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ENHANCEMENT OF RELIABILITY OF HUMAN RESOURCE MANAGEMENT BASED ON OBJECTIVE PSYCHODIAGNOSTICS

The offered paper describes a method of objective psychodiagnostics based on a wave model of brain and functional asymmetry of cerebral hemisphere. The definition of an individual psychological characteristic is carried out by measuring the domination of one of the hemispheres and coordination between them. The stated parameters are defined by two methods: measurement of electromagnetic radiation of cerebral hemispheres in a radio-wave range and measurement of a face phase portrait of the researched individual, in which required brain parameters are reflected. The developed hardware-software complexes are applied in health-improving medicine and human resource management, which leads to increase of reliability in definition of an individual psychological characteristic.

Keywords: *human resource management, occupational reliability, wave model of brain, radio wave psychodiagnostics, video-computer psychodiagnostics, hardware-software complex, occupational inclination, psychological comfort.*

Introduction

Human resource management means selection, arrangement and staff rotation, formation of teams in view of occupational inclination and psychological compatibility.

Existing methods for solving problems of human resource management are based on application of psychological questionnaires and, in some cases, on a lie detector.

Psychological questionnaires contain hundreds questions, which should be answered by an individual. Therefore, the result depends on a subjective opinion of the researched individual about himself.

A lie detector defines the case of the correct answer on the formulated question. The collection of such cases is further used by an expert to define the behavior of the researched individual that is an extremely difficult problem.

The offered method and the equipment of objective psychodiagnostics based on the definition of domination of one of the brain hemispheres and coherence between the hemispheres allows defining behaviors of the researched individual directly. The method is realized in two versions: on the basis of radio-wave gauges and video sensor. At the same time the version realization based on video sensors allows carrying out psychodiagnostics remotely and efficiently.

As a result of psychodiagnostics, the hardware-software complex gives out the following characteristics, necessary for the solution of human resource management tasks:

- Occupational inclinations and psychological comfort at performance of different sorts of works;
- Behavior prediction in extreme situations;
- Probability of socially disapproved behavior demonstration;

- Probability of transition of socially disapproved behavior into socially dangerous behavior;
- Probability of deceit demonstration and reasons of deceit;
- Probability of behavior demonstration to accuse others or to accuse himself.

1. Scientific and methodological basis of objective psychodiagnostics based on the brain wave model

The mathematical description of the brain wave model is presented in [1]. It is known that the human brain generates waves (oscillations). In particular, brain radiates electromagnetic waves, and this phenomenon is used in electroencephalography.

The offered model considers two brain hemispheres of an individual as two independent generators of oscillatory processes (waves) whose radiations intersect in space. From the physical point of view, at intersection of two coherent oscillations so-called intensity standing waves arise. These waves represent steady spatial interference structure if oscillations in them are coordinated in time, i.e. coherent. The coherence degree corresponds to stability of mental processes allowing an individual to make the adequate prediction of the future and to create realistic strategic plans, i.e. to be a manager. At violation of hemispheres' coherence the individual becomes impulsive. He impulsively reacts to irritants and is not able to think and operate strategically, but at the same time he develops masterly performance and executive ability and can succeed in mastery or irrational art, depending on hemispheres' dominance.

The coherence degree of oscillating processes in hemispheres is defined as intensity average value of stated interference structure (coherent component).

$$C = \frac{\pi}{T}\left| \int_{t_o}^{t_o+T} A_l A_r \mathrm{e}^{i\Delta\varphi} \ \mathrm{dt}\right| \qquad (1)$$

In expression (1) T is the time of averaging whose value corresponds to the time of an exposition (time of interference structure generation in sensitive environment). $\boldsymbol{T_0}$ is the initial time; $\boldsymbol{Ar}$ and $\boldsymbol{Al}$ are wave amplitudes in the right and left hemispheres. $\Delta\varphi$ is the difference of phases of two oscillating processes.

If during interferences structure generation (during averaging T) parameters of two oscillating processes do not vary and the difference of phases is a constant ($\Delta\phi = const$), then the average value of intensity (coherent component) will be equal to its instant value and will be maximal (for the given value of phases' difference) and constant:

$$C_{const} = A_l A_r \mathrm{e}^{i\Delta\varphi} = const$$

If parameters of two oscillatory processes vary during averaging time (T), then the coherent component will decrease. For example, if phases of oscillatory processes in left and right hemispheres vary casually, the difference of phases will be a random variable too.

This circumstance can lead to casual sign-variable integrand change in (4) and coherent component C will vanish.

The paper [1] has presented the mathematical formula derivation reflecting nature character of coherence (C) reduction depending on change of phases' difference in reference and subject waves during the exposition. As it follows from mentioned paper, coherent component as a result of phases' difference change will decrease from its stable value up to the values close to zero under the sine wave law:

$$C = C_{const}\left(\frac{Sin(\Delta\varphi)}{\Delta\varphi}\right)^2.$$

Change of phases' difference, according to the given model, is connected to movement of oscillation source inside a hemisphere. The maximal value C and stability of phases' difference takes place in that case when oscillation sources of both hemispheres are located invariably. From the starting position the oscillation source is able to begin movement. At the same time the phases' difference will change also and the value C will decrease as a result of oscillation coherence disturbance in two hemispheres.

Domination of one of the hemispheres can be determined by the value of oscillation source moving during exposition or by the proportional value, which is the difference of amplitudes of oscillation processes occurring in hemispheres (in the field of generation of intensity standing waves):

$$\Delta A = A_l - A_r.$$

Thus, in the brain wave model two key parameters are distinguished:

1) Domination of one of the hemispheres (difference of amplitudes),

2) Coordination between the hemispheres (coherence).

2. Model of human mentality

Three basic parts are distinguished in an individual's mentality: consciousness, superconsciousness, subconsciousness. Wherein consciousness relates to conscious mental activity and superconsciousness and subconsciousness relates to unconscious mental activity. Performance of these functions is connected with the functional asymmetry of the brain.

As is known, two brain hemispheres of an individual carry out various functions. The left hemisphere is responsible for consciousness, logic, basically for the conscious mental activity. The right hemisphere is responsible for superconsciousness, intuition, basically for unconscious mental activity.

The logic and the intuition are ways of information perception from an external world. This is what is common between them. The difference consists in the following. The logic is the ability of information perception from an external world by the analysis of surrounding world details.

The intuition is the ability of information perception from an external world as a whole, without the analysis of surrounding world details.

In more detail the logic is understood as conscious mentality, as practical mind, concrete thinking, ability of information perception without the censorship of superconsciousness allowing quickly and easily distinguishing the quantitative characteristic and details of surrounding world, carrying out of the differentiated analysis of a situation, revealing sophistication, inventive power and resourcefulness (connection with extraversion). In addition to that, the logic allows the individual to be aware of intuitively perceived images and describe them in the language understandable to other people. The logic governs the survival rate of an individual in the physical environment, therefore conditionally it can be named as mind or consciousness. The logic, mind, practical skills can become psychological automatism and can be in part superseded into subconsciousness and then they become unconscious mental abilities.

On the basis of the psychological automatism the individual is able to perceive details of surrounding world and conduct the differentiated analysis of a situation with very high speed, practically instantly to distinguish the attribute necessary to him and to make corresponding actions. Therefore, this behavior is wrongly attributed to intuition as externally it looks like intuition. Actually, the intuition is superconsciousness function, and psychological automatism is a function of subconsciousness.

In more detail the intuition is understood as part of unconscious mentality. It is manifested as superconsciousness, imaginative thinking, and also as ability of a situation recognition as a whole, without the analysis of details, ability of surrounding world quality recognition without the differentiated analysis, through itself (connection with introversion). The intuition defines the survival rate of an individual in the moral (spiritual) environment; therefore it can be named as spirit. The intuition (intuitively perceived images) can be in part recognized by the individual with the help of his logic and then it becomes conscious mentality. By such awareness the individual perceives the qualitative information from an external world, the normal beginning of the nature. The intuition associates with feeling, own emotion. Based on intuition the individual has feelings and emotions connected to superconsciousness. Intuition sometimes is confused with sensitivity to irritants, impulsiveness. Sensitivity not is emotionality. Sensitivity to irritants and impulsiveness arises at violation of oscillation processes' coordination in the hemispheres (destabilization of mentality), and emotionality (feelings, emotions, intuition, superconsciousness) is the behavior of the right hemisphere and it increases at its domination.

Subconsciousness relates to unconscious mental state and it is a function of both hemispheres. Subconsciousness relieves consciousness and it is a storehouse of the unnecessary and unbearable information. Subconsciousness contains what was conscious earlier and has turned into psychological automatism – skills, reflexes, and also what has become unbearable for mentality and has been forced out into subconsciousness. The mental traumas forced out into subconsciousness represent the latent feelings, fears, which the individual does not experience in direct sensations, but in an extreme situation they influence the behavior of an individual (together with instincts, reflexes).

The domination of one of the hemispheres (ΔA) and the coherence degree of oscillation processes in the hemispheres (C) define the degree of an individual harmony (H). The degree of an individual harmony is a function of the above two variables and the degree will vary also under the sine wave law [6].

Below you can see formula (2), which reflects an individual harmony degree nature depending on the domination of one of the hemispheres and the stability of connection between the hemispheres.

$$H = Sin\left(\frac{C}{2}\right)\left[1+\left(\frac{Sin\left(\frac{\Delta A}{C}\pi\right)}{\frac{\Delta A}{C}\pi}\right)^2\right], \qquad (2)$$

where:

H is the degree of an individual harmony.

ΔA is the difference of oscillation processes' amplitudes in two hemispheres of the brain (defines domination of one of the hemispheres).

C is the degree of coordination (coherence) of oscillation processes in two hemispheres (stability of connection between the hemispheres).

In expression (2) the difference of amplitudes and coherence degree have conditional dimension.

It should be noted that coherence (coordination) of oscillation processes in the hemispheres (C) relates to the stability of mental processes. The domination of the right hemisphere corresponds to primary development of intuition, and the left hemisphere corresponds to logic. The degree of an individual harmony corresponds to the individual adequacy.

From fig. 1 it is apparent that from two parameters on which the individual harmony degree depends, the main thing is the coordination of processes in the hemispheres (stability of connection between the hemispheres – C). An individual harmony changes exactly considerably due to this parameter (along axis C). The second parameter, the domination of one of the hemispheres is less significant for an individual harmony. An individual harmony changes to a lesser degree due to hemisphere domination, and in case of average stability it does not change at all.

It should be noted that till now only hemisphere domination has been taken into account for estimation of an individual psychological state, and the coordination of processes in the hemispheres has not been taken into account, what has not allowed constructing a logically full and unambiguous typology system. Therefore, the obtained mathematical dependence for estimation of an individual harmony degree matters for differentiation of psychological types and devel-

opment of unambiguous and objective system for definition of an individual psychological state.

3. Objective psychodiagnostics based on the definition of two brain parameters that is domination of one of hemispheres and coherence between hemispheres

The paper offers the method of diagnostics consisting in the fact that it is necessary to measure the domination of one of the hemispheres and the coordination of oscillation processes between the brain hemispheres of the investigated individual and on the measured values to define his psychological characteristics.

Two methods of technical implementation of the offered method are developed in radio and optical range of electromagnetic waves.

The first method implemented in radio range differs by the fact that the domination of one of the hemispheres is defined by difference measurement of electromagnetic radiation amplitudes of the left and right hemispheres, and oscillation processes' coordination is defined by measurement of coherence level in electromagnetic oscillations between the hemispheres. At the same time it is accepted that the domination of the right hemisphere is proportional to positive value of amplitudes' difference for the right hemisphere, while the domination of the left hemisphere is proportional to positive value of amplitudes' difference for the left hemisphere, and the coordination of oscillation processes between hemispheres is proportional to coherence of these oscillation processes.

Fig. 2 below presents the diagram of the offered method implementation in radio frequency band. With the help of two sensors, radio waves radiated by two hemispheres of the brain of the investigated individual are received at the frequency of 60 GHz. Further the received waves arrive into the phase mixer via wave conductor. On the phase mixer output there is a signal whose size depends on the difference of phases of two oscillation processes. Coherence between the hemispheres is defined by the average value of this signal. Domination of one of hemispheres is defined

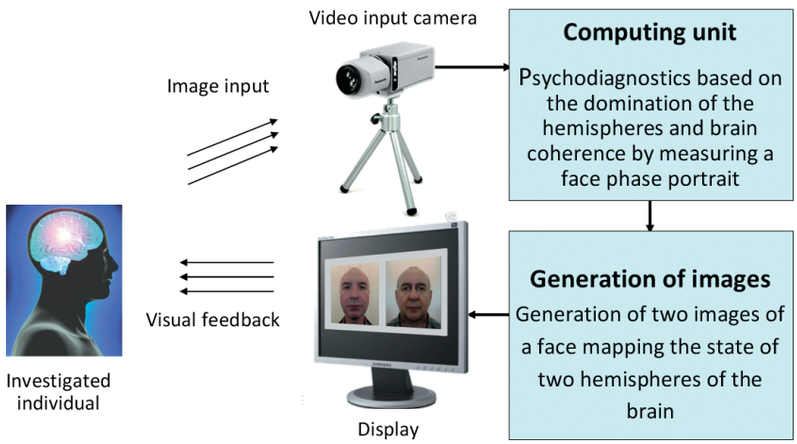

Fig. 2. The block-diagram of hardware-software complex «PORTRAIT» for implementation of the offered method in objective psychodiagnostics

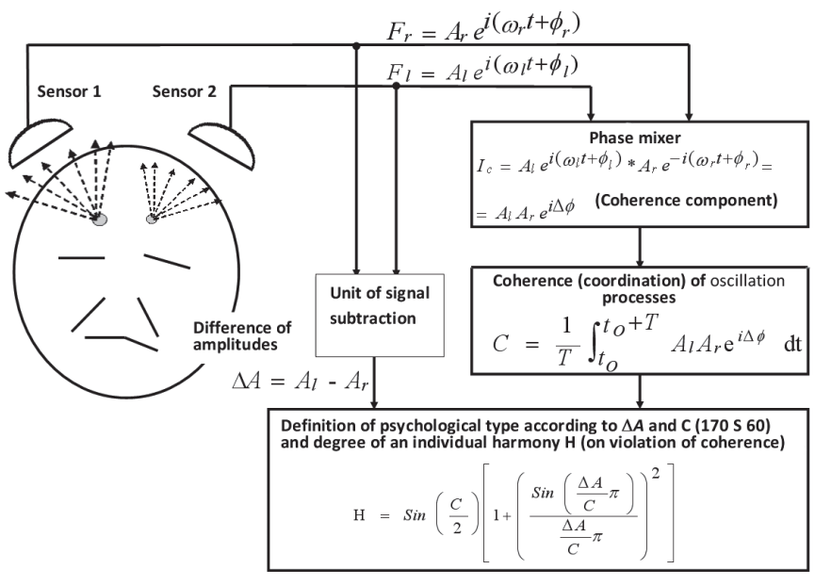

Fig. 1. The block diagram of the device for domination definition of one of the hemispheres and the coordination between the hemispheres by measurement of electromagnetic radiation of two hemispheres of the brain and calculation of amplitudes' difference averaged in time (domination) and coherence (coordination) between the hemispheres

according to the difference of signals' average amplitudes from the specified two sensors. The degree of the individual harmony (H) is calculated also according to the coherence violation.

The second way implemented in the optical range, differs by the fact that domination of one of hemispheres and a coordination of oscillation processes between hemispheres is defined by calculation of angles' difference and average angles between face features of the right and left half of the investigated individual (eye, nasolabial folds and lips). At the same time it is accepted that domination of the right hemisphere is proportional to positive angles of difference on the right face half, domination of the left hemisphere is proportional to positive angles of difference on the left face half, and the coordination of oscillation processes between hemispheres is proportional to the value of average angles between face

features of the right and left half of individual. Hardware-software means for execution of the given version in the offered method (Fig. 2) consist of the image receiver, the computing unit for the analysis of images and algorithm realization for definition of angles' difference and average angles of inclination of eyes, nasolabial folds and lips on the image of the left and right half of an individual face, the unit for generation of two synthesized portraits of the investigated individual face, made of two right and from two left half of image of his face, and the screen, displaying the specified two portraits and a software dialogue window for introduction of necessary designations by an expert.

4. Definition of occupational reliability based on objective psychodiagnostics

Definition of an individual's occupational reliability is possible on the basis of the domination of the hemispheres and the coordination between the hemispheres, which in turn are possible to define with the help of a psychodiagnostics video – computer system.

Occupational reliability is understood as psychological comfort of an individual at work performance. Here we do not mean abilities of an individual. It is meant that the individual has abilities and consequently works in the given occupation. However, presence of abilities does not mean comfort. If work is comfortable, the individual is not tired. If the individual experiences psychological discomfort at performance of the occupational duties he will be tired. The lower comfort there is, the more fatigue there is. If the individual is tired all the time performing the work, his occupational reliability decreases.

Occupational reliability is defined by probability of psychological comfort at performance of various sorts of works.

Fig. 3 below shows psychological comfort at performance of various sort of works for 4 basic psychological conditions depending on hemisphere domination and coherence between the hemispheres.

Each cell of the table lists the kinds of activity, which are comfortable for a corresponding (nearest) psychological type and, accordingly, at whose performance his occupational reliability is high.

It is necessary to note that, according to the accepted model, the structure of mentality of the individual consists of identical components, and only weighting coefficients are different. Therefore, in each individual there is all 4 basic inclinations, but in different proportions.

Psychological comfort in percentage of the individual is presented below in the table at performance of the following 4 basic occupational duties of the psychological type "Intuitive impulsive I80D70"

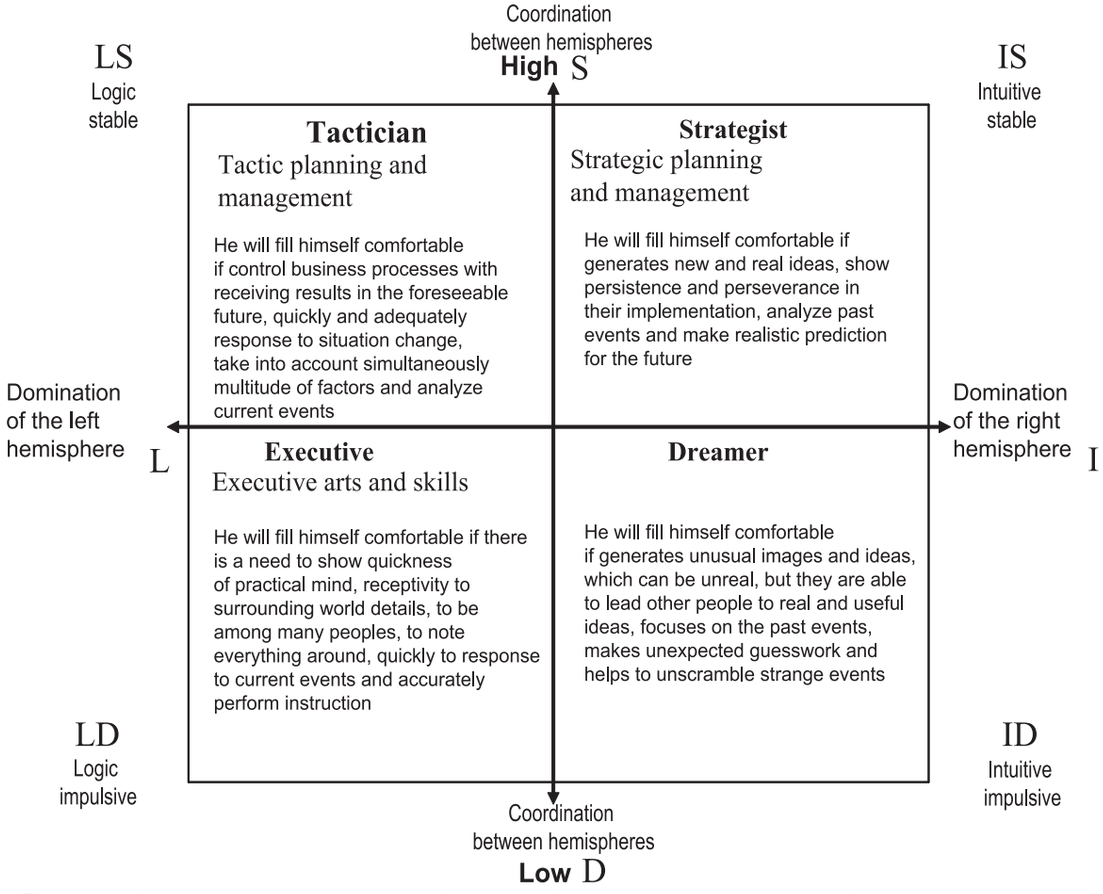

Fig. 3. The table of psychological comfort at performance of various occupational duties for 4 basic psychological types

Strategic planning and management, realistic creativity **Strategist**	Tactical planning and business management **Tactician**	Irrational art **Dreamer**	Performing art **Executive**
55 %	**25 %**	**75** %	**45** %

This individual is more suited to occupational type «Dreamer» with probability of psychological compatibility – **75 %.** These are occupations connected to irrational skill, individual creativity of abstract, illusory and impractical nature. In these cases it will show stubbornness and originality as for him it is important to make everything in own way, unusually and beautifully, even to the detriment of logicality, common sense, rationality and practical benefit.

To a lesser degree with the probability **55 %** he is suited to occupational type **"Strategist".** It is strategic planning and management, realistic creativity (scientific and art).

Still to a lesser degree with the probability **45 %** he is suited to occupational type **"Executive".** These are occupations which require quickness of mind, sophistication, mobility in with resourcefulness, impudence and improvisation in public places.

It is less than others, with the probability **25 %** he is suited to occupational type **"Tactician"** and a corresponding variety of activity: control, management in rational sphere, tactical planning and administration.

5. Joint application of the hardware-software complex "Portrait" and a lie detector "Polygraph"

If video-computer psychodiagnostics (VCP) is applied in the form of hardware-software complex (HSC) **"Portrait"** together with **"Polygraph"** (lie detector), there can be a positive effect. The lie detector defines a case, and VCP – behavior.

There is a possibility to have such a situation when during interrogation on a lie detector the investigated individual does not give the correct answer on the given specific question since he simply does not want to give information on the given subject, which may not have the direct relation to the issue. But this answer will be considered as his lie. Though as a whole he may be not a lying individual and in the certain conditions can easily go to agreement.

At the same time the other alternative is possible when the individual can give correct answers to majority of questions, but hide the most important issue since he as a whole is the lying individual and will not go to agreement, will digress the issue up to the end or will give a confession, and then refuse.

Therefore, it is reasonable to apply jointly video-computer psychodiagnostics ("Portrait") and a lie detector ("Polygraph").

It is necessary to note that such application already occurs in some civil services and private organizations. For example, Ltd "Legal Safety" (http://www.poligraf35.ru/pricelist.html) applies "Polygraph" и "Portrait" jointly for testing individuals, solving service quarrelling and forming teams.

Conclusion

The above mentioned method is intended basically for selection of top administrative staff as well as the staff who should work in extreme conditions, at important facilities, where occupational and human reliability plays a crucial role.

The developed computer program makes it possible to produce in one minute the full individual characteristic, motivation and forecasts of his behavior in various situations with the help of an individual's face (photo). This program gives a possibility to make exact diagnostics, to exclude rough blunders, to facilitate process of diagnostics, to make diagnostics of 14 more super types of unusual people in addition to 49 ordinary psychological types. An expert requires less training, skills and teaching for correct diagnostics, than it has been earlier. It takes place due to automatic averaging of data entered by an expert.

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