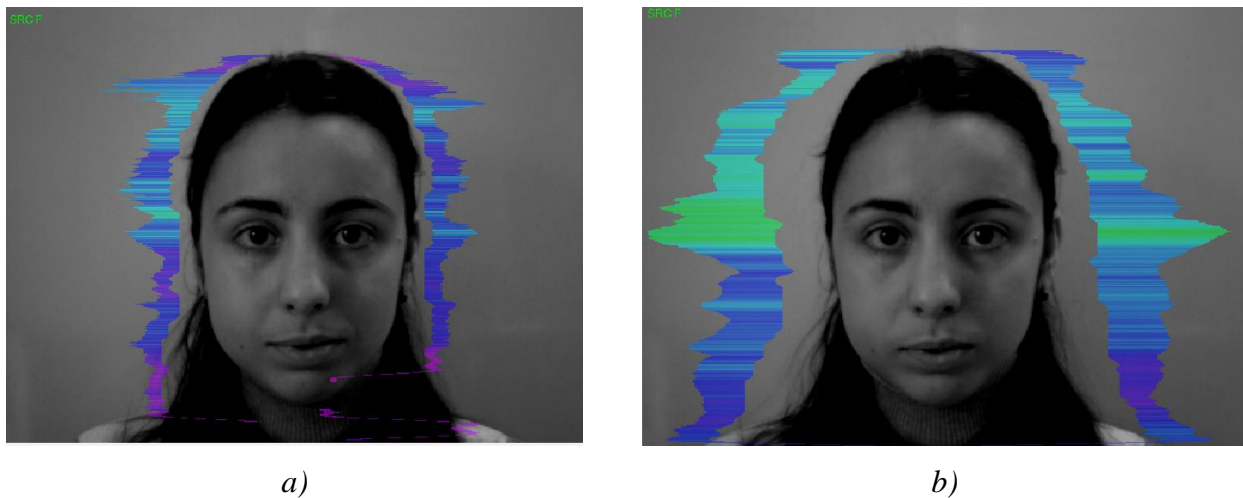


Fig. 4.10 Neuroticism a) $T10 = 10\%$, b) $T10 = 35\%$

Mathematical formulas on which basic there is a $T1$ – $T10$ parameters calculation, are resulted in the description of the Vibraimage statistical analysis software ([VibraStat](#)).

Set of the $T1$ – $T10$ parameters is selected so that with the maximum information content to record all micromovements of a human head. Thus, the name of each T_i parameter can characterize different psychophysiological characteristics depending on use of [VibraMed](#). For the characteristic of each parameter its name is primary not, it can be read the conditional, and a formula by which this parameter is determined.

Integral coefficient K, characterizing the general functional state of the person based on parameters T1 - T10 is calculated using the formula:

$$K = \sum_{i=1}^{10} m(T_i - T_n)$$

where K - integral indicator of the general condition (IIGC); T_i - measured value of the mathematical estimation (M, S, V) of these parameters; T_n - mathematical average value of (M, S, V) i-th parameter in the sample, and m - the normalization factor.

Thus three integrated indicators K of functional states (IIGC) were defined. The first K_M is calculated based on measured values of a mathematical expectation (M) of parameters T1 – T10, the second K_S – based on the standard deviation of parameters (S), the third K_V – based on the variability of parameters (V).

Statistically defined norms (corresponding to the person normal condition) for controllable psycho emotional parameters Aggression, Stress, Tension, Suspect, Balance, Charm, Energy, Self-regulation, Inhibition, Neuroticism are resulted in a fig. 4.12 in NMin and NMax columns. It is necessary to note, that each parameter has the range of normal values, and a deviation, for example, Aggressions below set level 20 % it is considered a deviation from norm. The offered approach to measurement of emotional conditions is based that each emotion has the quantitative value in any condition of the person. Even the extremely excited person has the certain Balance value, and visually absolutely quiet person, possesses the certain level of Aggression. The measured «print» of ten emotions characterizes set of psycho emotional person conditions and these set measured psycho emotional parameters allows to analyze with high accuracy any change of the person condition deviation from statistical norms.

Note

1. All measured by vibraimage system psychophysiological parameters are resulted in a range of 0 – 1 (0 – 100) % with the use of experimentally picked up fixed factors specified in formulas.

2. For everyone measured psychophysiological parameter the mathematical formula is primary, and secondary the conditional name of parameter. The psychophysiological sense of each T1–T10 parameter can change depending on conditions of experiments.

3. Set of measured parameters T1–T10 defines the general psychophysiological (psychosomatically, functional) a condition of the person based on integrated coefficient K.

Note:

This brief vibraimage parameters interpretation correspond default vibraimage system settings and based on main rules for right vibraimage scanning:

- uniform and stable object illumination;
- high quality and low noise camera application;
- frontal plane object before camera;

- maximum facial image size on monitor;
- mechanical stabilization of camera.

4.2 Psychophysiological (subconscious) response

The subconscious reaction measures by analyzing the information state and energy state (IE) as general features of psychophysiological state by vibraimage technology. This technology is similar to psychophysiological detection of deception and confirms or rejects conscious response based on positive or negative reaction of the examined person on the indicated stimulus.

As an example, we consider the change of a psychophysiological status (PPS) of the person given in a scale information - energy in fig. 4.11 Actual PPS displayed in the form of a point and change of person's PPS in time is displayed in the form of a straight line or a curve between two points. The example of PPS change from a state 0 in various states 1, 2, 3, 4, 5 is given in figure 4.11.

As shown in fig. 4.11 on the information-energy diagram changing from initial PPS (point 0) to other states characterized by one change of consumed energy and different states of psychological comfort.

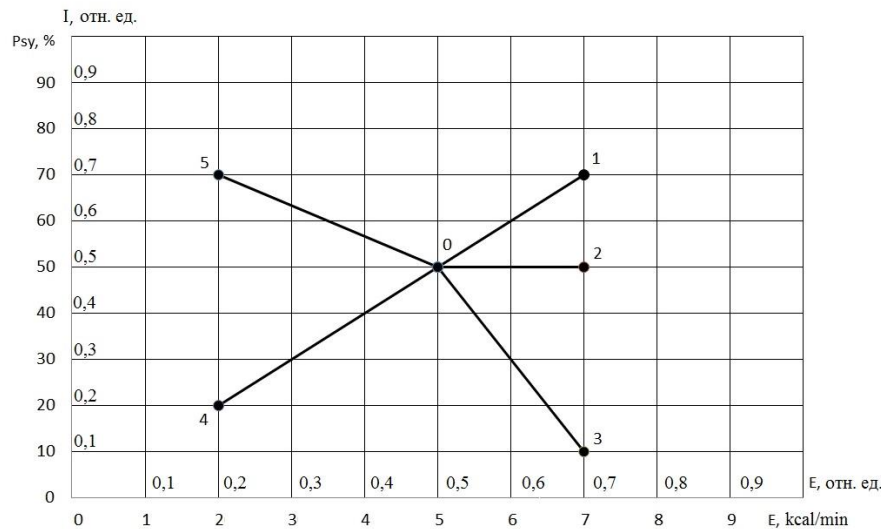


Fig. 4.11. Information-energy diagram of the PPS.

Transition 0-1 characterized by an increase in energy consumption and improvement of psychological state. The reason of this PPS change can be a good or pleasant news (the stimulus), it leads to a more intensive exchange processes (increase in energy consumption), and the psychological condition and mood notably improved (entropy of metabolic processes decreased, and the information content of the exchange increased).

Transition 0-2 characterized by an increase in energy consumption and an even level of psychological state. The reason can be, for example, an increase in mental and physical activity, which lead to more intensive exchange processes (increase in energy consumption), at the same time, the psychological state and mood are unchanged, as conducted by the impact did not cause emotional changes.

Transition 0-3 characterized by an increase in energy consumption and impairment of psychological state. The reason can be unpleasant information that leads to a more intensive exchange processes (increase in energy consumption), and the psychological condition and mood became notably worse (entropy of metabolic processes became worse, and the information content of the exchange decreased).

Transition 0-4 characterized by a decrease in energy consumption and impairment of psychological state. The reason can be unpleasant information that leads to a slowing of metabolic processes (reducing energy consumption), and the psychological condition and mood became notably worse (entropy of metabolic processes became worse, and the information content of the exchange decreased).

Transition 0-5 characterized by a decrease in energy consumption and improvement of psychological state. The reason can be pleasant news, which soothes and slows down the metabolic processes (reducing energy consumption), and the psychological condition and mood are notably improved (entropy of metabolic processes decreased, and the information content of the exchange increased).

4.3 Definition of emotions

Head movements in space classically associated with vestibular system are studied and discussed in relation to the status of vestibular reflexes (i.e., the vestibulo-ocular, vestibulo-collic, and cervico-ocular reflexes). But it is possible to look on head movements according to the vibraimage system and technology. We supposed that head balance for person without consciously movements could be considered as isolated thermodynamic system and any emission of internal energy would change the balance of this isolated system and realized by movements or vibrations.

Every emotional state characterized by specific energy conversation and work done by the system transfers to micro vibrations, if the person forced to stand or set still. The head vibration parameters (frequency in range 0.1-10 Hz and amplitude) are stable in time for stable emotional state of person. Parameters of vibrations changed only after emotional state alteration. **VibraImage** technics allows to contactless register of person vibration parameters and calculates emotions according to accumulated statistics of comparative testing with EEG, skin galvanic reaction and psychological testing. **VibraImage** technics, parameters and research results are below.

4.3.1 VibraImage parameters

Values of amplitude and frequency of vibrations of a person head differ in each point of space and displays as pseudo color image. Integrated processing of parameters values of vibration in each point can give the general information on parameters of the person movement. Vibraimage the person heads displaying amplitude (fig. 4.12) and frequency (fig. 4.13) the distributions of vibrations modulated by a color scale (fig. 4.14), showed below:



Fig. 4.12. Amplitude vibraimage

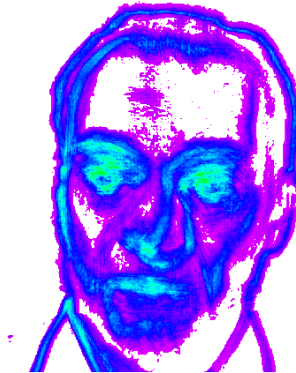


Fig. 4.13. Frequency vibraimage

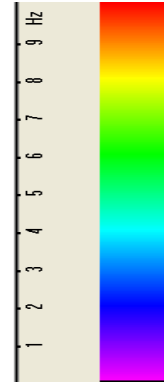


Fig. 4.14. Pseudo color scale of frequency distributions

Each point (pixel) amplitude vibraimage (fig. 4.12) reflects the relative moving of an element of the image saved up for determined time as it is known, that at insignificant moving the frames difference is proportional to the movement of object. For transformation of this relative moving in absolute, it is necessary to have the exact information on distance up to object and a working corner of an objective of the chamber, and then a color scale (fig. 4.14) can be scaled in millimeters or microns. However, at about the same location of faces on the screen, automatically the condition the single relative amplitude vibraimage scale satisfies. This allows to compare the obtained information about moving images to different people.

As against amplitude analyses, each point frequency vibraimage has physical dimension frequencies (Hz) as really displays frequency of signal change in each element of the image. Therefore the resulted color scale (fig. 4.14) scaling in Hz, i.e. violet color frequency vibraimage displays a range of vibrations (0-1) Hz, dark blue displays a range of vibrations (1-4) Hz, green the range of vibrations displays (4-8) Hz, red displays a range of vibrations (8-10) Hz.

Based on the given two primary images the technique assumes definition more than 40 integrated vibraimage parameters, reflecting various types of movement and vibration, and the parameters divided into 4 basic groups:

- A – amplitude parameters;
- F – frequency parameters;
- S – symmetry parameters;
- P – spatial and timing parameters of mathematic calculation.

4.3.2 Aura-VibraImage

External (around of a head) interline display of the maximal frequency and average amplitude vibraimage looks as aura and more informatively displays a condition of the person, than internal vibraimage. Color of vibra-aura codes by the same color scale, as vibraimage (fig. 4.15), and displays the maximal frequency in each line. The size of aura defines by average amplitude for the given line. Any non-uniformity in color and the size of aura characterizes movements of object and its emotion condition. The normal condition of the person is characterized more uniform external vibraimage (vibra-aura), and for an intense condition of the person are characteristic the big space and color non-uniformity of vibra-aura.

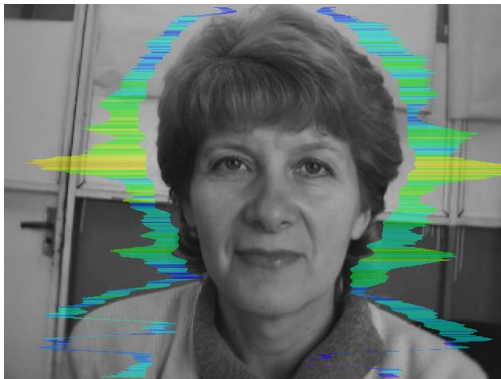


Fig. 4.15. External vibraimage (vibra-aura) of person in normal condition



Fig. 4.16. External vibraimage (vibra-aura) of person in tension condition

Obvious distinctions between images on fig. 4.15 and fig. 4.16 illustrate advantages of the visual analysis of the person condition on external aura in comparison with the visual analysis initial vibraimage. The vibraimage method gives significant freedom of a choice of registration of a condition, and visual supervision of aura allows estimating quickly and evidently practically all emotion parameters of the person. Brief interpretation of the form and color of aura is resulted on the fig 4.17. This brief information does not limit, and sets to the user of system the basic directions of the analysis of person condition. Getting experience and taking into account the specificity of application, each user of system can diversify and deepen essentially results of the analysis of vibra-aura, open secret secrets of soul and a body of the person.

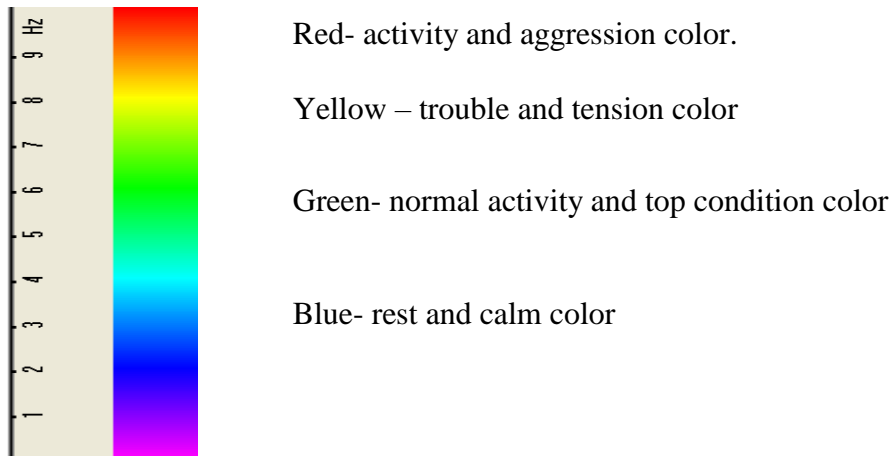


Fig. 4.17. Brief vibra-aura color interpretation

Brief aura form analysis

- 1 Any aura asymmetry (form, color) characterized deviation from mental or physiological norms.
- 2 Color irregularity of vibra-aura characterizes psycho-physiological imbalance of a person status.
- 3 Any breaks in aura uniformity characterized deviation from mental or physiological norms.
- 4 Ideal aura has mono color, symmetrical and uniform. Any real aura differs from ideal and the question of interpretation is to characterized real aura deviations.

Note!

This brief aura interpretation correspond default vibraimage system settings and based on main rules for right vibraimage scanning:

- uniform and stable object illumination;
- high quality and low nose camera application;
- frontal plane object before camera;
- maximum facial image size on monitor;
- mechanical stabilization of camera.

4.3.3 Vibraimage emotion samples

Normal and top emotional state

Normal condition characterized by aura color and form uniformity around the head, relevant monochrome color in the middle of suggested color scale (fig. 4.18). Activity level is about 0.3–0.6. Stress level is about 0.2–0.5.

Tension level is not more than 0.4.

Every emotion level measured in the range from 0 till 1,0 and minimal value coordinates with minimal emotion intensity.

Frequency distribution histogram is near normal (Gauss) distribution and spectrum of high speed vibraimage signals is near exponential distribution.

Vibra-aura photos samples for normal condition of person are on fig. 4.18 below:



Fig. 4.18 Vibra-aura photos samples for normal condition of persons

Stress state

Stress state characterized by amount gaps in aura form and greatly aura colors non uniformity. Vibra-aura includes every scale colors and sharp color transfer, like red color could transfer to blue (fig. 4.19). Stress level more than 0.7.

Aggression or activity level is low, not more than 0.5 and tension level is high and usually more than 0.4.

Frequency distribution histogram has several modes and high speed vibraimage signals spectrum presents superposition of exponential and uniform distributions.



Fig. 4.19. Vibra-aura photos samples for stress condition of person

Aggressive and/or tension state

Aggressive state is not every time coordinates with tension, and tension state is not always coordinates with aggression. But often these two emotions accompany each other. Aggressive state obligatory characterized by high frequency vibrations and red colors in vibra-aura (fig. 4.20). Vibra-aura size is more than normal and gaps could absent, but color and form non uniformity must present. Stress level could be low, less than 0.3.

Anger level is more than 0.7 and tension level is more than 0.4.

Frequency histogram distribution has maximum in right part of the range and distribution has amount dispersion. High speed signals spectrum envelope looks like uniform distribution.

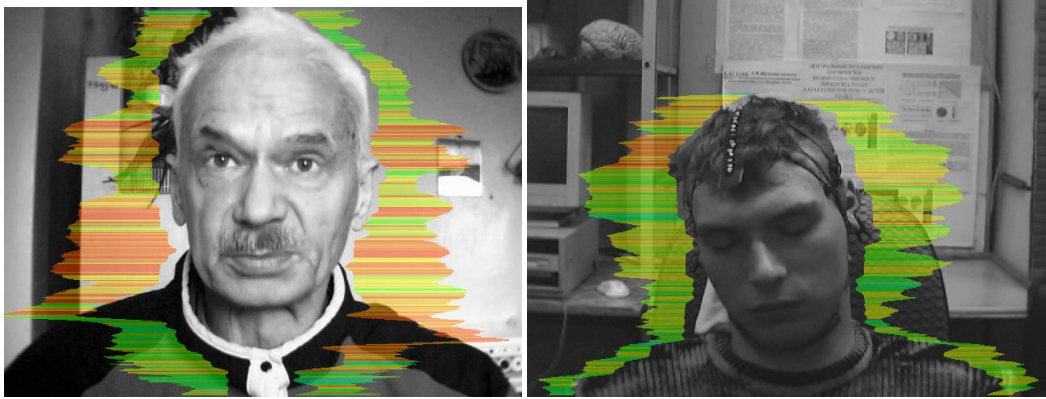


Fig. 4.20. Vibra-aura photos samples for aggression condition of persons.

Meditation

VibraMed system application allows to register distinction not only between the aggressive (abnormally excited) and normal condition of the client, but also and to register a degree of condition change of the person when the person calms down (fig. 4.21).

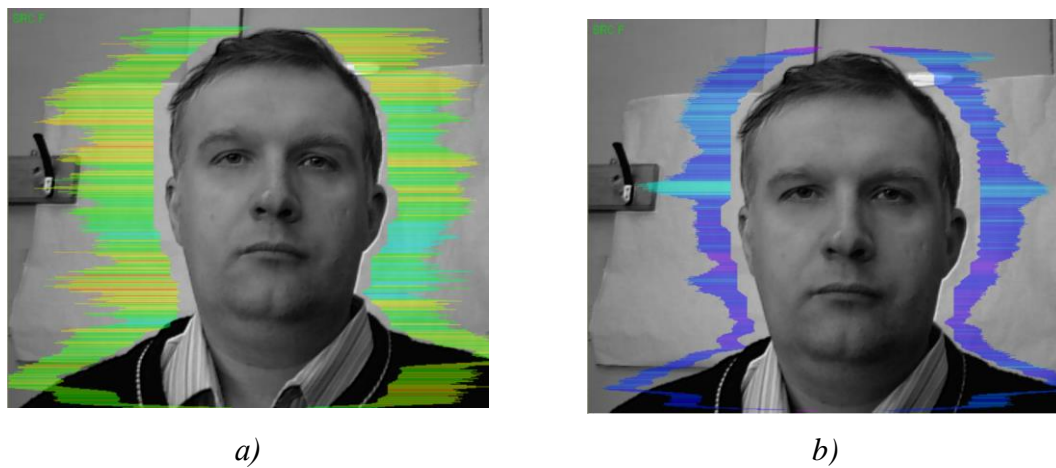


Fig. 4.21. Samples of self-correction person emotional states: a - 10 seconds after the beginning of supervision, b - 100 seconds after (the person have asked to calm down and count up to 100).

5 Psychophysiological state analysis results

After the end of information processing in a mode «**M**» user (operator or examiner) can view all testing results and save it by standard Windows functions: PrintScreen result in system and download image from the screen to any standard program such as Paint to view graphics.

After end of the test program **VibraMed** automatically also creates files with the test results in the directory «C:\Users\user\Documents\Med Result».

Statistical processing of parameters measured in a mode «**M**» is carried out by the program Vibrastat.

The result of testing recorded in the form of files of the following types:

YYY-MM-DD hh_mm_ss_M.xlsx	BASE RESULT for Mental-Functional state. Excel format (fig. 5.1)
YYY-MM-DD hh_mm_ss_histH.png	graphic file with the histogram of frequency distribution (fig. 3.22)
YYY-MM-DD hh_mm_ss_histH.xml	data file with the histogram of frequency distribution. XML format
YYY-MM-DD hh_mm_ss_histT.png	graphic file with graphs of I-E state of a person changes over the period (fig. 3.23, 3.24)
YYY-MM-DD hh_mm_ss_M.xml	testing result for Mental-Functional state. XML format

In all files in names **YYYY-MM-DD** and **hh_mm_ss** date and time of measurement.

Base results of psychophysiological research are in Exel file (fig. 5.2). Data in a main table (Testing result for mental-functional state) in the Exel file based on data from a Reference table with yellow row and column headers (fig. 5.1).

In the reference table there are parameters M, S, Vi, bmin, cmin, bmax, cmax (see p. 3.4.2) according to each parameter T1 – T10. Parameter M is the same as parameter Avg in the main table. Parameters bmin and bmax are the same as parameters Nmin and Nmax from p. 3.4.2.

	M	S	Vi (S/M)	bMin	cMin	bMax	cMax
Aggression	26,66	6,74	25,27	20,00	18,89	50,00	43,74
Stress	23,78	9,75	41,02	20,00	14,43	40,00	57,14
Tension	26,36	10,39	39,42	15,00	4,03	40,00	49,32
Suspect	25,58	3,82	14,95	20,00	18,24	50,00	36,61
Balance	61,76	9,08	14,70	50,00	42,16	100,00	80,04
Charm	81,10	8,94	11,03	40,00	45,91	100,00	87,74
Energy	17,30	5,86	33,89	10,00	4,81	50,00	25,50
Self-Regulation	70,51	6,57	9,32	50,00	53,94	100,00	83,21
Inhibition	21,62	4,97	22,98	10,00	13,30	25,00	41,42
Neuroticism	49,69	15,49	31,18	10,00	0,00	50,00	49,70
Positive	57,67	48,5%	17,24	23,1%			
Negative	25,59395	21,5%	30,1667	40,5%			
Physiological	35,6547	30,0%	27,0812	36,4%			

Fig 5.1 Reference table in the result Exel file

Conditionally **positive** emotions are Balance, Charm, Energy, Self-regulation (T5 – T8). Conditionally **negative** emotions are Aggression, Stress, Tension, Suspect (T1 – T4). Conditionally **physiological** emotions are Inhibition and Neuroticism (T9, T10). In a row “Positive” (fig. 5.1) there are average value for parameters M and Vi for T1 – T4. By analogy, values in rows “Negative” and “Physiological” are calculating. Emotion distribution charts (fig. 5.4) display part of positive, negative or physiological parameters indicating by corresponding color.

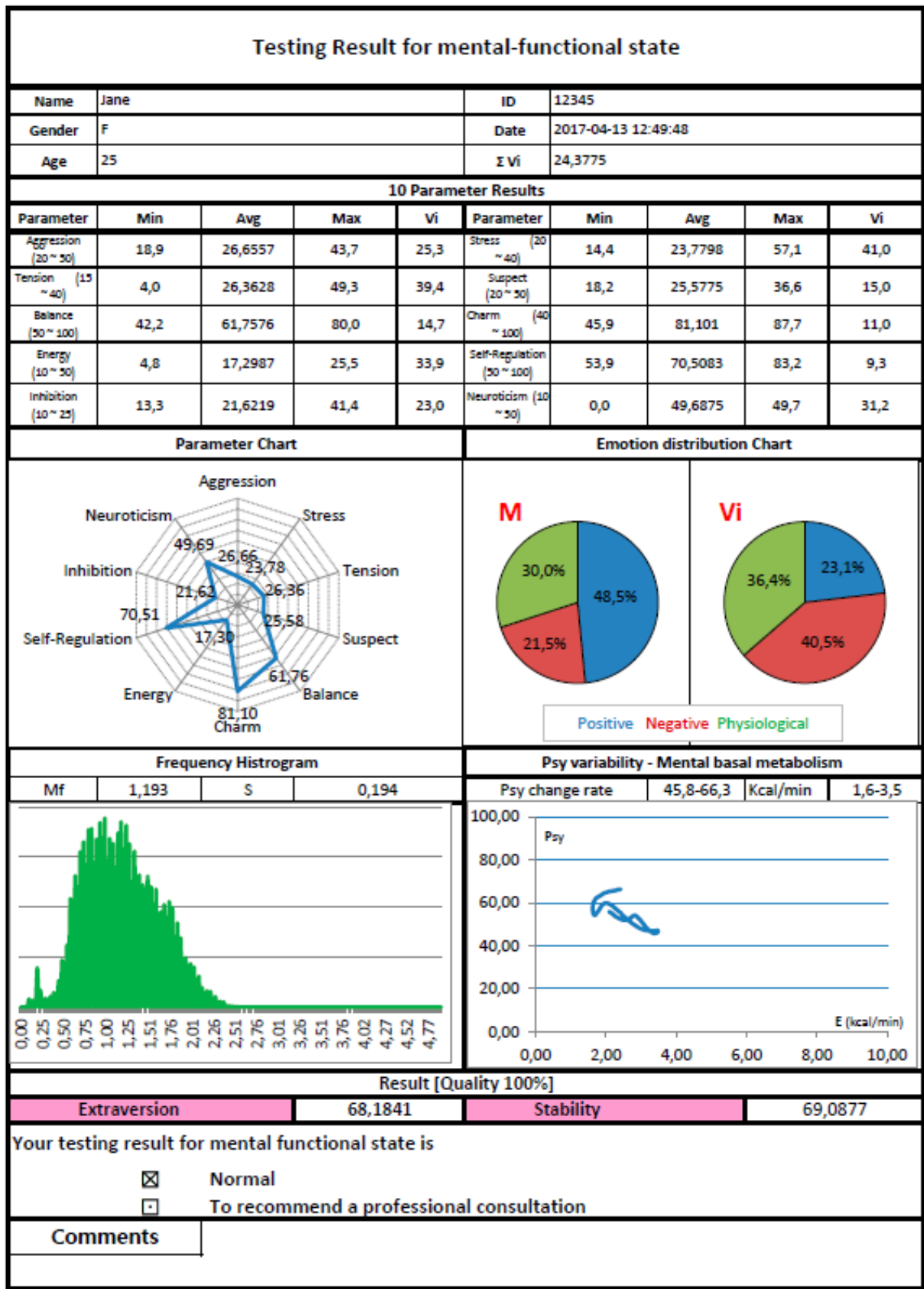


Fig. 5.2. Psycho-emotional status of the person

At the beginning of the main table, there are data about testing person (name, gender, age, ID), date and time of measurement and $\sum Vi$ – the average of the «Health» (mean value of health level).

Further there are values of parameters T1-T10 during the test minimum (Min), maximum (Max), average (Avg) and variability (Vi). For example on fig. 5.1 for parameter T1 Aggression with normal value between bmin 20 and bmax 50: Min – 18,9; Max – 43,7; Avg – 26,6 and Vi – 25,3.

Parameter Chart is round diagram with average values of parameters T1-T10 during the test (fig. 5.2).

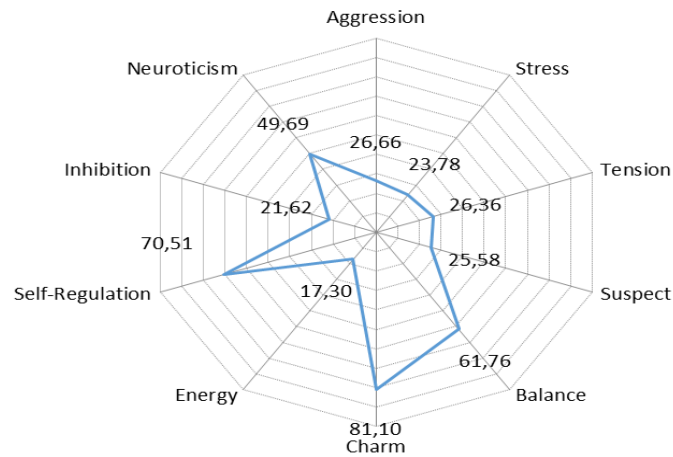


Fig. 5.3. Parameter Chart

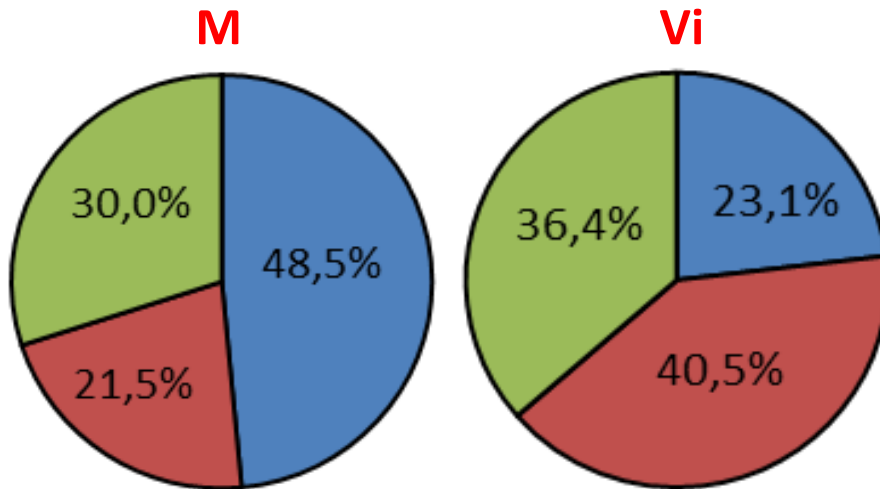


Fig. 5.4 Emotion distribution charts

Frequency Histogram and Psy variability - Mental basal metabolism (I-E graphs) described in p. 3.4.2, 4.2.

At the bottom of the file there are extraversion and stability levels and result for mental functional state (normal or recommended a professional consultation). Quality 100 % mean that during whole test quality test of image is 100 %.

6 Warranty

Maintenance service and service regulations of **VibraMed** system is carried out according to this Manual and instructions of used hardware maintenance (a computer, the camera, etc.).

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Version **VibraMA**

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