VIBRAIMAGE
AND MULTIPLE INTELLIGENCES

Viktor Minkin & Yana Nikolaenko
This monograph bases a new approach for multiple intelligences calculation by vibraimage technology, acquaints the reader with the possibilities of using vibraimage technology and systems in evaluating of multiple intelligences profile and human abilities, career guidance, the use of vibraimage in new methods of psychophysiological and emotional states research. A technique and method for testing multiple intelligences using vibraimage technology is described, the relationship between the conscious and unconscious (psychophysiological) response of a person to the presented stimulus is investigated.

The monograph is dedicated to specialists working in the field of applied psychology (general and clinical), profiling and recruiting, will be useful to a wide range of readers whose field of interest lies in the area of innovative methods of psychophysiological detection and assessment of the current psychophysiological state. Mastering the vibraimage technology, based on the VibraMI program solves such problems as assessment of abilities for children of preschool and school age, assessment of abilities and vocational guidance of students, professional counseling and personnel management, help in professional retraining and human resource profiling.

Includes 33 figures, 8 tables, 123 references.
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In various fields of psychology and other related sciences, the results of psychometric measurements of the cognitive sphere, in particular, abilities, are widely and successfully used.

However, despite the achieved success, scientists still continue debating about the very existence of the phenomenon of intelligence, and the right to evaluate it based on the total quantitative index, for example, an intelligence quotient (IQ), about its connection with abilities in a certain sphere of professional activity.

The study of individual distinctions and the development of innovative diagnostic tools for this purpose, which is the technology of vibraimage analysis, make it possible to partially clarify this situation.

Before proceeding to this, the authors introduce the reader in detail to all the variety of available models of intelligence, the notion of “abilities” and “inclinations”. Their work shows those focal points that reflect positive or negative psychological factors in the understanding of intelligence and abilities in the structure of Howard Gardner’s multiple intelligences. In the light of the provisions set forth in the monograph, the phenomenon of “multiple intelligences” is carefully and multilaterally considered within the framework of modern applied psychodiagnostics.

For this, a comparative analysis of the polar profiles of multiple intelligences in specialists from different fields, with biographical references, is given.

It is concluded that the main problem is that most theories are characterized by a clear underestimation of the emotionally
personal factor in the actualization of cognitive potential. There is no need to retell the content of the book. However, I would like to emphasize that the main thing in it is the authors’ attempt to encompass the synthesis of psychological, psychophysiological and information-physical approaches to the understanding what constitutes “intelligence”.

At the same time, as the authors themselves admit, many conclusions in the monograph are drawn on the basis of assumptions and hypotheses. For example, the assumption about the equivalence of conscious and unconscious reactions of the examinee when forming the result of multiple intelligences. Or the formula proposed by the authors for calculating the unconscious reaction with the priority of the information component over the energy component. The presented hypotheses look logical and, probably, will be confirmed by experimentally independent researchers.

The content of the monograph reflects the authors’ desire to present to the reader the peculiarities of the vibraimage technology application in the study of the structure of multiple intelligences, and the role of the data obtained when forming in a person the motivation for choosing a profession.

The classification of multiple intelligences structure, complemented and expanded to 12 types, with the indication of an opportunity to self-actualization in a specific professional sphere is presented in the VibraMI program developed based on the vibraimage technology. The vibraimage technology and the theory of multiple intelligences, according to the authors, share a common dynamic approach to the study of psychophysiological characteristics of a person. For the first time Gardner’s model was not simply extended by introducing new types of multiple intelligences, but line-opposite systematized and structured according to the principle of dichotomy: each of the multiple intelligence acquired a “pair” and “place” in the hierarchical structure.

The authors’ conclusions about the connection between the profile of multiple intelligences and the optimal choice
of profession open up new opportunities for specialists in vocational guidance. The proposed structure and method of determining multiple intelligences include various aspects of human personality psychodiagnostics — an important characteristic in the forecast of professional success. The VibraMI program according to the authors, allows to define quickly and efficiently a person’s abilities, and to carry out staff recruitment using the data obtained by means of the proposed technology.

The extensive research work resulted in revealing the specificity of the use of the vibraimage technology in the evaluation of multiple intelligences profile as a basic feature in the structure of occupational guidance early diagnostics of abilities; the use of vibraimage in the study of psychophysiological and emotional state of a person. “A technique for testing multiple intelligences using the vibraimage technology is offered, and the relationship between conscious and unconscious (psychophysiological) responses of a person to the presented stimuli is investigated.”

The results of the research, explained in the monograph, stimulate attention to the field of objectification of the psychodiagnostics results, undoubtedly, are innovative and determine a very important direction in the use of modern computer technologies in psychology and psychophysiology.

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INTRODUCTION

This monograph relates to the field of psychometrics, and investigates human potentials and abilities through Howard Gardner’s theory of multiple intelligences (Gardner H., 1983, 1993) and vibraimage technology (Minkin V. A., 2007, 2008, 2017). The author of the multiple intelligences concept offers an alternative approach to the general intelligence measured by classical IQ tests. Gardner’s multiple intelligences are equally valuable and independent of each other. Each of the basic intelligences represents its own special way of interacting with the surrounding reality, a person’s ability to solve problems or to raise new issues valuable within one or several cultures.

In recent decades, the credibility of intelligence tests measuring general IQ is steadily decreasing. Studies in different areas show that intelligence quotient IQ scores reflect only the “zone of actual development”, i. e. what a person knows at a given time but not the “zone of proximal development” according to Lev Vygotsky (Vygotsky L., 1962, 1983), i. e. the abilities for learning and acquisition of knowledge in a certain area.

Many researchers objected to the use of the term “intelligence” to describe some abilities, preferring to define musical and bodily-kinesthetic intelligences as “talents”. However, according to Gardner, such a narrow definition depreciates these abilities in the sense that conductors and dancers are talented but not smart. The advantage of Gardner’s theory of multiple intelligences is in its flexibility and unlimited opportunities for personal fulfillment in professional sphere. In this regard, Gardner speaks of the “infinity” of intelligences, their integrity and ability

Everybody is a genius. But if you judge a fish by its ability to climb a tree, it will live its whole life believing that it is stupid.

Albert Einstein
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for development. The classification of multiple intelligences structure, complemented and extended to 12 types, indicating the potential for personal fulfillment in a particular professional sphere is presented in the VibraMI (VibraMI, 2017) program developed based on the vibraimage technology.

A vibraimage is an image indicating the parameters of motion and vibration of an object. The vibraimage technology relates to the field of biometrics and can be used for measuring, rating, processing and analysis of psychophysiological state of living biological objects, relatively fixed in space (quasi-stationary), for example, standing or sitting on one place. The psychophysiological basis of informational content of the vibraimage is the vestibulo-emotional reflex (Minkin V. A., Nikolaenko N. N., 2008).

The vibraimage technology and the theory of multiple intelligences share the dynamic approach to the study of human characteristics. A profile of multiple intelligences is determined primarily by the used dynamic links and the transmission of information signals between the neurons of the human brain. In relation to humans, the vibraimage technology analyzes motor activity (microvibrations) of a human head and converts the motion parameters to the characteristics of a psychophysiological state. The Great Russian physiologist Ivan Sechenov (Sechenov I. M., 1965) claimed in 1863 year, that each thought has muscular expression. In this research, the authors tried to reveal the interrelation between the movements and thoughts, between conscious answers to questions and unconscious (subconscious) psychophysiological response.

There is a good reason that this monograph is jointly written by two authors with different specializations and science views regarding to the subject under study, Viktor Minkin, a specialist with 40 years of experience in the field of IT, measuring techniques, metrology and biometrics, and Yana Nikolaenko, a deviance specialist, special education psychologist, Candidate of Psychological Sciences. The founder of analytical psychology
Carl Jung (Jung C., 1971) argued that people of different psychological types see one and the same phenomenon differently. Such a versatile approach to the phenomena under study allowed us to achieve the necessary progress in revealing a mutual interaction of mental-physical processes and examining conscious and unconscious psychophysiological responses of man to imposed stimuli.

We express utmost gratitude, first of all, to the best computer programmer in the world, Mr. Valery Akimov, who algorithmically implemented our unrestrained imagination and requests and also to the entire staff of the ELSYS Company, St. Petersburg, Russia, who participated directly in carrying out the research and experiments. We are enormously grateful to Doctor of Medicine, Professor Viktor Sedin for a joint discussion of the issues under examination and the transfer of his experience of self-testing experts, which allowed expanding our knowledge in this area. We thank Doctor of Biology, Professor Alexander Bobrov for joint publications and the discussion of mathematical algorithms of the unconscious psychophysiological response analysis, which contributed to our understanding of psychophysiological processes. We are very grateful to Candidate of Pedagogic Sciences Dr. Elena Miroshnik for the discussion of practical results of young children testing. Thanks to Mrs. Galina Filymonova for the quality translation of difficult Russian text of the original book. We appreciate the support of Research and Development program of Elsys Corp. for publishing this book.
1. THEORIES OF INTELLIGENCE AND ABILITIES. A HISTORICAL EXCURSUS

Quite often the notion of “ability” replaces the concept of “intelligence” or is the main component of this definition. Under the term “intellect”, most authors denote the totality or combination of abilities necessary for survival and successful self-actualization in a particular culture (Barnes M. L., Sternberg R. J., 1989; Gardner H., 1983; Stein S. J., Book H. E., 2000). Thus, depending on the specific discipline of the learning intellect and its particular direction / approach (psychometric, biological, phenomenological, educational approach, etc.) will vary the structural components and their hierarchy in determining what “intelligence” is.

Another difficulty is that the structural components of the intellect can be found among themselves in varying degrees of dependence or independence. As a result, the structure of the intellect reflects not only the number of components included in it, but also their hierarchy (dependence on each other). In this chapter, we will try to briefly analyze the most well-known and, in our opinion, the most interesting, models of intelligence that differ among themselves in terms of structural components and their hierarchy. Unfortunately, we are not able to cover the whole variety of available models of intelligence, even within different psychological approaches, but we will try to briefly characterize those models of intelligence that influenced our own judgments in this field.

Many people traditionally associate the value of intelligence with intelligence quotient (IQ). William Stern was the developer of the intelligence quotient concept (Stern W. L., 1912) and his concept formed the basis of the famous IQ test Alfred Binet and
Theories of Intelligence and Abilities. A Historical Excursus

other similar tests and test batteries. Some parts of this concept are actual and using nowadays (Binet A., Simon T., 1907).

The first scientific research of intelligence structure began at the turn of the 20th century, with Charles Spearman’s works (Spearman C. E., 1904). It was assumed that any intellectual activity contains a single common factor, called “general” \( g \) by Spearman, and also many other specific factors inherent only in one kind of activity.

Theories of intelligence structure successfully developed in the different directions. Spearman’s conception also evolved. New doctrines emerged refuting Spearman's theory of a single general intelligence: the theories of social, emotional and multiple intelligences. All these areas appeared as a result of low efficiency of traditional general intelligence tests, and their inability to predict success of a person in the process of personal and professional fulfillment. It turned out that the ability to effectively interact with other people and objects is based not only on the notorious \( g \)-factor but also on the opportunities to properly manage its components, including the ability to effectively control emotions and behavior.

1.1. Factor-Analytic Theories of Intelligence

Factor-Analytic Theories of Intelligence represent the structure of intelligence as a complex of mental abilities (factors) in a varying degree independent from each other. The distinctions of the theories of this type mainly come down to the number of the selected factors and the nature of their interrelations (linear or hierarchical).

a) Thurstone’s Hierarchical Model of Intelligence

Spearman’s methods of analysis were based on the assumption that the matrix of correlations between all possible
pairs of tests contains only one factor. Louis Thurstone (Thurstone L. L., 1938) developed a statistical means to determine the minimum number of factors in the matrix that is needed to explain the ability to perform test tasks. He proceeds from the principle of “simple structure” which essence is that the matrix of factors is subjected to rotation in order to obtain the maximum possible number of large absolute value factor scales, and at the same time the maximum possible number of zero or close to zero value factor scales. Thurstone did not obtain the results of any single general factor by factor analysis. He offered a “multifactor model of intelligence” in which he included seven “primary factors” that determine relatively independent mental abilities. Thurstone’s theory of intelligence is an example of a linear structure (cit. ex Alexandrov A. A., 2008). Thus, Thurstone became one of the main opponents of Spearman’s general factor theory.

b) Guilford’s Multifactor Model of Intelligence

Joy Guilford’s multifactor three-level model (Guilford J., 1967) is based on the assumption of three dimensions which combinations define various types of intellectual abilities. Each intelligence factor is formed by a combination of one of the types of intellectual operations, the area in which it is performed (content), and the resulting outcome fig. 1 (Burlachuk L. F., 2006).

c) Non-factor intellect model to Eysenck

Another non-factor intellect model is developed by Hans Eysenck (Eysenck H. J., 1952, 1973, 1981). This model borrows certain elements of Guildford’ scheme and visually resembles a cube (fig. 2). Each plane of the cube represents different modalities: intellectual processes (thinking, memory, perception, etc.), test material (verbal, spatial, etc.), and so called “quality” (speed and force of intellectual processes). It is noteworthy that
1. Theories of Intelligence and Abilities. A Historical Excursus

**Fig. 1.** Intellect Model according to Guilford

**Fig. 2.** Model of intelligence according to Eysenck
the success of intellectual activity is directly dependent on the persistence and propensity for error checking fig. 2 (Burlachuk L. F., 2006).

* d) Multifactor hierarchical models (by Thurstone’s multifactor model, Cattell-Horn multifactor hierarchical model) *

As it was mentioned before, in the intelligence structure Spearman singled out the “general factor” $g$ that determines successful performance of any testing items and also a number of “special factors” that are significant to perform individual test tasks ($s$). In principle, this two-factor structure of intelligence abilities is hierarchical. Later, under the pressure of new results of statistical analysis Spearman recognizes the existence of group factors of intelligence, since it was found that the correlations existing between the tests cannot be explained solely by the presence of “general factor” alone. The systematics of the variety of intellectual abilities developed within this theory created the basis for a consistent understanding of the work of intelligence, and relevant ways of measuring and assessing it from different aspects. In different periods, this theory has undergone significant changes: from Spearman’s one-factor hierarchical model with the “general factor” ($g$) to Thurstone’s multifactor model, Cattell-Horn multifactor hierarchical model, Carroll’s (Carroll J. B., 1993) model, and Cattell-Horn-Carroll hierarchical, three-stratum model of intelligence (an integrated version) shown in figure 3 (cit. ex Alexandrov A. A., 2008).

* e) Stenberg’s Triadic Intelligence Theory *

We shall briefly analyze Robert Sternberg’s intelligence model (Sternberg R. J., 1975), better known as triadic intelligence theory. The author of this theory considers it similar to the theory of crystallized and fluid intelligence. It comprises three parts:
1. Theories of Intelligence and Abilities. A Historical Excursus

**Fig. 3.** Cattell-Horn-Carroll factor-analytic theory of cognitive abilities
Analytical (componential), Creative (experiential), Practical (contextual) (fig. 4).

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<th>Analytical (componential) Intelligence</th>
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<td>Meta-Components</td>
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<td>Performance Components</td>
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<td>Knowledge Acquisition Components</td>
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<th>Creative (experiential) Intelligence</th>
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<td>Novelty Skills</td>
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<th>Practical (contextual) Intelligence</th>
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<td>Adaptation, Selection</td>
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*Fig. 4. Model of intelligence according to Sternberg*

*Analytical Intelligence (componential)* similar to the standard psychometric definition of intelligence e.g. as measured by Academic problem solving: analogies and puzzles, and corresponds to his earlier componential intelligence. Sternberg considers this reflects how an individual relates to his internal world. Sternberg believes that Analytical Intelligence (Academic problem-solving skills) is based on the joint operations of meta-components and performance components and knowledge acquisition components of intelligence.

- **Metacomponents**: control, monitor and evaluate cognitive processing. These are the *executive* functions to order and organize performance and knowledge acquisition components. They are the higher-order processes that order and organize the performance components. Used to analyze problems and pick a strategy for solving them. They decide what to do and the performance components actually do it.

- **Performance Components**: execute strategies assembled by the metacomponents. They are the basic operations involved in any cognitive act. They are the
cognitive processes that enable us to encode stimuli, hold information in short-term memory, make calculations, perform mental calculations, mentally compare different stimuli, retrieve information from long-term memory.

- Knowledge acquisition components: are the processes used in gaining and storing new knowledge — i.e. capacity for learning. The strategies you use to help memorize things exemplify the processes that fall into this category. People with better reasoning ability generally spend more time for understanding the problem but reach their solution faster than those who are less skilled at the task.

The second is Creative Intelligence (experiential): this involves insights, synthesis and the ability to react to novel situations and stimuli. This he considers the Experiential aspect of intelligence and reflects how an individual connects the internal world to external reality.

Sternberg considers the Creative facet to consist of the ability which allows people to think creatively and that which allows people to adjust creatively and effectively to new situations. Sternberg believes that more intelligent individuals will also move from consciously learning in a novel situation to automating the new learning so that they can attend to other tasks.

- Novelty & Automatization skills. Basic assumption: That there are two broad classes of abilities associated with intelligence: novelty skills and automatization skills. A task measures intelligence if it requires the ability to deal with novel demands or the ability to automatize information processing (two ends of a continuum). Novel tasks or situations are good measures of intellectual ability because they assess an individual’s ability to apply existing knowledge to new problems.

In, the third Practical (contextual), Intelligence it is postulated that intelligence is mental activity associated with the ability of an individual to adapt to the environment so that this adaptation could optimally satisfy the requirements of the environment.
Practical Intelligence: this involves the ability to grasp, understand and deal with everyday tasks. This is the Contextual aspect of intelligence and reflects how the individual relates to the external world about him or her.

- Sternberg states that Intelligence is: “Purposive adaptation to, shaping of, and selection of real-world environments relevant to one’s life” (Sternberg R. J., 1984). Purposive means that intelligence is directed towards goals, however vague or subconscious they may be. This means that intelligence is indicated by one’s attempts to adapt to one’s environment. Practical Intelligence can be said to be intelligence that operates in the real world. People with this type of intelligence can adapt to, or shape their environment. In measuring this facet, not only mental skills but attitudes and emotional factors that can influence intelligence are measured.

Intelligence, according to Sternberg, cannot be considered outside the sociocultural context. Therefore, intelligence may differ in different groups of people, depending on the differences in their environment. It follows that it is unacceptable to test two groups of people by the same test unless it is ascertained that their adaptive characteristics are identical. Sternberg’s concept emphasizing the sociocultural basis of intellect confronts its psychophysiological reduction according to Eysenck (Burlachuk L. F., 2006).

1.2. Social, Emotional and Multiple Intelligences

Edward Thorndike (Thorndike E., 1920) first introduced the concept of social intelligence, which he described as “the ability to understand people, men and women, boys and girls, the ability to deal and wisely interact with people”. Some sources consider that the term “social intelligence” was introduced by Barnes M. L., Sternberg R. J., 1989. His scientific monograph
was called “History and Social Intelligence”. Thus, the question of superiority in the terminology remains open (Luneva O. V., 2008, 2009). In the year 1926 the first test for social intelligence measuring was published — Social Intelligence Test (Moss F. A., Hunt T., Omwake K. T., 1949).

*Emotional intelligence* (EI) according to the accepted definition is a person’s ability to recognize emotions, to understand intentions, motivation and desires of other people and their own as well as the ability to manage their emotions and emotions of others in order to solve practical problems. According to S. J. Stein and Howard Book (Stein S. J., & Book H. E., 2000, 2007) emotional intelligence “is the ability to correctly interpret a situation and to exert impact on it, to intuitively catch what other people want and need, to know their strengths and weaknesses, to resist stress and to be charming.”

A particular contribution to the study of intelligence made D. Wechsler (Wechsler D., 1949) who considered intelligence as “the aggregate ability of an individual to act purposefully, to think rationally and to communicate effectively with the surrounding world.” All the abilities of a person were divided into “intellectual” and “nonintellectual”, affective, personal and social abilities being referred to the latter group. In particular, according to Wechsler intellectual abilities are key abilities to predict success in life of a person.

The concept of “emotional intelligence”, as opposed to Wechsler’s ideology, has been widely used since 1964, in M. Beldoch’s works (Beldoch M., 1964) “Sensitivity to Expression of Emotional Meaning in Three Modes of Communication” and in 1966 in B. Leuner’s work (Leuner B., 1966) “Emotional Intelligence and Emancipation”. The study of emotional intelligence had been widespread in later years.

the concept of emotional quotient, EQ (by analogy with Intelligence Quotient, IQ). Meanwhile, there are data on a ratio of creativity and intelligence (psychometric intelligence which measures only those cognitive abilities which are put in test models). As is known, the ratio of intellect and creativity is of a threshold character. Up to a certain size (average values) creativity is closely linked with intellect indexes, further it does not depend on the growth of intellectual abilities (at very high rates of intelligence creativity can remain on very mean values) (Kholodnaya M. A., 2002; Ushakov D. V., 2004).

In 1990 the article Emotional Intelligence of Peter Salovey and John D. Mayer was published (Salovey P., Mayer J. D., 1990). After that, the theory of emotional intelligence drew great attention, and a lot of publications on emotional intelligence followed. This approach to understanding emotional intelligence is also called the theory of emotional and intellectual abilities. Emotional intelligence was defined as the ability to process information contained in emotions, the ability to use emotional information as a basis for mental operations. The authors of this book believe that emotional intelligence is closely connected with cognitive intelligence, since they treat affect and intellect as a unity, which corresponds to the traditions of Vygotsky scientific school.

In 1995 Daniel Goleman published the popular scientific book Emotional Intelligence in which he described the history of the development of emotional intelligence, gave the overview of modern scientific ideas about emotional intelligence, and even introduced his own model of emotional intelligence which later was called the mixed model or the theory of emotional competence. The main problem is that the majority of cognitive theories, as well as Wechsler’s approach, underestimate emotionally personal factor in realization of cognitive potential. For the “intellectual functions” (according to Wechsler) to be fully developed and realized, there “nonintellectual” functions should be involved.

There are many mental diseases in which cognitive functions remain intact, but their realization is dramatically difficult
due to the scarce development of “nonintellectual” functions. An example would be Asperger’s syndrome (a form of autism) in which some patients have a phenomenal long-term memory, abilities to mathematical calculations on the background of the overall heavy desocialization. Such patients can quickly and accurately make mathematical calculations in mind but they are unable to leave the house and buy food, their speech is broken and difficult to understand. It is impossible to call such persons successful, to predict their career development relying only on their mathematical abilities. A patient with Asperger’s syndrome will not be able to fully realize the existing abilities and inclinations due to the deficit of development of social and emotional components of intelligence.

Multiple Intelligences of Howard Gardner

Certainly, each of the above theories of intelligence has the advantages, reflects the view of process of a person self-fulfillment. The development and interaction of the emotional, social and cognitive (Sternberg, Cattell et al.) components of intellectual activity is equally important in predicting successful self-fulfillment of a person. Since the outlined approaches to the understanding of intelligence assumes the character of contradiction, only multiple intelligences (MI) is a cumulative concept. Howard Gardner introduced this term in 1983. In one of his books “An intelligence is the ability to solve problems, or to create products, that are valued within one or more cultural settings — a definition that says nothing about either the sources of these abilities or the proper means of ‘testing’ them.” (Gardner H., 1983).

The evolution of Gardner’s views involves several stages. In 1967, together with the Nelson Goodman, Gardner developed Project Zero. Project Zero attempted to connect abilities of a person with particular areas of the brain. The experimental part of the research involved aphasic patients. Finally the idea took shape in 1983 in Gardner’s book Frames of Mind: The Theory
of Multiple Intelligences. Gardner initially described 7 types of multiple intelligences. In later works, he describes the eighth, naturalistic, and the ninth, existential types of intelligence, stipulating that their total number cannot exceed 10–12 items (Gardner H., 2008, 2011). In one of the latest publications Gardner also assumes the tenth type of intelligence — teaching-pedagogical. Its essence is the ability to impart knowledge and skills to other people (Gardner H., 2011). At the same time, the functions of the teaching-pedagogical intelligence can also be referred to the existing verbal-linguistic intelligence.

Gardner is an opponent of theories of indivisible intelligence and traditional test approach to diagnostics. The majority of intelligence tests reflect the level of awareness positioned within a particular subculture. They contain the “proficiency/awareness” coefficient, but not abilities parameters.

There are several reasons why Gardner’s theory of multiple intelligences gained wide recognition in the field of education. Apart from everything else this theory confirms what teachers face every day: people think and learn in many diverse ways (Gardner H., 2011). “The problem lies less in the technology of testing than in the ways in which we customarily think about the intellect and in our ingrained views of intelligence. Only if we expand and reformulate our view of what counts as human intellect will we be able to devise more appropriate ways of assessing it and more effective ways of educating it” (Gardner H., 1983).

In his earlier works, Gardner focuses the readers’ attention on the “dominant intelligence” (Gardner H., 1983) and the opportunities to develop other MI types. In later works the concept of “dominant intelligence” has been supplanted by the concept of “intelligence profile” (Gardner H., 2011) which can be interpreted as manifestation of dominant intelligences plurality.

Since “individuality” is the concept including a unique MI profile the author of the MI conception sees its future in development of the following areas:
– student-centered approach;
– maximal intensification but not expansion of knowledge (with reference to the profile of the dominant MI types);
– maximal computerization (personal computer (PC) as a flexible tool for developing individual abilities underlying MI profile);
– virtual reality software development as a way of activating several MI types;
– development of new methods for assessment of neural connections with MI and study of brain structures and their functioning in vivo;
– connection of MI and the biological (behavioral and genetic) component of human personality.

Gardner’s multiple intelligences do not deny the social, emotional and cognitive components of intellectual activity. Each of the intelligences is important, and its priority is a life story of a certain person. Individuality is the concept accumulating personality, multiple intelligences and the biological basis of a person. At the same time, the creation and widespread application of special software estimating the personality and psychophysiological characteristics of a person can be considered as a means of evolution to reveal personal abilities, and define a multiple intelligences profile.

The theory of MI is based on the principle of genius relativity, in contrast to the methods of IQ, using absolute values of abilities in the calculation of intelligence. This situation resembles the transition from Newton’s absolute physics to modern physics, based on Einstein’s theory of relativity.

1.3. Abilities and Multiple Intelligences

In the life of a modern person very often arises the problem of differentiation of such concepts as “abilities” and “intellect”, “mental capabilities” and “creativity”, “individuality” and
“talent”, and so forth. The problem of their correlation is well known since Francis Galton (Galton F., 1869) and eugenics. Definitely, the genetic factor plays its role in the development of abilities and intelligence. At the same time, there are many examples of children with good inclinations who did not become highly intellectual adults, did not show any apparent abilities in any area. Often an adult with good intellectual abilities and inclinations does not seek to develop them. Thus, the individual factor in the development of intelligence and abilities is of no less importance than the genetic factor. At the same time, it is necessary to distinguish between these concepts, in order to avoid methodological confusion.

Abilities are individual psychological features of personality, a person’s capability to successfully perform a particular kind of activity with minimal use of internal resources and time. Abilities develop in the process of human activities while inclinations are inherent.

Abilities reflect individual personality traits providing success in activities when there is motivation to these activities. There are general and special abilities.

- **General abilities** are favorable capabilities for the development of such features of the human psyche, which are equally important for many kinds of activity.
- **Special or professional abilities** are the capabilities to develop certain mental qualities for a particular activity: musical, mathematical, linguistic, sports-oriented, etc. They assume persistent and long-term exercise (Teplov B. M., 1985; Karpov A. A., 2015; Leites N. S., 1971, 1996).

“With regard to intelligence these and similar models, combining innate abilities and acquired knowledge and skills in theoretical terms cannot cause objections (how each of them corresponds to reality is a different matter). However, they have little to do with abilities and giftedness if they are understood as genetically determined human capabilities” (Ilyin E. P., 2009).
Inclinations are the manifestations of anatomical and physiological features of the nervous system that serve as the basis to form particular abilities. Inclinations are often (but not always) genetically determined. Without goal-oriented learning and motivation good inclinations do not guarantee the development of abilities and high achievements. “Inclination, in the scientific sense of the term, is anatomical and physiological feature of a person which is strongly not aimed at anything.” (Teplov B. M., 1985). As a result, even the finest inclinations cannot guarantee high achievements and personal success.

In childhood there is often a situation when a lack of motivation on the part of a child, and excessive pressure from an adult, does not allow inclinations to grow in ability. The situation when an adult considers a child “untalented”, “capable of nothing”, just “stupid” is even more often observed. This attitude towards a child rather reflects the problems of an adult than the lack of abilities and inclinations of a child.

Direct diagnostics of abilities in the mode of examination is inadmissible for children of a preschool and younger school age. Because of the lack of life experience a child, with all the will in the world, cannot show his or her palette of abilities and their depth (even with good inclinations!). First of all, it is required to diagnose the areas of interest of a child relying on his or her psychophysiological state (PPS). This approach will allow avoiding the so-called “imposed interests” and “labels” on the part of parents. For example, in a family of mathematicians there may be a very skeptical attitude to a child’s passion for human sciences. Moreover, there are situations when parents impose technical interests, when they “know better” what abilities their child has. The child in this situation quite often obeys the will of the parents. The child believes that s/he really has these mathematical abilities, and thinks that s/he should strive and one day will succeed. There might be different potential future options. For example, a child with calculated low general intelligence will develop severe intrapersonal conflict
of discrepancy of expectation to the available opportunities, neurosis, behavior disorders, etc. In children with self-sufficient behavior, it is possible to develop mathematical abilities, and they will have good grades in mathematics at school. Unfortunately, this progress is unlikely to be above average, and learning will be unpleasurable for the child. Only years of diligence, the repeated drill of the same intellectual operations make it possible to transfer the acquired skills to the rank of abilities. Hence, the question arises of the adequacy of time and energy spent for the goal. In the context of the MI theory, the harmonious development of a personality presupposes a balance between an intelligence profile, abilities orientation and motivation of an individual. It reflects an individual profile of the MI in which existing abilities and inclinations are most developed.

1.4. Profiling, HR, Recruiting. Profiling in Pedagogy

The need to clarify vocational choices is observed throughout the active professional life of a person (Strenze T., 2007). For the first time a person faces this problem at school: the choice of the relevant class, the choice of preparatory courses for admission to secondary or higher educational institution, and others. What career to choose, and where to go to study?

Professional identity is considered as a process of self-realization in professional activities on the basis of the best use of abilities and individual psychophysiological features (Borisova E. M., 1995). Professional identity in the conditions of modern society and its requests means the monitoring of both the needs of the society and the needs of an individual.

The essence of professional identity is often reduced to the concept of “searching and finding a personal sense in the work activity which is chosen, mastered and performed, and also finding meaning in the very process of identification”
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(Pryazhnikov N. S., 1999). One of the key problems is the imbalance of needs, capacities and professional orientation (inclinations) of an individual. The motivational component of the choice (or change) of professional activity not always reflects actual opportunities to self-realization in the field.

The standards of professional success applicable to employees in a particular area are interdisciplinary, and involve diverse fields of professional fulfillment. To clarify a professional choice is the need both personal and sociocultural, dictated by the changing standards of modern society.

In this regard, the problem of staff selection, which is the key to success and prosperity of a company (enterprise), is no less important. One more problem is the fashion for certain professions and the corresponding attitude towards the representatives of these professions (Udalova Y. S., 2012). The choice of “a fashionable profession” means a distortion of motivational structure of personal priorities, lack of diagnostics of abilities to the chosen profession and formalization, both in education and professional work. In other words, such person will not make for a valuable career staffer. How to ensure that the right person should take the right place and that s/he should be able and wish to take that place? A qualified tool in the recruiting system will help to solve this problem. The qualified recruiting will aid in a radical change of a person’s life, finding a dream job will aid in actual change of direction and affect the success of a company with the help of one new first-class employee at a key position (Sullivan J., 2017).

In recent decades, the use of testing techniques has been widespread in the practice of personnel assessment of Russian and foreign companies. It is obvious that incorrect use of testing techniques can lead to serious negative consequences both for the people who apply practically these techniques, and for the organizations using their results in the policy and decision making processes. The realization of certain testing techniques potential also depends on how competently and appropriately
these techniques are applied. Application errors depreciate results even in case of use of initially qualitative techniques (Baturin N. A., Vuchetich Y. V. et al. 2015).

**Profiling in Pedagogy**

The concept of “profiling” is rather new. It is widely used in psychology, criminology and some other sciences dealing with the development of lie detection methods. In fact, *profiling* is a set of psychological methods and techniques of assessment and prediction of the most probable line of human behavior in a particular situation. A profiler is an expert whose duties include building a profile of probable behavior of an examinee (an object of observation). In the forecasts a profiler relies on particular characteristics of verbal and nonverbal behavior with the help of special tools or without them. There is a technical profiling which provides the necessary information about an examinee by using technical means. The best known application area of technical profiling is security systems where it is necessary to obtain objective information within minimum time and in difficult environment. Any qualified teacher, if she is a true expert, unwittingly becomes a profiler in their field. This is manifested in the fact that a qualified teacher after a short communication period with the whole class, using his/her own observations, easily notices “problem” pupils.

Among teachers of different countries of the world Gardner’s multiple intelligences theory has become rather attractive. This theory is widely put into practice both in vocational training at mainstream schools, and in classes for gifted pupils, for children with various educational needs. There are several reasons why the theory of multiple intelligences gained recognition in education. Among other things, this theory confirms what teachers face every day: people think and learn in many diverse ways. This theory also sets conceptual bases for organizing and reflection in the spheres of curricula development,
education and teaching practice efficiency assessment. In its turn, this reflection enabled many educators to develop new approaches which can satisfy educational needs of a fairly wide audience more efficiently.

The observation of pupils’ behavior can give much more information on their abilities than their educational success. School grades for academic progress reflect the level of awareness in a certain field but not the abilities. Moreover, a teacher is not immune from “professional deformations” when “one sees what s/he got used to see and not what really is”. In this way, technical profiling provides a means to solve many pedagogical problems successfully. Modern hardware, such as a web camera and software make it possible to use information and measuring methods for psychophysiological data registration and their objective interpretation. A web camera “sees” exactly what actually exists, and a computer program determines the profiles of multiple intelligences and optimal specialization of an examinee on the basis of certain physical laws and statistically confirmed mathematical relationships, without the influence of subjective stereotypes.

Early diagnostics of abilities in childhood will avoid many learning problems at school, and timely career guidance will help make a major step towards inclinations and abilities development.

1.5. Development of Abilities in Children. Sensitive Periods and Multiple Intelligences

Sensitive periods represent sensitive and the most favorable periods of development of highest possible opportunities of the psyche and the type of dominant activity (Vygotsky L. S., 1983). The concept of sensitive periods is closely connected with the age periodization of the development of the psyche (personality development, intellectual and social aspects of development)
with the stages of development in ontogenesis. Therefore, the term “age sensitivity” is quite often used to bind the maximum development of abilities for a particular age stage. Individual constituents of the sensitive period depend on the general patterns of mental development, its previous achievements and, at the same time, they are strictly individual.

“In the development of the psyche of a child there are a number of age periods with specific characteristics of perception formation, thinking and other higher mental functions (HMF). Also there are critical periods or crises of development (Vygotsky L. S., 1972). Age development of the psyche occurs through these crises of development which emphasize its non-uniformity. At the same time, the transition from one period to another can manifest itself in the form of a sudden change, ‘a leap forward’ in development (Kossakovsky A, 1989). <...> In this regard, the concepts of the sensitive and critical periods are in many respects close and quite often combined (Kon I. S., 1979). It is known that non-uniformity of mental development is its integral, inherent property (Ananyev B. G., 1968). At the same time it is necessary to consider it not only in external aspect, as the uneven pace of the psyche development in general — recurring periods of acceleration and deceleration of the development pace, and in critical phases a possibility of short-term regress, but also in internal, structural aspect as the asynchronous development of individual functional systems or various subsystems within one system. Individuality of development rates, the lack of a uniform development rhythm for all children while preserving general patterns of development — the transition from one period to another, there being a unified plan, or rather, a sequence of developmental stages, suggest that there are only orientation age boundaries of each period, with obvious individual variations” (Sandomirsky M. Y., Belogorodsky L. S., Yenikeyev D. A., 1997).

If individual experience as a development factor, becomes predominating in ontogenesis, then it is expedient to speak
about the sensitive periods and stimulation of certain intellectual abilities.

The scientific contribution of Teplov (1961, 1985) to the theory of development of abilities and giftedness is considered fundamental in the world and Russian psychology. Thus, the author among the features of the concept “ability” gives the first place to the personality factor, psychological constitution that distinguishes one person from another. Thereby it is emphasized that ability is rooted in a person, it always bears the stamp of individuality. In the light of preceding information, it follows Teplov understanding that the differences in abilities are coordinated by nature. He repeatedly noted the complex, mediated dependence of abilities development on their natural background. He rejected the ideas of abilities being inborn (“Only anatomical and physiological features can be innate, i. e. inclinations...”) speaking thus against biologist and mechanistic conceptions of differences between people on their abilities (Leites N. S., 1996).

Children process the information from the outside world in various ways, and these ways largely have a physiological basis. In particular, the ways of processing the information from the outside world in early childhood can be designated as general abilities (see Chapter 1.1.). For example, the olfactory and tactile way of understanding the world for a one year old is the norm. A one-year-old child who received a toy as a gift will not only view and touch it from all the sides but will also willingly taste it. To deprive a child of such an opportunity means to deprive of the opportunity to get fully acquainted with the toy. Certainly, the auditory way of learning the world also takes place but it is not the dominant way within this sensitive period. On the contrary the behavior of a five-year-old child licking and feeling unfamiliar objects testifies to underdeveloped cognitive processes. It is logical to assume that there are individual periods which are also timed to the age sensitivity of particular intellectual abilities development. For example, parents of grown-up children often
say looking back, “You were very little, went to kindergarten, and did not know how to draw but you liked drawing so much. We bought Lego kit for you not to spoil everything around”. What happened? The child activated visual and spatial type of intelligence (according to Gardner), but it was suppressed by the economic dominant of the nearest social environment. How would it be correct to deal with this case? What algorithm of actions is correct?

- Diagnostics of interests and abilities of a child (“zones of actual and proximal development”, according to Vygotsky L. S., 1983) — visually, or by means of professional programs (VibraMI, (VibraMI, 2017) a children’s questionnaire of Gardner_12S5);
- Buying special tools for artistic self-expression of a child (pencils, paints, paper in sufficient quantity, and the tablet for drawing).

Thus, well-timed diagnostics of abilities in children of preschool and younger school age allows timing their intellectual development to coincide with a certain sensitive period, i.e. the most efficient period of formation and deployment of general abilities. Gardner’s multiple intelligences theory makes it possible to differentiate these abilities, to localize in relation to an individual (a child), and at a certain zeal — to a particular sensitive period or to the period of special abilities formation in adulthood.
Almost all the testing techniques described in the first Chapter are based on the questionnaires in which an examinee gives conscious answers to the questions and stimuli. This approach of psychological testing is always connected with a solution of the results objectification problem, as, due to many reasons, an examinee not always truthfully answers questions. The task of objective lie detection is almost as old as the existence of mankind (Varlamov V. A., 1998). In early 20th century psychophysiological testing methods using physiological information (heart rate, blood pressure, galvanic skin response, respiration rate, etc.) were developed to determine psychophysiological response of a person to stimuli (Varlamov V. A., 1998). The classical contact lie detector (polygraph) analyzes unconscious physiological response of a person to stimuli which significantly increases objectivity of information obtained when testing. However testing by a contact polygraph is not quite comfortable for a user, it practically excludes a possibility of self-testing and, consequently, it is practically not applied for psychological research.

Unlike the contact polygraph, the vibraimage technology makes it possible to contactless investigation of examinee physiological parameters. At the same time, the reliability, validity and the information value of obtained physiological parameters is not inferior to the contact polygraph. The specified opportunities allow combining the processing of conscious information (answers to questions) together with the analysis of unconscious psychophysiological response during one testing which significantly reduces time of testing and increases its accuracy.
When conducting psychophysiological testing not only questions themselves, but also the order of presentation of questions and stimuli (Baur D., 2006) is important, therefore, the correct understanding of the phenomenon structure under study makes it possible to formulate correctly the sequence of stimuli, and considerably increases accuracy and efficiency of testing.

In the following chapters it is shown how the combination of psychological and psychophysiological testing in one method are increasing the accuracy for the testing result determining.

**2.1. Why 12 Types of Intelligences?**

Specific structuring of multiple intelligences emerged in Gardner’s theory only in the synthesis of intrapersonal and interpersonal intelligences into the overall concept of “Personal intelligences”. Other types of intelligences (among the six) are presented as separate entities reflecting the essence of one phenomenon. The exact nature and breadth of each intellectual “frame” has not so far been satisfactorily established, nor has the precise number of intelligences been fixed. But the conviction that there exist at least some intelligences, that these are relatively independent of one another, and that they can be fashioned and combined in a multiplicity of adaptive ways by individuals and cultures, seems to me to be increasingly difficult to deny (Gardner H., 1983). Multiple intelligences complement each other, and this is the integrity of mental organization of a person.

Quite often the MI model was criticized for arbitrary addition of structural components to it. Certainly, all these components affect a person’s success in the process of self-fulfillment. At the same time, the methodological basis of a research assumes establishing clear principle of structuring of intelligence profile as an integral phenomenon. Without this principle the concept of intelligence profile is only an arbitrary set of factors (a list) affecting a person’s life — this is the main criticism of Gardner’s theory and the like.
Thus, in Gardner’s MI structure there are three main problems:

a) absence of the fundamental principle of intelligence profile structuring as an integral phenomenon;

b) uncertainty of the scientific approach that objectively reflecting the principle of structuring;

c) unfinished structuring and refining of the complete list of multiple intelligences.

Attempting to resolve the designated problem, we used the principle of **dichotomy** within the framework of evolutionary approach as a logical division of a class into subclasses where a divisible concept is divided into two completely mutually exclusive ones. One and the same person cannot be at the same time a distinctively expressed extrovert and introvert, as well as an expressed intrapersonal intelligence cannot go with distinctively expressed interpersonal intelligence. Each type of intelligences should have an oppositional type, counter on a certain psychophysiological feature. In the history of psychology and biology the principle of dichotomy is common. At the same time, from physical perspective, classification of such phenomena can be limited to one scale, for instance, of extroversion (for introvert-extrovert classification). It is appropriate to take into account the approach developed in psychology also in the proposed classification of multiple intelligences. In addition, proceeding from the Darwinian approach to the evolution of species, the intelligence structure of a person must be inextricably intertwined with the current distribution of specialties relevant to this historical period.

From modern neurophysiology perspective, the intelligence profile in many respects is determined by the development of connections between neurons of the brain; this process is constantly going on in the head of every man due to age-related changes and phenologeal effects (Deary I. J. 2007; Deary I. J., Penke L., Johnson W. 2010). There is quite a large number of modern scientific works associating brain activity, including intelligence level, with topological features of brain development
The search of sustained biometric characteristics of deviant behavior is a longstanding dream for criminalists, the most famous of whom was an Italian psychiatrist Cesare Lombroso (Lombroso C., 1859; Myers D. G., 2015; Myers D. G., Jean M. Twenge, 2016). Proceeding from the specified assumptions, the list of the available multiple intelligences according to Gardner needs to be extended because it requests by our development of line-opposite structure of multiple intelligences. At first the existential intelligence appeared to be without pair. In addition, the classification given by Gardner has not intelligence characteristics related to the attitude to wealth accumulation and business (modern component of a successful person, a refraction of his/her abilities). Therefore, we added to a new classification of multiple intelligences three types of intelligences: business-mercenary, its counterpart ascetic-sacrificial and arts-bohemian complementing existential (existential-theoretical in our double terms classification) intelligence (fig. 5).

![Extended and amended Gardner’s classification structure of multiple intelligences.](image)

The added MI types are highlighted by black background
Of course, we prefer to preserve the structure and names of multiple intelligences developed by Gardner with minimal additions and changes.

Let us consider the resulting classification structure of MI types.

Naturalistic and bodily-kinesthetic intelligences are located in the center for a reason. These intelligences are opposite in their relation towards the sense of the surrounding world. An observational type of thinking and behavior is inherent in naturalistic intelligence, and an active, sensor type of thinking and behavior is inherent in bodily-kinesthetic. Both of these types of intelligences are some kind of basic core — laid by evolution the beginning of understanding the world through merging with nature by means of moving (movement) in it. Other types of intelligences, onto — and phylogenetically with more complex structural organization, are located around this basic core. Naturalistic and bodily-kinesthetic intelligences we consider by analogy with Stein and Book’s emotional intelligence where a person is considered as a part of this nature. In this case, the mechanism of merging with nature through movement is a prerequisite level of development of other more complex kinds of intelligence. Phylogenesis and ontogenesis of higher mental functions, in which a sequential origin of multiple intelligences occur, are their derivatives. The ontogenesis will also show itself in individual variability of the dominant types of intelligences, with obligatory development of all other types of intelligences. In this regard, naturalistic or bodily-kinesthetic intelligence may well be dominant in a modern person, if required by social roles that s/he performs.

The ability to recognize emotions is basic for the survival of humans and animals, as biological species. Emotional self-expression makes related man and animals in the ability to emotional contacts with their tribespeople and neighboring tribes. Charles Darwin (Darwin C., 1872) touched this aspect in his work *The Expression of the Emotions in Man and Animals*
where he wrote about the role of external manifestations of emotions for survival and adaptation. At the same time, the survival of biological species and its development are different components of the process of evolution. Emotional differentiation of potentially dangerous stimuli should be considered as one of the manifestations of the instinct of self-preservation which is equally present in a prehistoric man and animals. Emotional and behavioral manifestations of instincts are unconsciously determined and therefore they are difficult to control. In a modern person, on the contrary, the conscious motivation of acts and emotional self-expression prevails, and the self-preservation instinct is weakened. Professional activity, conscious management of the available abilities and inclinations, intelligence successfully compensate the sphere of instincts (not fully, of course). In this mechanism of a conscious intellectual regulation of behavior a modern man differs from the prehistoric tribesman and other biological species in which unconscious (instinctive) mechanism of behavior management was dominant.

“We know that the reason for a change of the body’s organ shape is in its function” — Konrad Lorenz (Lorenz K., 1966). To consider intelligence as an indivisible whole is almost impossible within evolutionary approach. A variety of intelligences and the differences in their structural organization at different stages of a person’s life correspond the dynamics of social roles, which they perform. This mechanism is functionally close to species variability: influenced by external factors of social environment in which a person lives his/her social roles change as well. Performing new social roles implies a reorganizing of the previous structure of intelligences or the rejection of those roles as unsuccessful or unavailable to that individual. For example, it will be difficult for an actor (arts-bohemian type of intelligence) to become a businessperson overnight (business-mercenary type of intelligence), to start thinking as a businessperson, to understand the hidden mechanisms of management. However, who said, that it is impossible? Such examples,
though rare, but they exist. For instance, a successful actor can become a producer and director of his movie. It should be noted that the style of its acting skills at the same time changes. This is, probably, due to a total reorganization of the old structure of multiple intelligences, in which the mixture of styles of analysis and synthesis leads to the emergence of a new prototype of thinking of organization. The shift and complication of professional activity priorities leads to the fact that such person does not become “more stupid” or “smarter”; he starts thinking in a different way since his social roles have changed and become more complicated.

“If any special interests of social organization do not demand closely living together, then, understandably, the most favorable is perhaps a more even distribution of individuals of a given animals species used in the living space. This can be explained by a comparison of human professional life: if a considerable number of doctors, dealers or bicycles repair mechanics wants to settle in some area, then it is the best of all for them to be accommodated as far as possible further from each other” (Lorenz K., 1966). In relation to our example, it looks in the following way.

If, using the verbal-linguistic intelligence as a tool, the entire dominant arts-bohemian intelligence is released and then their coexistence in the category of the dominant types of intelligence is possible. While the existence of a prototype of intellectual interaction “bohemian philosopher” is impossible due to severe intrapersonal conflict (as intraspecific competition) of these two types.

Thus, natural development of human intelligences must be inextricably linked with the development and distribution of the market of specialties. In this case, labor market is still the same habitat mediated by “species variability”. Social roles which people perform constantly become more complicated as well as the requirements for professional qualifications. The concept of “success” in the modern world is increasingly
frequently associated with the possibility to discover one’s abilities and to transfer them to professional activity. A competition where the strongest wins increasingly rare means physical removal of the rival. A means of survival in a complex and dynamic social environment become not only cognitive but also intellectual personal characteristics, abilities, knowledge and skills. In an environment where physical removal of the rival is an atavism, the most primitive (though effective at the local level), the development of a relevant intellectual profile is a way of conducting evolutionary competitive fighting, the fighting in which the aggressor becomes the victim of a highly developed society and advanced information technologies. The species fight is continuously conducted at all levels: between individuals, the micro level, a conflict between countries, macro level.

2.2. Models of Psychophysiological Scales. Personality as Harbinger of Multiple Intelligences Profile

The history of mankind is an endless search of ways of cognition of the surrounding nature and of a man himself as a part of it. Measuring is the only way to obtain quantitative information on the dimensions characterizing certain physical phenomena or processes (Novitsky P. V. et al., 1975). Measuring the power of learning — is the main slogan of ETS, one of the leaders in psychological testing. Man is, certainly, a part of nature, and the ability to measure certain human (now we call psychophysiological) characteristics developed in the process of human evolution. The basis of any measuring process is a measurement scale. A scale of a physical value is an ordered set of physical quantity values serving as a basis premise for measuring this physical quantity (ISO/IEC GUIDE 99:2007, JCGM 100:2008, Metrology 2000). Measurement or evaluation of mood, character, abilities or any other properties of a human
personality should be considered as a dimension related to the field of biometrics and psychophysiology, despite the fact that biometrics and psychophysiology are fairly modern terms, and the evaluation of the properties of a human personality is carried out since the beginning of existence of mankind.

Traditionally, the search for a physical measure was focused on measurement of the objects and phenomena surrounding man, there was always a dual approach to a person as an object of measurements. Objective and subjective approaches to man always fight among themselves, for example, the famous statement of Protagoras “Man is the measure of all things” shows the counter subjective approach which means that there is never an objective truth (Protagoras, 410 BC, cit. ex Rosengren M., 2014).

Hippocrates, one of the first researchers of an antiquity era, set the problem of searching a measure of a psychophysiological value hidden in man, the features of mental and physical organization. His typology of personalities (choleric, phlegmatic, melancholic, sanguine) with its bipolar distribution of psychic energy (a component of higher nervous activity (HNA) and its derivatives in the form of temperament types) is a search for a physical objective evaluation of manifestations of a person psychic activity. Hippocrates made an important contribution to the development of many modern sciences (from metrology to psychology) having assumed that such universal value exists (cit. by Jones W. H. S., 1868). The founder of the theory of humorism (the association of a personality type with the properties of certain fluids in a human body) assumed that external manifestations of psychic activity of man (in the form of temperament types) are subject to the principle of bipolarity: choleric is opposite to phlegmatic as sanguine is opposite to melancholic (fig. 6). A temperament, underlying these behavioral prototypes was considered as a result of the predominance of one of the bodily humors (fluids): bile, black bile, phlegm, and blood. In any case, the search for a universal
physical value was directed to the inside, and not outside of man, and this is one of the indisputable advantages of Hippocrates classification.

![Fig. 6. Model of temperament types according to Hippocrates](image)

Certainly, from the perspective of the modern science such typology is imperfect and covers only behavioral manifestations of HNA characteristics. A cell, gene or a chromosome in layman’s terms are much more convincing arguments than the power of prevailing bodily fluids. At the same time, the prominent Russian scientist Peter Lesgaft considered, in the manner of Hippocrates, the traditional types of temperament
as a manifestation of the peculiarities of blood circulatory system and metabolic rate (Riordan J., 1977). However, such biological approach to understand a physical value is not universal since a biological measure not always correlates with psychical processes. Moreover, no science (e.g., biology, microbiology, genetics, etc.) is able to explain the diversity of partial associations within the same biological species or its separate representative.

In the same direction, but moving away from a humoral component of the theory of Hippocrates, the studies of Jung, the founder of analytical psychology are focused: “I want to try to give a general description of the psychological types. First, it should be done for both general types which I termed as introverted and extraverted. Then, in addition, I will try to give some more characterization of those special types, the uniqueness of which is determined by the fact that an individual adapts and orients primarily by means of the most developed function. I would designate the former the general types, which depend on attitudes and differ from each other in the direction of their interests and their libido, and the latter as functional types... Finally, it is the individual predisposition that be attributed to the fact that under the same external conditions one child forms one type, and another — another type. At the same time, of course, I mean only those cases which are in normal conditions” (Jung C., 1971).

Jung distinguishes two general types, differing in the orientation of the interaction energy: extraverted (giving priority in interaction to the outside world) and introverted (giving priority in interaction to the inner world). In addition to a conscious attitude in the field of interaction organizing both types have also an unconscious attitude, which in relation to the first one performs a compensatory function. Depending on the development of the four basic mental functions: thinking, emotion, sensation and intuition, Jung distinguishes four types of extraverts and four types of introverts (fig. 7). Basic functions:
– Thinking is a psychological function that leads the content data of perceptions to the conceptual link. Thinking is occupied with truth and is based on extra personal, logical, objective criteria.

– Feeling is a function that gives the content a certain value in terms of accepting or rejecting it. The feeling is based on evaluative judgments: good — bad, beautiful — ugly.

– Intuition is a psychological function which transfers perception to the subject in an unconscious way. Intuition is a kind of instinctive grasp, reliability of an intuition is based on certain mental data which implementation and existence remained, however, unconscious.

– Sensation is a psychological function which perceives physical irritation. Sensation is based on the direct experience of perception of concrete facts.

The presence of all four psychological functions in each person gives a holistic and harmonious perception of the world. However, these functions develop nonuniformly. Traditionally, one function dominates, other functions are expressed to a
lesser extent, i.e. lag behind it, which is not a pathology at all, and their “backwardness” is seen only in comparison with the dominant function. “Experience shows that the basic psychological functions seldom or never have the same force or the same degree of development in one and the same individual. Usually one or the other function outweighs both in force and in development” (Jung C., 1971).

Consider the psychological types according to Jung:

1. The extraverted thinking type. Subjects who make important decisions rationally, create schemes of objective reality and are accurately guided by them in their behavior, demanding the same from people around. If these schemes (“formulas”, according to C. Jung) result from a deep understanding of reality, people may become reformers and innovators. However, the narrower the scheme is the higher is mental rigidity and the narrower are life horizons. Serving the ideal, in this case, becomes an obsession, where the end justifies the means. People of this type are characterized by emotional coldness, formalism, tend to devalue interpersonal relationships, they are alien to aesthetic experience, not interested in art.

2. The extroverted emotional type is characterized by adequate emotional evaluation of the events. Communication partners preferences are structured in advance and meet certain criteria (for example, occupying a certain social position). Drawn towards the world of art, but prefer not to bare their own feelings. Create an impression of themselves as of people lacking in emotion, at times, insincere.

3. The extraverted sensation type prefers sensory stimuli as the fundamental principle in the hierarchy of life priorities. Depending on a pole of emotions, people of this type can make an impression of esthetes enjoying life or sensuous and immoral (vicious) persons.

4. The extraverted intuitive type gravitates to novelty, with typically intuitive type of cognition, is easily inspired, easily loses interest. Ethical and moral component of communication plays
insignificant role, makes an impression of a charming, light-minded person, prone to adventures.

5. The introverted thinking type is prone to inferencing and theories, often, to the manipulation of facts for the sake of an idea, unlike the extroverted thinking type tends not to expand knowledge about the world, but to deepen it. Does not consider it necessary to captivate others with his own ideas and gain their support. A poor story-teller and teacher. Makes an impression of a haughty and masterful man, but not really being like this. Deep inside, he is naive and unadapted for actual life.

6. The introverted emotional type. Makes an impression of a calm, level-headed man. In fact, constantly restrains the manifestation of emotions, up to deliberate coldness which is not always perceived positively by the people around him.

7. The introverted sensation type. Unlike the extroverted sensing type, is oriented not to the objects causing intense feelings but to the intensity of feelings. Therefore, once the feeling arises, the object loses for him any attraction.

8. The introverted intuitive type. Lives in the world of the grotesque ideas, does not strive to analyze them, does not attempt to explain anything to others. Science fiction writers and artists, mystics, etc.

Jung’s typology emphasizes the fact that between people there are strong psychological distinctions in the very process of reality perception. Without rejecting the role of individual factor in the development Jung proposes eight sustained psychological types of a personality based on the cognitive-emotional component of their formation. This typology does not cancel all the variety of human characters, does not set any rigid framework in cognitive, emotional, or personal development. A psychological type is a structure, a kind of a personality frame.

Eysenck (Eysenck H. J., 1952, 1973) as well as Jung adheres to the bipolar (opposite) model of personality, describing a set of personality traits within the two factors: extroversion/introversion and neuroticism (stability/instability) (fig. 8).
Each factor, in its turn, is also bipolar. The *extroversion/introversion* factor emphasizes individual psychological configuration of a person. The extreme poles of the presented model correspond to an individual’s orientation: to the world of external objects (extroversion) or to the subjective inner world (introversion). Extroverts are considered to be sociable, impulsive, flexible, highly initiative (but short of persistence) and highly socially adaptable. On the contrary, unsociability, isolation, social passivity (with rather high persistence), a tendency to introspection and difficulty of social adaptation are inherent characteristics of introverts.
The second factor is *neuroticism* which describes some property-state, characterizing a person from the perspective of emotional stability, anxiety, self-esteem level and possible autonomic disorders. This factor is also bipolar, and forms a scale where at one pole there are people who are characterized by extreme stability, maturity and fine adaptability, and at the other pole there is an extremely nervous, unstable and poorly adapted type. The majority of people falls between these poles. The intersection of these two bipolar characteristics makes it possible to refer a person to one of the four temperaments according to Hippocrates (fig. 6).

The third factor, *psychoticism*, was added in the fourth version of the Eysenck Personality Questionnaire (EPQ) (Eysenck H., Eysenck S. B. G., 1975), and represents the characteristic of propensity to asocial behavior and inadequacy of emotional reactions. This factor is not bipolar. Its high values may indicate difficulty in social adaptation; although there is no clear justification of the legitimacy to discern this category, and it is disputed by many foreign researchers.

Thus, to the two-dimensional pattern of the previous questionnaires was added third independent factor “psychoticism” was added which does not change the original “dual-axis” conception.

Biological (temperamental) and personal approaches to find a universal measure of psychophysiological value resulted in the need to include an emotional component. 50% of Jung’s and Eysenck’s bipolar model of personality is based on an emotional factor.

In the works of Wilhelm Wundt (Wundt W., 1896) and James Russell (Russell J. A., 1980), the emotional factor becomes dominant. There is withdrawal from a macrolevel to microlevel — to emotions, basic affect in which an emotion is a measure of a psychophysiological value (fig. 9, 10).

The majority of the models of emotions is the two-factor, as well as previously considered by us models of temperament
and personality which axes are the sign of emotion and the level of activation. Wundt distinguishes three dimensions of emotions: pleasantness-unpleasantness, calm-excitement, strain-relaxation (fig. 9).

![Fig. 9. Wundt’s model of emotions structure](image)

Later, this model was refined and extended through the introduction of concrete emotions, with the list of basic states (affects) (Yik M., Russell J. A., Steiger J. H. 2011).

![Fig. 10. A circumplex model of basic affect by J. Russell](image)
Various scientists in the 20th century (Pavlov I. P., 1927, 1967, Wiener N., 1948) noted the integrity of the human body and the existence of interrelations (feedbacks) between all physiological systems of a person. In the classical work *Cybernetics: Or Control and Communication in the Animal and the Machine* (Wiener N., 1948) which started a new science, cybernetics, Wiener does not discriminate between the physical processes occurring in physical and biological objects. According to Wiener, all physiological and psychophysiological processes proceeding in a human body are associated with the exchange of energy and information within or between human physiological systems. Thus, correctly made psychophysiological model of a person should have a certain correlation with the structure (profile) of his intelligence. Consider in this regard the proposed structure of multiple intelligences, having arranged it similar to the structure of personality typology suggested by Jung (fig. 11).

*Fig. 11. The scheme of MI distribution in relation to C. G. Jung’s typology*
The radial structure of multiple intelligences given in figure 11 has close binding to the psychological types proposed by Jung, which indirectly confirms the hypothesis made by authors that the dominant type and profile of multiple intelligences practically defines the psychological type of a person, hence behavior, consciousness, abilities and other personal characteristics are defined first of all by the profile of his multiple intelligences, it is the unifying characteristic of the conscious and unconscious world of a person.

### 2.3. Behavioral Manifestations of the Dominant Type of Multiple Intelligences

Gardner’s multiple intelligences can be represented as multicomponent profiles which include social, emotional and cognitive components of intellectual and physiological activities. Not only each of the intelligences, but also the nature of their interaction with each other is important. Each type of intelligences has an oppositional type, counter to it on the basis of a certain psychophysiological feature. A profile of multiple intelligences of a person has a projection in behavior and the preferred sphere of interests. This connection is well noticeable in social “labels” of professions where behavior, intelligence and the chosen profession is a coherent whole. Let us consider behavioral manifestations of the dominant oppositional MI types.

The role of **intrapersonal and interpersonal intelligences** in life of any person is invaluable. Interpersonal intelligence is manifested in the ability to establish social contacts, team work; the ability to clearly assert one’s position, taking into account already established collective opinion, etc. In other words, a developed interpersonal intelligence allows its owner to feel most comfortably in the team. Intellectual self-fulfillment also comes through direct interaction with team members. For example, in the lexicon of a person with dominant interpersonal
intelligence often there are such words: “we all need it” — to refer to their own position; “let’s think together over this problem”, instead of “I don’t know what to do”.

Interpretation of behavior and mood of people — these functions are still closely associated with a developed interpersonal intelligence. At the same time, their actualization implies a close cooperation with visual-spatial intelligence.

Intrapersonal intelligence makes it possible to concentrate, to abstract one’s mind from ongoing events, and “in the privacy of one’s own mind” to find the correct decision, which is necessary. It is not without reason that even people with the dominant interpersonal intelligence prefer silence and privacy while making important decisions. People with the dominant intrapersonal intelligence can be said, “Only be able to live in yourself — there is the whole world of mysterious and magic thoughts in your soul” was written by Russian poet Fyodor Tyutchev in 1830 year.

Interpersonal and intrapersonal intelligences are inseparable from each other, as they are not only mutually exclusive, but also complementary. The result of their interaction is a manifestation of the integrity of the mental organization that accompanies the performance of any activity. In this linkage the feeling of psychological comfort arising in the course of activity is an integral part of its success. The combination of the dominant type of intelligence and the activity promoting its disclosure is the key to successful self-fulfillment in this activity.

In the developed line-opposite structure of multiple intelligence is algorithmically impossible situation, when opposite intelligence types of MI are both leading and developed by 100%. However, the opposite types of intelligence can be leading relative to the other types of MI with a ratio of (100/75)%, between opposite types of MI.

Existential-theoretical and arts-bohemian types of intelligences can play a key role in the life of a certain person. Existential-theoretical type of intelligences is called existential
because the area of its interpretation is beyond a daily routine of human interests. The development of any science is impossible without collaborative involvement of the dominant existential-theoretical intelligence. Existential-theoretical intelligence involves validity and integrity devoid of emotional and personal background.

The opposite functions are performed by arts-bohemian intelligence for which emotional and personal factors are dominant. Public recognition is substituted for external attributes of public attention. Where existential-theoretical intelligence will be focused on regularity searching, arts-bohemian intelligence will be oriented towards the demonstration of exclusiveness, grotesque.

Existential-theoretical and arts-bohemian intelligences can complement each other if existential-theoretical type of intelligence is dominant. But also the reverse situation is possible in another social situation. For example, receiving an honorary award for a scientific achievement is often accompanied by a magnificent ceremony or any other action (ritual) of public recognition of scientific exclusiveness. The history of mankind knows many examples when scientists refused an award (or, at least, its public component) because of its low value for the development of science, from their viewpoint.

**Logical-mathematical** and **verbal-linguistic** intelligences. Manifestations of these types of intelligence are most noticeable for people around. It is not without reason that the characteristic of a person from the position of “tech” or “arts” is common. If a person is close to a humanitarian range of sciences (in all its diversity), then mastering technical sciences is usually complicated. Logical-mathematical type of intelligence is responsible for any calculations and measurements including human resource. A good facilitator, a businessperson or a manager are, usually, also persons with a developed logical-mathematical intelligence. Public opinion very often, and,
certainly, in vain, connects senior positions with logical-mathematical intelligence.

It makes sense that one of the most common types of leading multiple intelligences combination is logical-mathematical/intrapersonal/existential-theoretical. A reclusive mathematician has become the prototype of many characters of literary works and movies.

Verbal-linguistic intelligence makes it easy to communicate, including the mechanisms responsible for the phonetic (speech sounds), syntactic (grammar), semantic (meaning) and pragmatic components of speech (the use of language in different situations). When logical-mathematical intelligence is dominant, the ability to verbally convey information to the interlocutor is the prerogative of verbal-linguistic intelligence, and it is not the common type of combination for these types of intelligence. Leading verbal-linguistic type of intelligence is much more often combined with interpersonal or arts-bohemian intelligences, and with musical abilities — with musical-rhythmic intelligence.

Business-mercenary and ascetic-sacrificial intelligences have a strong psycho-emotional charge, and the motivational component is dominant when choosing professional activities. In this case, it is difficult to speak about any specific domineering abilities. The commitment to business-mercenary or ascetic-sacrificial intelligence reflects the ability to effectively accumulate the available abilities in all their diversity, in compliance with living position. A defining moment in its formation is either selfish motive of self-interest (business-mercenary), or altruistic motive of philanthropy. Here it is important to emphasize that each person has a number of abilities but not everyone can accumulate them so efficiently in professional self-fulfillment owing to the dominating motive.

The representatives of business-mercenary type of intelligence efficiently fulfil their potential in the field of sales, forecasts and calculations related to them. Analytical abilities and numeracy combined with developed communicative skills are infused with
enthusiasm; not allowing referring this type of intelligence neither to interpersonal nor to logical-mathematical one. A successful businessperson manages human resources, accumulates their achievements for the purpose of enrichment. At the same time, enrichment is not the final result of the activity but a process component. A popular question, “Why do you need so much money?” does not imply a rational response neither from the viewpoint of ethics, nor from the point of view of common sense.

Ascetic-sacrificial type of intelligence bears in itself the same informational and motivational charge where the ideas of humanity and the common good is a process, but not the result accumulating a huge number of resources-abilities. Ascetic-sacrificial intelligence may be localized within a particular area. For example, “Save the Baikal seal — make the world better”. The problem is that even if all the Baikal seals are saved, there will remain sea bears, whales, sea-calves, and other representatives of aquatic wildlife. In the same way as a businessman may have a localization area in a specific field (footwear, food, etc.), a representative of ascetic-sacrificial intelligence may specialize in the rescue of marine fauna. It is much harder for those people, for whom the ideas of humanism, altruism and pacifism are global in nature, reaching the level of self-sacrifice, exhaustion of internal reserves.

Can business-mercenary and ascetic-sacrificial types of intelligence be combined? Yes, line-opposite structure of MI allows being dominant for any opposite intelligence from the pair. There are a great many examples of formal combination of these types of intelligence. For instance, a representative of criminal business makes considerable donations to charitable organizations without stopping his criminal oriented activity. In this situation it is necessary to pay attention to the impetus of the act but not the act itself. Because the desire to help (even when its formal realization is mediated) is the prerogative of the ascetic-sacrificial intelligence. Not at all the representatives of criminal business have a desire to fix something, to help,
to make the world better. The suppression of this desire or formal implementation is not the same as its absence. Therefore we speak about the formal combination of business-mercenary and ascetic-sacrificial intelligences, the former being dominant.

**Visual-spatial and musical-rhythmic** types of intelligence may occur when there are corresponding *inclinations*, and also may become a result of abilities development. They are based on the opposite physiological sensor systems oriented on the visual or sound information. At the same time, without directive teaching the available inclinations do not develop into abilities. This type of intelligence can be characterized by the ability to perceive the surrounding objects and phenomena in three-dimensional space, regardless of their initial position and dynamics. Visual type of perception is dominant, and bears in itself the main informational and psychological charge. It also manifests itself in the sensitivity to the shades of colors, and forms, and is characterized by excellent terrain orientation. This type of intelligence is often dominant in conjunction with other types of multiple intelligences. A fashion designer: visual-spatial is the dominant intelligence combined with arts-bohemian and logical-mathematical types of intelligence. A hair stylist: visual-spatial is the dominant intelligence combined with arts-bohemian and interpersonal intelligences.

Musical-rhythmic type of intelligence, more often than visual-spatial one, is a consequence of development of the available *inclinations*, but can become also a consequence of abilities development. This type of intelligence is characterized by a hypersensibility to sounds and phonemes. It can manifest itself in the form of having an ear for music (but not necessarily) or the presence of persistent musical hobbies. Music has a deep psychological charge in the life of such person, being a vocation or a serious hobby. It may be combined with different types of intelligence: verbal-linguistic, naturalistic, intrapersonal, etc.

Can visual-spatial and musical-rhythmic intelligences be combined with each other? Yes, they can. Both types of
intelligences are the result of the development of abilities on the basis of inclinations. Even despite this fact, proportional development of both types of intelligence is unlikely, in the course of time one of them will become dominant. Early, bright spontaneous development of visual-spatial or musical-rhythmic intelligences on the background of existing inclinations often found in general deficiency development. For example, savant syndrome (from French savant — “the scientist”) — a condition in which people having developmental disorders have outstanding abilities in one or several areas of knowledge on the background of general intellectual inferiority.

Daniel Tammet is one of a hundred most famous savants. He suffered epilepsy in his childhood. Today he can recite pi from memory to 22 thousand digits, in his mind he can calculate any day of the week by the designated date. The very process of adding and multiplying large numbers is interesting. Daniel says he sees multi-colored shapes, which represent different numbers. That is, for him to multiply two large numbers in his mind is to merge two colored shapes into one.

Derek Paravicini, the greatest jazz musician, was prematurely born on July 26, 1979 with intellectual disorder. Later he became blind. He practiced music since he was four. He got the nickname of the “Human iPod” because of his ability to learn and play a piece of music after just one hearing. At the age of nine, he gave his first major public concert at the Barbican Hall in London when he played with the Royal Philharmonic Orchestra. His intelligence level corresponds to the age of a four-year-old child.

An early manifestation of visual-spatial or musical-rhythmic intelligences, based on inclinations, is much more rare the result of a true genius not burdened with any form of disturbed development (Wolfgang Amadeus Mozart, Ivan Aivazovsky and others).

Naturalistic and bodily-kinesthetic types are opposite in relationship to nature, from creative to user. As mentioned
earlier, both of these types of intelligence are some kind of basic core — evolutionary set the beginning of understanding the world through merging with nature by means of moving or dissolving in it.

Naturalistic type of intelligence is largely creative. It is the beauty of the environment in different forms: visual, auditory, kinesthetic and tactile: “to admire the sea”, “to smell the sea”, “to listen to the roar of the waves”, “to rock on the waves”. A person with the dominant naturalistic intelligence will develop the abilities enabling to see/hear/feel the nature. Quite often it seems to a person with naturalistic type of intelligence that he did the right thing (made correct calculations, etc.) absolutely intuitively. If we consider the term “intuition” as unconscious knowledge then such person really is guided in the acts much by intuition.

The dominant naturalistic intelligence assumes a connection with the world around, the subtle differentiation of the aspects of its transformation. Merging with nature is a synthesis of natural and spiritual sources in which man is considered not as the “apex of creation” but as its part.

Contemplative-creative interaction component of intrapersonal and existential-theoretical types of intelligence (with dominant naturalistic type) can take shape in musical-rhythmic and visual-spatial types (a canvas “breathing” of spring, a symphony of spring, etc.).

Bodily-kinesthetic intelligence can be characterized as cognition through movement. Different kinds of movements are the main source of self-expression for persons with the dominant bodily-kinesthetic intelligence. Well developed may be both gross motor (coordination of movements, balance, agility, strength, flexibility, etc.) and fine motor skills (dexterous sensing fingers). Strong bodily-kinesthetic intelligence can be equated to the inclinations of professional athletes.

Nowadays ecology is not only a science but also partly a way of life for many people. The idea to preserve the remnants of pristine nature has led to the development of alternative sources
of energy and fuel, common promoting of cycling, etc. Many athletes say that they have improved mood during and after sports activities outdoors. Interest in extreme sports can also have natural orientation (mountaineering, mountain skiing, etc.) and bear in itself a deep psycho-emotional charge of knowledge and unity with the nature.

Thus, the behavior of a person and the scope of his professional interests are in close connection with the dominant types of MI. The MI profile reflects the combination of these interests and their projection in behavior. Social “labels” of professions really take place not only in free but also in scientific interpretation (in relation to MI typology).

2.4. Hobby or Profession? Different Approaches to Questionnaires

Self-fulfillment involves various spheres in which a person performs a particular social role. The differences in the spheres of self-fulfillment lead to the fact that a person can perform social roles which are opposite in their psycho-emotional charge. For instance, a successful businessperson (with the dominant business-mercenary and logical-mathematical intelligence) suddenly turns out to be a secret philanthropist (with the dominant ascetic-sacrificial intelligence). How is it possible? Actually, both these social spheres are equally important for the individual. He cannot choose between his profession and the hobby which makes an important part of his life. The profile of the dominant MI in choice of profession can be obtained by means of Gardner_12 questionnaire of VibraMI program (VibraMI, 2017) see Attachment.

“In fact, the ‘struggle’ which was meant by Darwin, and which is the driving power of evolution is, first of all, the competition between close relatives. A species ceases to exist in its old form or transforms into another kind owing to some useful ‘invention’
which one or few brothers of the species got as a result of an absolutely random prize in the eternal lottery of Variability. The descendants of that lucky one, as it was already said, immediately start to force out all the others, so eventually there are only individuals possessing a new ‘invention’” (Lorenz K., 1966).

The dominant type of intelligence can be seen as the result of the “competition between close relatives” i.e. related types of intelligence, which are located next to each other. Moreover, there may be several dominant types of intelligence (see Chapter 2.3). It is important to determine in what professional fields a person will be successful, even if they are the areas which are not correlating with his current profession. To this purpose also serves Gardner_12 questionnaire.

Gardner_12 questionnaire consists of 12 pairs of questions. Each pair of questions corresponds to one of the 12 multiple intelligences (MI). The diagnostics of MI profile is performed by means of the program VibraMI. Each of the 12 pairs of questions is a pair consisting of opposite questions like a control and a relevant question, as classical “zones of comparison” (Zone Comparison Technique, ZCT) in lie detection developed by Cleve Backster (Backster C., 1963). Differential-stress approach to the design of the questionnaire means a forced choice situation. Testing in this mode is as close as possible to the classical lie detection. This is an important condition of the validity of this questionnaire, since it is about psychophysiological response of a person, but not a standard diagnostics of the sphere of his interests (as it occurs in traditional psychological tests and questionnaires). “Zone” approach to the design of the questions puts the respondent in the situation of forced choice, the situation of emotional dilemma. Thus, the check of initial intentions/professional preferences is carried out. A bright stimulus material, by means of 24 photos (i.e. one photo for each question) is the final touch in artificially simulated emotional state.
Underestimating the role of a hobby in a person’s life is detrimental. Hobby and profession are closely related to each other, complement each other, contributing to the optimization of internal processes of mental organization. In this regard, depending on a person’s psychological type, there may be different or similar MI profiles in the diagnostics of professional inclinations (Gardner_12 questionnaire) and hobbies (Gardner_12S questionnaire). The structure of Gardner_12S questionnaire is partly close to Gardner_12, but there are essential differences. Gardner_12S questionnaire also consists of 12 pairs of questions. Each couple of questions corresponds to one of 12 multiple intelligences (MI). The diagnostics of MI profile is performed by means of the VibraMI program. Each of the 12 pairs of questions is a pair consisting of two complementary questions. This is the key difference between questionnaire Gardner_12S and Gardner_12 questionnaires. In this case, instead of the differential-stress approach the total-comfortable approach is used. The total-comfortable approach is similar to the classic psychological approach used in designing questionnaires. There is no the “forced choice” situation to choose of two questions bearing counter information-psychological charge, the emphasis is placed on the conscious preferences of the respondent.

Thus, the dominant types of intelligence will vary depending on social roles, their personal importance and the sphere of implementation in a person’s life. It is referred to personally significant, settled social roles, important spheres of self-fulfillment in a profession and a hobby.
The need is long overdue to create a diagnostic tool affordable and comfortable to operate by both an expert and any person interested in the objective determination of person abilities and solving the problem of professional choice at any stage of their life. At the same time, this tool should meet all the requirements of professional recruiting. It should combine the characteristics of ability test and questionnaires, interests and attitudes. It should take short time to perform and interpreted correctly, should be protected from typical observation and attitudes errors to an answer from a respondent. In the course of the experiments conducted by us it was found, that passing a questionnaire of 24 questions does not lead to mental exhaustion of the examinees. In addition, it is necessary to automate both the procedure of testing, and the interpretation. It is noteworthy that the psychophysiological assessment of diagnostic criteria of professional suitability allows eliminating observation errors, as there is no need for an observer. The goal was to do fully automated the process of observation and data recording.

For testing of a multiple intelligences profile of a person in Elsys Corp., St. Petersburg, Russia, there has been developed a special VibraMI program (VibraMI, 2017) which analyzes conscious and unconscious responses of a person when answering for the questions and presenting stimuli.

Conscious response of an examinee is determined when processing answers to the questions in the format Yes/No. The content of the questionnaire incorporated in the VibraMI program
meets the main criteria of the questionnaires of interests and attitudes, on the one hand, and the ability test, on the other hand. The content of the questions is partly related to potential interests of a respondent, and their wording allows estimating the orientation of attitudes. The orientation of attitudes can be traced by the change of information and energy component of psychophysiological response to a question.

The information component of psychophysiological response is an indication in information exchange between and within human physiological systems under the influence of a stimulus. It is known that within physiological systems of a person and within each physiological system there are a constant exchange of information signals (Pavlov I. P., 1927, 1967; Wiener N., 1948, Bernstein N. A., 1967; Tamar H., 1972). The amount of information transmitted and received every second in physiological system is huge. The human brain contains $(50–100) \cdot 10^9$ neurons (Herculano-Houzel S. 2009), and the number of connections and signals transmitted between them exceeds the number of atoms on the Earth. This work is not expected to describe in detail the internal physiological processes in the human body. For proper understanding of the change in a physiological state the standard cybernetic black box method will be used (Shannon C., 1948; Wiener N., 1948) However, we will try to estimate in a relative form (given to limit human capabilities) the information-energy processes continuously occurring in the human body.

The basic rule of metrology means that for measuring a physical value, it is necessary to understand clearly, what it is, and to know the peculiarities of its change. Thus, to determine a psychophysiological state of a person it is necessary to single out the key parameters characterizing this state, and for this purpose, it is necessary to represent a person in the form of a conventional block diagram as is customary in natural sciences. On the formal level, person is an information-measuring system spending particular energy for processing of incoming information.
Consider the representation of a human person in the form of a conventional information-measuring or cybernetic system (fig. 12), consisting of a number of physiological systems $P_1 - P_K$ (cardiovascular, nervous, digestive, vestibular, etc.), (Tamar H., 1972), which functioning has particular physiological tasks. In addition, each physiological system has a certain impact on all other systems. The mutual influence of one physiological system to another is characterized by the correlation coefficient $C_{kn}$. Using information-measuring terminology, it is possible to say that any person is constantly subjected to input exposures in the form of energy carriers $E_{ex}$ (food, oxygen, ...) and input information $I_{ex}$ (light, sound, heat, etc.), which are converted by metabolic internal physiological processes ($I_{in} - E_{in}$) into

![Fig. 12. Cybernetic information and energy block diagram of person](image-url)
external manifestations in the form of the metabolic energy $E_{out}$ (heat, motion) expenditure by a person (Mathie M. et al., 2004), and information $I_{out}$ (words, appearance, changes in physiological parameters heart rate, GSR, ECG, etc.). Probably, it is difficult to imagine a more general scheme of human functioning, however, in our opinion, this scheme covers all conscious, unconscious, physical, chemical and informational processes occurring in man, and allows estimating changes in a psychophysiological state of a person when exposed to stimuli.

Determining a psychophysiological state of a person which, as follows from the block diagram shown in figure 12, is inextricably linked with the need to determine the internal energy of physical and chemical processes $E_{in}$ occurring in the person, and his informational state $I_{in}$. From the diagram it follows that the nearest analogs of the internal values of information and energy state of a person are their external components $I_{out}$ and $E_{out}$ which can be measured physically, and which have direct or indirect dependences with internal parameters. At the same time, to determine a consumption or input energy of a person by metabolism is a known physical task that has many technical solutions.

We assumed that it is possible to estimate the internal information state of a person as informational efficiency coefficient $I_{in}$ which reflects the ratio of the useful volume of the accepted physiological information to the total volume of the transmitted physiological information.

The vibraimage technology developers argue that such informational efficiency coefficient is proportional to the function of the correlations sum of the various physiological systems operation $I_{in} = f \left( \sum_{1}^{kn} C_{kn} \right)$ (Minkin V. A., 2017), and this process can be estimated in various technical ways, for example, by means of the vibraimage technology, or by measuring the total correlation of temporal dependences of various physiological signals. The decrease in physiological systems correlation
dependence between the functioning of various human physiological systems is characterized by the loss of control, chaos, entropy increase, and, in extreme cases, death.

Thus it is expected to implement the information-physical approach to the assessment of the psychophysiological state of a person, and for the first time this approach is not based on subjective evaluation of emotional state (aggression, stress, anxiety, etc.) and not on formal physiological parameters (heart rate, GSR, blood pressure, etc.), but on objective physical and informational parameters.

Various authors and researchers used the analogical technical approach to person previously. For instance, Libb Thims (Thims L., 2007) in his work Human Chemistry wrote that all consciousness and the unconscious psychophysiological responses to the questions of may be reduced to chemical processes. Similar behavioral approach to the study of human personality was used by the founder of the functional analysis method in behaviorism, Burrhus Skinner (Skinner B., 1931), who did much to transpose psychological theories to the practical area.

Skinner (Skinner B. F., 1931) as one of the prominent representatives of behaviorism, in his works paid special attention to precision and forecast of human behavior. Any science, psychology, psychophysiology or genetics must have accurate measuring tool. This tool helps predict the behavior of a person or animal most correctly. Only the precise forecast is the criterion of the scientific character of a discovery. The verification of the hypothesis credibility in this case is the ability to manipulate a person’s behavior on the basis of the precise forecast.

“It is better to be precise, than imprecise. Modern science is impossible without precise mathematical tools and the quantitative observations to convert the information obtained to conclusions (general statements). However, mathematical calculations and measurements may not be scientific in the same way as it is possible to have science without these tools. <...>
Science is more than a set of any resolutions. It is searching of an order, uniformity, regularities between natural phenomena. The transition to a comprehension of general laws begins with observations of separate episodes. Similar regularity is observed not only in science, but also in behavior of a person in the early childhood. We study the pure geometry of space in which we move. We study the ‘laws of motion’ as we move, or push and pull objects, or throw and catch them. If we were unable to find any consistency in these actions, our behavior would remain random and ineffective. Science absorbs and complements this experience, showing more precisely more and more number of relationships between events.” (Skinner B. F., 1974).

Thus, for objective conducting of psychophysiological testing and to determine a profile of multiple intelligences, it is necessary to carry out the experiment correctly (to synchronize the processing of objective information-energy characteristics with the exposed stimuli), and to do a logical uniform mathematical processing of the obtained results.

3.1. Conscious Response of an Examinee in Answering a Question in the Yes/No Format

Conscious response of an examinee in the Yes/No answer format is traditionally used in passing both psychological and psychophysiological testing (Baur D., 2006; Varlamov V. A., 1998). For statistical processing of the results, it is necessary to transform the reply in Yes/No format to the number, characterizing the degree to which the conscious response of this stimulus corresponds to the person being tested. For example, if a person loves a sweet, he will answer YES to several questions, as “Do you like sweets, pastry, cakes, etc.?” In this case, the quantitative characteristics of conscious reactions to the question will make 100% for the answer YES. If to set another task and to learn if the person loves nature,
and to ask him specific questions whether he likes forest, field, rivers, seas, then, for example, a person who loves nature but fears water will answer the questions about land YES, but about rivers and the sea the answer will be NO. Therefore, the quantitative response to this group of questions will be 50% YES and 50% NO, in case the number of questions about the land and the sea will be the same. This calculation allows obtaining any assessment of positive perception of a certain notion in case there is a significant number of questions directed at one concept or stimulus. At the same time, previously it was determined that the number of MI types makes 12, and the maximum number of the questions (not to cause fatigue of the examinee) makes 24, which determines the number of questions asked, for one type of intelligence it is no more than 2 questions. In that case, the level of positive attitude to the stimulus can make only 3 values: zero — if all two answers are NO, 50% — if one of the answers is YES, and 100% — if both answers are YES. It seems that three levels will be insufficient to validate a person’s abilities, and it is true if to use only conscious responses to the answers. The increase in the number of questions up to 3 per one intelligence, will add only one gradation to the quantitative reaction, up to 4. The increase in the number of questions up to 4 per one intelligence will increase the number of distinguishable gradations up to 5 which is, of course, good but it also increase the entire questionnaire up to 48 questions, so it does not meet the requirements of the questionnaire duration.

At the same time, it is known, that conscious and unconscious responses of an examinee considerably depend on the sequence of presentation of questions and stimuli, and the most adequate response of examinees comes at the sequential presentation of questions of a counter orientation (Backster C., 1963; Baur D., 2006). This principle was the basis of the questionnaire Gardner_12.

The questions in this questionnaire are designed in such way that for each type of intelligence, a person with a developed
type of this intelligence would give the answer YES to the first question, and NO – to the second question. When answering the corresponding pair of questions of the second questionnaire Gardner_12S, a person with a developed type of this intelligence should answer YES two successive times. The questions and stimuli are presented sequentially according to the developed structure of multiple intelligences, beginning with the questions on the MI types line with minimum extraversion and maximum tech abilities.

Figure 13 shows an example of successive conscious responses to the questions and stimuli on the intelligence structure in the Yes/No format. The YES answers are assigned with the conscious response value +1, and the NO answers with the conscious response value –1.

![Figure 13](image)

*Fig. 13.* The result of a conscious response when answering the 24 questions of the questionnaire Gardner_12

The results of the responses to the Gardner_12 questionnaire obtained in figure 13 are presented in the given form characterizing the degree of conscious positive perception of the exposed stimuli. According to the previously mentioned, the negative reaction to even-numbered questions indicates a positive perception of the stimulus.

For calculation of conscious responses to 12 MI types is necessary to combine the responses in 12 pair questions of the Gardner_12 questionnaire and bring it to 100% for positive perception of corresponding MI type.

A conscious response in figure 14 shows that the examinee equally positively answered the questions relating to 1, 2, 3, 5,
and 6 questions pair or corresponding MI types. Naturally, such a versatile development of the dominant 5 types is relatively unlikely and needs to be clarified.

![Fig. 14. The given result of a conscious response when answering the 24 questions of the questionnaire Gardner_12](image)

In the questionnaire Gardner_12S the sequence of stimuli is different, and consequently the results processing is also different. The result of primary responses to Gardner_12S questionnaire is given as an example in figure 14.

A conscious response when answering Gardner_12S questionnaire in figure 15 shows that the examinee equally positively answered the questions relating to 1, 5, 8, 9, and 12 questions pair of corresponding MI types.

![Fig. 15. The result of a conscious response when answering the 24 questions of Gardner_12S questionnaire](image)

As can be seen in figure 16, for Gardner_12S questionnaire, the given resulting conscious response consists of sums for two questions per one type of intelligence, in contrast to Gardner_12 questionnaire (fig. 14), where the resulting response is determined by the difference between the odd
3. Psychophysiological Testing of Multiple Intelligences

and even values of conscious response. We think that the first differential approach provided by Gardner_12 questionnaire (fig. 14) better reflects a person’s behavior in a stressful situation, and is peculiar to business conduct. The second total approach provided by Gardner_12S questionnaire (fig. 16) better reflects the behavior of a person in a calm, relaxed atmosphere, and gives more information about the hobby and passion of the person. The resulting profile of a conscious response to the questions already gives a rough idea about the profile of multiple intelligences which is considerably specified in a joint analysis with information about the unconscious (psychophysiological) response to the stimuli.

![Graph](image)

Fig. 16. The given result of a conscious response when answering the 24 questions of Gardner_12S questionnaire

3.2. Psychophysiological (Unconscious) Response

Previously it was shown that the most objective parameters indicating the changes of a psychophysiological state of a person, are information-energy characteristics of a person’s state. It is known, that one of the most informative areas characterizing personality and behavior of a person is physiology of activity. The founder of Russian physiology, Ivan Sechenov, argued that each thought has its muscular manifestation (Sechenov I. M., 1965). Great Charles Darwin on the basis of the theory of evolution in the book The Expression of the Emotions in Man and Animals
(Darwin C., 1872) assumed that “reflex actions characterize the expression of emotions”. The founder of psychoanalysis Sigmund Freud considered that “a person has no random movements” (Freud S., 2010). The first Russian Nobel prize winner Ivan Pavlov, the most famous in the world researcher of reflexes, claimed that all physiological phenomena are determined by two processes of excitation and inhibition (Pavlov I. P., 1967). The famous Russian psychophysiologist Nikolai Bernstein who introduced into science the term “activity physiology” found that any movement of a person is discrete and based on bio-feedback (Bernstein N. A., 1967). A prominent biologist and psychologist of the 20th century, Nobel prize winner Konrad Lorenz in his book Aggression (Lorenz K., 1966) declared that the one who will manage to measure the amplitude and intensity of reflex movements will be able to determine the level of aggression. Brazilian psychologist Emilio Mira y López (López M. E., 1958) offered a practical technique of the personality parameters analysis on repeatability of movements (myokinetic diagnostics) as early as in the sixties of the last century. The principles of physiology of activity developed by great scientists formed the basis of modern vibraimage technology (Minkin V. A., 2007, 2008), which converts the data of reflex head micromovements to psychophysiological characteristics of a person.

The vibraimage technology nowadays is practically the only technology determining psychophysiological state, which declares the possibility of measuring or estimating these parameters (Minkin V., 2004, 2009, 2017; Blank M. A., 2012; Bobrov A. F., 2016). In a somewhat simplified form, we may say that the dispersion (root-mean-square deviation) of vibration frequency distribution reflects the information efficiency coefficient of a person, and the average value of vibrations frequency distribution reflects the energy consumed or released (spent) by a person. As all physiological systems of a person are in equilibrium due to multiple feedbacks (Wiener, 1948), a person’s energy regulation leads to the fact that the
time-averaged energy expenditure is approximately equal to the energy emitted by a person for the same time. At the same time, at certain time moments the values of the expended and emitted energy can differ considerably. Naturally, we talk about physical energy measured in calories and joules, or the power, usually measured kcal/min, or in the other physical values (Ceaser T. G., 2012).

As an example, consider the changes in the psychophysiological state of a person given in the scales of information-energy characteristics, where by the information we understand informational efficiency coefficient of a person, and by the energy — the energy expenditure by a person. The actual PPS is shown as the initial point 0, and the change of a person’s PPS in time — as a straight or curve line between the two points. A hypothetical example of PPS change from the zero state to various states 1, 2, 3, 4, 5 is shown in figure 17.

Fig. 17. Information-energy diagram of psychophysiological state changes
In the information-energy diagram provided in figure 17 the transition from the initial PPS (point 0) to the other states is characterized by one and the same change in energy consumption (2 kcal/min), but into the different psychophysiological states depending on the direction of motion.

The transition 0→1 is characterized by the increase in the energy expenditure and the increase in informational efficiency coefficient, i.e. the increase in the effectiveness of information exchange inside and between physiological systems of a person. Usually, the increase in informational efficiency coefficient is also due to the general improvement of psychological state, as minimum losses of informational physiological signals are related to memory improvement, absence of pains, good mood, etc. For instance, if a stimulus (question and image) causes improvement in a psychological (informational) state, and at the same time the energy emitted by the person increases, it is peculiar to the person at positive perception of the presented stimuli. Acceleration and more intensive activity of metabolic processes in a human body (increase in the consumed energy) is the physiological reason of this phenomenon. At the same time psychological state and mood considerably improved (the entropy of metabolic processes decreased, and the informativeness of signals exchange inside and between physiological sensory systems of an organism grew).

The transition 0→2 is characterized by the increase in the energy expenditure, and a smooth level of informational state. The stimuli have not led to a change in the information state, but increased the energy emitted by the person. It means that psycho-emotionally, the person response to the presented stimulus neutrally, but physiological growth of the energy emitted by the person is observed.

The transition 0→3 is characterized by the increase in the energy expenditure, and deterioration in psychological state. It means that the presented stimuli are unpleasant to the person
and caused deterioration in psychological state which is followed by acceleration of physiological processes.

The transition 0–4 transition is characterized by the decrease of the consumed energy and deterioration in psychological state. It means that the presented stimuli lead to the slowing of metabolic processes (decrease of the consumed energy), at the same time psychological state and mood considerably worsened (the entropy of metabolic processes deteriorated, and the informativeness of exchange fell).

The transition 0–5 is characterized by the decrease of the energy expenditure and improvement of psychological state. It means that the presented stimuli calm and lead to the slowing down of metabolic processes (decrease of the consumed energy), at the same time psychological state and mood are considerably improved (metabolic processes entropy decreased, and the informativeness of exchange grew).

The provided explanations describe psychophysiological processes at the qualitative level, and the VibraMI program makes measurement and calculation of information-energy processes occurring in the body of a person exposed to stimuli, and shows the calculated psychophysiological reactions of a person after each question in the form of an informational diagram. The main problem of determining a psychophysiological response to a stimulus is unambiguous understanding of the inverse conversion of the obtained objective information-energy parameters in the subjective positivity or negativity of human reaction to the presented stimulus. For instance, what of the transitions is more positive with relation to the change of a psychophysiological state, 0–1, or 0–5? In our understanding the answer to this question depends not only on the measured characteristics of information and energy, but also on the conditions of stimulus impact on the object.

In the course of the experiments there were specified two basic equations for calculating the changes of psychophysiological
state depending on the conditions of impact on a person being tested.

\[ P_1 = (I_2 - I_1) + (E_1 - E_2) \]  
\[ P_2 = (I_2 - I_1) + 2|E_1 - E_2|\sin A \]  

Equation (1) is based on the following basic assumptions:
- The significance of information and energy changes is identical when analyzing a psychophysiological state of a person.
- Increase in the information component (informational efficiency coefficient) is associated with a positive change in PPS.
- Increase in the energy component (spent energy) is associated with negative change in PPS.

This equation (1) should be applied when detecting a hidden psychophysiological reaction when a tested person may try to hide their emotions and feelings to the presented stimulus, for example, in lie detection.

Equation (2) is based on the following basic assumptions:
- The significance of the information component exceeds the significance of the energy component and defines the sign of PPS change.
- A positive change of the information component of PPS always leads to a positive change in PPS, and a negative change in the information component of PPS always leads to a negative change in PPS.
- The value of PPS changing depends on the vector of information-energy coordinate changes of PPR and \( \sin A \) (3), where A is the angle formed by the vector of PPR changing and the energy axis of coordinates.

\[ \sin A = (I_2 - I_1) / \sqrt{(I_2 - I_1)^2 + (E_1 - E_2)^2}. \]  

The equation (2) should be applied when a tested person is interested in detecting their response, for example, when testing...
multiple intelligences, or the optimal choice of specialization and occupational guidance.

Experimental studies provided by us have shown that in different situations one and the same change of information-energy scale may correspond to different PPS changes. For example, in the situation of lie detection, when the examinee must meet specific control and relevant questions about the committed or uncommitted crime, the PPS should be determined by equation (1) as the degree of positivity of perception of the questions is defined by the informative and the energy indexes in equal measure. However, when conducting more neutral psychophysiological testing including multiple intelligences, the energy component of psychophysiological response becomes less significant, and the informational component becomes determinant. Therefore, testing multiple intelligences with the VibraMI program is carried out according to equation (2), although the data obtained by equation (1) are given as reference in the general Table of research data of VibraMI program.

Naturally, it would be desirable to define a single-valued algorithm for identification of any PPS irrespective of external situation and presented stimuli, but the desirable not always becomes possible. However, we do not exclude that the possibility will emerge in the future.

At the same time, the obtained result allowing identifying objectively positivity or negativity of PPS change with the help of information-energy parameters for a particular situation is a significant step forward in modern psychophysiology. Thus, there is an opportunity to measure (to estimate quantitatively) the value and the sign of PPS change when presenting a stimulus, and, therefore, to calculate psychophysiological response of an examinee to the presented question and the stimulus, and to observe PPS change over time. Figure 18 shows an example of PPS change when presenting 3 questions-stimuli; the transition from one question to another is designated in the graph with different hatch type.
Fig. 18. PPS changes for presenting three different stimuli

We will consider briefly the change of PPS given in figure 18. Plot 1–2 shows the response of an examinee when presenting the first question, plot 2–3 shows the response of an examinee when presenting the second question and plot 3–4 shows the response to the third stimulus. It is interesting to note that in the above example the direction of psychophysiological response of an examinee was different when answering different categories of questions. Besides, from the given dependence it follows that psychophysiological response possesses has certain inertia since the direction of change in psychophysiological state does not occur immediately after the presentation of a question (stimulus). Pauses between questions are intended for returning the PPS to its original state, and to minimize the mutual influence of one question on another. Psychophysiological inertia of response requires creation of certain time intervals between the presented stimuli. This approach has long been used in psychophysiological lie detection, and the typical time between two questions makes about 10 seconds (Backster C., 1963). The provided graph shows that the task of returning the PPS to its original state is not always achieved during a pause
between the questions, although all deviations of PPS occur around the conditional center of regulation of the state. At the same time a particular change of PPS during pauses between the questions is still observed, therefore when testing, the mode was selected, in which a picture-stimulus intensifying the impact of the question remains on the monitor screen even after answering the question and continues influencing the examinee. This testing method allows to have more time for measuring psychophysiological response, than the couscous reply on questions, so unconscious response includes also feedback response on the given couscous reply. Pause between pictures-stimuli in the course of the test are absent to reduce total test time. This combined mode, according to our testing allows achieving optimum indication of an examinee PPS to the stimuli presented. The PPS change when presenting the first stimulus is estimated by the straight line passing through the points 1–2, the PPS change when presenting the second stimulus is estimated by the transition 2–3, and when presenting the third stimulus — by the transition 3–4. The method of calculating PPS transitions possibly may be improved for the most accurate binding of PPS change to the stimulus, however at this moment the technique being used provides the most adequate and stable results.

The resulting histogram of calculated by the said method psychophysiological responses to each of the 24 questions-stimuli presented is shown in figure 19.

Psychophysiological response is calculated in the numerical values of the physical value reflecting the values of positivity changes in psychophysiological state and determined by equation (2). So a more positive response to the stimulus is characterized in proportion by a more positive number. If the presented stimulus leads to a negative or adverse response, then the calculated level of response should be the negative. Besides, as mentioned earlier, the total response to consecutive pairs of questions aimed at defining psychophysiological
response to a specific type of intelligence is determined by the difference of responses between the respective odd and even question from Gardner_12 questionnaire. A single response (fig. 19) processed by the above-noted differential method, shows PPS response to the corresponding types of intelligence, as it is shown in figure 20.

![Fig. 19. Quantitative evaluation of psychophysiological responses to each question-stimulus presented](image1)

![Fig. 20. Quantitative evaluation of psychophysiological responses to the presented questions-stimuli with reference to the type of multiple intelligence](image2)

It is obvious that with the above-noted differential processing the value of response (0.067) to the first question (fig. 19) the value of the response (–0.127) to the second question is subtracted (or is added to the absolute value of the response to the second question). So the value of the differential response to the first type of intelligence is defined as 0.194 (fig. 20). Similarly undergoes the calculation of response values for the next types of multiple intelligences. The histogram of value distribution of psychophysiological responses according to the types of multiple intelligences, submitted in figure 20, has
the physical dimension of positivity of psychophysiological response showing the degree of unconscious attitude to the presented stimuli from the most negative (value — 0.508 for the 10nd MI type) to the most positive (value 0.389 for the 2nd MI type).

The histogram of responses to stimuli provided in Figure 20 can be adjusted by means of the selected approach to oppositional MI classification, by averaging the PPS responses obtained for the opposite types of intelligence, certainly, taking into account the reversed sign. Figure 21 shows the graph in which near actual value of psychophysiological response (PPR) obtained (a white column) for each MI type, the value of PPR is given which is obtained as the difference of responses between the main and the opposite types of intelligence (grey columns).

Fig. 21. Quantitative evaluation of individual and differential psychophysiological responses to the presented questions-stimuli with reference to the type of multiple intelligences

The histogram given as an example in figure 21 shows that the response to the majority of questions-stimuli calculated in this way, coincides in the direction, practically, for all MI types, except the fourth MI type (business-mercenary). Given the selected orientation of MI scale, the authors assumed that it is reasonable to carry out the correction of the opposite types of intelligences only for the first four types and their corresponding opposite
four last MI types, since the middle of the scale has insignificant difference in responses, and the correction of intelligences from the 5th to the 8th may bring an additional error, and affect the result. Therefore, in figure 20 for MI types from the 5th to the 8th calculation of differential response is not made, and the values of grey columns is identical to corresponding value of white columns on figure 21. By our opinion, this adaptive processing with aligning of psychophysiological responses of extreme types of intelligences (first 1–4 and last 8–12) gives more accuracy in total MI profile processing.

For the joint processing of conscious and unconscious responses it is necessary to bring the values of unconscious response to relative units or percentages, and normalize the results, binding the maximum negative response to zero, and the maximum positive response to 100%. After such adjustment the histogram of unconscious response given on figure 21 will take the form presented in figure 22.

The graph given in figure 22 shows a profile of multiple intelligences obtained when analyzing only unconscious (psychophysiological) response. In this case, the minimum value of PPR making the value –0,73 for the 11th MI type (fig. 21)
is taken to be zero (fig. 22), and the maximum value +0.73 for the 2nd MI type (fig. 21) is taken as 100% (fig. 22). Thus, serial conversion and reduction of PPR allows obtaining MI profile based on psychophysiological or unconscious responses. To find a final profile of multiple intelligences it is necessary to add up and to bring to the relative scale the values of intelligences profiles obtained in conscious and unconscious responses processing.

In figure 22 onwards, the following abbreviated names for the types of multiple intelligence are used:

1. Intrapersonal (IA)
2. Existential-Theoretical (ET)
3. Logical-Mathematical (LM)
4. **Business-Mercenary (BM)**
5. Visual-Spatial (VS)
6. Naturalistic (NL)
7. Bodily-Kinesthetic (BK)
8. Musical-Rhythmic (MR)
9. **Ascetic-Sacrificial (AS)**
10. Verbal-Linguistic (VL)
11. **Arts-Bohemian (AB)**
12. Interpersonal (IE)

**3.3. Determining Multiple Intelligences Profile**

After presenting of 24 questions and images, VibraMI program obtains conscious (Yes/No answers) and unconscious (psychophysiological response in the scale information-energy) data on the responses of an examinee to the presented stimuli. Currently, there are various estimates of the significance of these responses in relation to each other (Freud S., 2010; Baron R., Richardson D. 1994). In view of uncertainty of preferences between the conscious and the unconscious, we considered it was correct to equalize in significance these responses.
It should be noted that it is metrologically correct to solve a problem of addition only for corresponding homogeneous physical values like are conscious responses (0–100)% in the format of answers (Yes/No) and unconscious psychophysiological responses (0–100)%. This approach is implemented by VibraMI program, which consistently brings every human response (conscious and unconscious) into the conditional range from 0% to 100%. In this case, there is the possibility of metrologically correct addition of the results obtained for each type of multiple intelligences, separately for the conscious and unconscious reactions, and the resulting final response (including conscious and unconscious) are again normalized from 0% to 100% after addition. The obtained intellectual profile or the profile of multiple intelligences characterizes the objective attitude of the examinee (the degree of positive perception) to the stimuli, characterizing the relation of a person to each type of intelligences (fig. 23).

It should be emphasized that the obtained MI profile is individual and unique for each person. It determines behavioral and personal characteristics of a person in various situations (Minkin V. A., Nikolaenko Y. N., 2016). In the theory of MI offered by Gardner, it does not restrict a person’s abilities to only one dominant MI type, but uses the entire obtained intelligence profile to determine the area and specialization in which a person can achieve the maximum result. The offered structure and technique of determining MI give almost endless possible number of options to define individuality.

Thus, in contrast to the calculation of general intelligence, the offered method of MI calculation is metrologically correct, there are no operations of addition of non-homogeneous values, or, translating into the language of psychology, different abilities should not be added, they should be analyzed separately. Similar approach to the joint analysis of conscious and unconscious psychophysiological information was offered and developed by Russian Professor Revold Polonnikov in several of his works in the early 2000 s (Polonnikov R. I., 2003, 2006).
3. Psychophysiological Testing of Multiple Intelligences

Fig. 23a. Unconscious responses to stimuli

Fig. 23b. Conscious responses to stimuli

Fig. 23. Final MI profile by averaging the results of unconscious (23a) and conscious responses (23b)
3.4. Professions and Multiple Intelligences

To consider the interrelation of MI profile and career choice we shall consider the current international classification of education. One of the stages in the system of professional identity is searching of interrelations between professional qualities of an individual and the chosen profession. In the proposed method, the binding of MI profile and professions to the international classification of education is carried out. The International Standard Classification of Education (ISCED-F 2013) is a framework which allows for the standardized reporting of a wide range of policy relevant education statistics according to an internationally agreed set of common definitions and concepts thus ensuring cross-national comparability of resulting indicators.

ISCED is a fundamental international document, which regulates elaborating of educational programs, also including the territory of the Russian Federation (All-Russia Classifier of Specialities of Higher Scientific Qualification, ОК 017-2013). Thus, the diagnostics of professional interests and abilities should be based on the available classification of professions. Otherwise, there will be diagnostics of abilities without reference to a specific field of their implementation. VibraMI program allows diagnosing professional interests and abilities with reference to the international classification of specialities (ISCED-F 2013).

ISCED-2013 covers 10 main educational areas, each of them includes 29 fields of education and the particular list of specialties.

**Areas of education:**
01 Education
02 The humanities and the arts
03 Social sciences, journalism and information
04 Management, business and jurisprudence
05 Natural sciences, mathematics and statistics
06 Information technologies and communication
Specialities (skills) are grouped in such a way that there is a common informational component that can be traced. If a person has developed abilities in a certain area, they can successfully fulfill themselves in two or more professional fields (in two or three professions respectively). It is an important component in the process of self-actualization of a modern person, when abilities are not limited to one particular area of professional fulfillment.

The automated diagnostics of abilities (MI profile) with the reference to a particular sphere of professional self-actualization on the basis of ISCED is carried out by means of VibraMI program. In this case, professional specialization is not restricted to one particular dominant type of multiple intelligences; for each specialization, an index of perspectiveness is calculated, which is determined by several main dominant MI types.

Consider the relationship between abilities and the range of recommended specialties exemplified by one of the 10 areas of education: “05 Natural Sciences, mathematics and statistics” (table 1).

In table 1, crosses indicate the most important (in our opinion) MI types, which should be used to achieve success in the specified profession and area of education for group 05. The same expert evaluation was given by the authors for all the 154 specialities (groups of specialities) included in ISCED for other groups.

According to ISCED, natural-scientific cycle of education of group “05 Natural sciences, mathematician and statistics” includes 4 education areas and 9 basic professions (table 1). Information-psychological charge of each of the nine professions involves at least 2–3 dominant types of multiple intelligences. The priority of the dominant MI depends on the informational

07 Engineering and construction
08 Agriculture and forestry, fisheries and veterinary medicine
09 Health and social security
10 Services
Table 1

Expert selection of dominant intelligence types for professions of 05 ISCED area

<table>
<thead>
<tr>
<th>Narrow field</th>
<th>Detailed field</th>
<th>IA</th>
<th>ET</th>
<th>LM</th>
<th>BM</th>
<th>VS</th>
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component of a profession and the personality of the performer (the subject of professional activity). As an example, we shall consider the cycle “05 Natural Sciences, mathematics and statistics” and explain our logic in setting priority intelligence profiles for each speciality. This cycle refers to the exact sciences, the probability of mistakes in mastering which should be minimized. It is assumed that accuracy and concentration, as personality properties, closely coexist with the desire for solitude and reflection, which corresponds to the parameters
of intrapersonal intelligence. At the same time, the listed informational components and person properties are essential not for all professions of the natural sciences cycle “05”. At the same time, they perfectly match the fields of education “Mathematics and statistics”. In this case, intrapersonal and logical-mathematical MI types will be dominant in mastering these professions. Concerning “Physical sciences”, “Biological and related sciences”, there is, on the contrary, a withdrawal of logical-mathematical intelligence in favor of naturalistic intelligence, while maintaining intrapersonal intelligence as one of the dominant. Combinations of intrapersonal and existential-theoretical intelligences are desirable in the acquisition of biological and related sciences, as well as of physical sciences.

Consider in more detail one of the ten main areas of education “05 — Natural sciences, mathematics and statistics”, and their relationships with behavioral manifestations of personality as a subject of professional activity:

051 **Biological and related sciences** include such specialities as biology (0511) and biochemistry (0512). The biological component of natural sciences cycle in this case is dominant and corresponds to naturalistic type of intelligence. At the same time, existential-theoretical and intrapersonal types of intelligences supplement it perfectly. What do these specialties have in common? It is assumed that a person fulfilling their cognitive potential in this area feels comfortable out of the team and can concentrate a long time on the subject under study IA, and has a high motivation to study/research ET. In compliance with the specificity of professional activity, the area of their interests involves studying natural phenomena NL and various objective laws of natural sciences.

052 **Environment** is a priority education segment for persons with the dominant naturalistic intelligence. In case with environmental sciences (0521), and environmental and wildlife sciences (0522), the identity of the names of the dominant
type of intelligence, naturalistic, and the recommended specialties attracts attention. The combination of naturalistic and intrapersonal intelligences is considered optimum in mastering these specialties.

**053 Physical sciences** is an education area, which includes the following specialties: chemistry (0531), earth sciences (0532), physics (0533). The specificity of professional activity involves the acquisition of knowledge in the field of natural-scientific cycle of education, natural phenomena, the ability to analyze and synthesize, and differential leveling of scientific approaches when using existential-theoretical intelligence. Possible various combinations of intelligence types (including an equal ratio) are ET, IA and NL.

**054 Mathematics and statistics** is the last segment in the presented educational direction 05. It is assumed that the tendency to study mathematics (0541) and statistics (0542) is the prerogative of the logical-mathematical and intrapersonal types of intelligence. There is a shift of psychological focus from research activity in the area of calculations and measurements LM, the tendency to isolation IA in professional fulfillment remains. So existential-theoretical intelligence involves validity and integrity for which the ability to calculation and computation is not obligatory (see professions 051–053). On the contrary, logical-mathematical type of intelligence is responsible for calculations and measurements.

Thus, different combinations of abilities allow using individual profile of multiple intelligences to determine the optimum profession corresponding to the calculated MI profile.

Consider a specific example of the calculation of optimal career choice or the compliance of the chosen profession to the available MI profile: Dmitry, 45, an engineer, whose MI profile calculated by VibraMI program is given on figure 24.

In the resulting MI profile, the dominant intelligences are logical-mathematical with a significance level (rating) of 100%, the bodily-kinesthetic with a significance level of 78%, and
naturalistic with a significance level of 66%. Optimal professions, education areas and directions corresponding to the MI profile, shown in figure 24, are given in table 2 in decreasing order of significance.

Fig. 24. Profile of multiple Intelligences. Dmitry, aged 45, design engineer

<table>
<thead>
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<th>N</th>
<th>%</th>
<th>Field №</th>
<th>Broad field</th>
</tr>
</thead>
<tbody>
<tr>
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<td>70</td>
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<td>Information and Communication Technologies (ICTs)</td>
</tr>
<tr>
<td>2</td>
<td>63</td>
<td>05</td>
<td>Natural sciences, mathematics and statistics</td>
</tr>
<tr>
<td>3</td>
<td>54</td>
<td>08</td>
<td>Agriculture, forestry, fisheries and veterinary</td>
</tr>
</tbody>
</table>

The recommended range of Broad, Narrow and Detail fields of specialities in decreasing order of their significance or rating

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
<th>Field №</th>
<th>Narrow field</th>
</tr>
</thead>
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<td>3</td>
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<table>
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<th>Field №</th>
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</tr>
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<td>2</td>
<td>73</td>
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</tr>
<tr>
<td>3</td>
<td>70</td>
<td>0611</td>
<td>Computer use</td>
</tr>
</tbody>
</table>
The rating of each speciality is determined proceeding from the sum of ratings of the dominant types of intelligences, given their number, as for different specialties the number of dominant types of intelligence may be different. For instance, for specialty 0511 Biology, the authors indicated 3 dominant types of intelligence, while for profession of 0541 Mathematics 2 dominant types of intelligence were selected (see table 1).

The offered calculation procedure shows that the technical profile of intelligence with prevailing logical-mathematical (100%), bodily-kinesthetic (78%) and naturalistic (66%) MI types, best meet “Information technologies and communication”, “Natural sciences, mathematics and statistics”, and others, as directions of specialization (table 2). These directions of specialization can be reduced to “Mathematics and statistics” (73%), “Information technologies and communication” (70%) as the fields of education. In its turn, the list of the recommended professions includes (in decreasing order): mathematics (73%) and statistics (73%), computing (70%) and other areas.

Let us check the calculation made by VibraMI program for the first line of specialties rating. The rating of speciality is determined by summing the values of dominant MI types. Dmitry has logical-mathematical MI (100%) as the dominant type. Consequently, its nearest “pair” in profession determining will be intrapersonal MI (47%). The sum of these MI divided into two, is equal to 73% as corresponds to the first line of specialties rating and specialties “mathematics” and “statistics”. Other specialties ratings will be lower than 73%, consequently, both their rating and position in the table 2 will also be lower. VibraMI program automatically places specialties, areas and the directions of specialization in decreasing order of rating which simplifies the choice of optimum specialization.

The obtained results should not be interpreted from the perspective of hyper selection of abilities, i. e. that other professions are not open to this person. On the contrary, age, gender role, economic and social aspects introduce certain
amendments in the structure of occupational choice or choice of a hobby, being available at different stages of life.

The creation and widespread introduction in practice of the corresponding software promotes the maximum disclosure of the personal abilities, which are the cornerstones of MI profile and career choice. The main aspects of MI profile transformation to a specific area of education, the direction and range of professions (with reference to the classifier of specialties of ISCED) are reflected in an intelligible form (in the form of tables and histograms). Clearly structured MI profile and the area of its practical application are designed to facilitate as much as possible a person’s career choice at any stage of life.
Intelligence tests originally were developed as the tools allowing diagnosing many different functions of the human psyche. Psychologists gradually came to the recognition that the term “intelligence test” distorts the true situation, because not all major aspects of intelligence are measured. Certainly, these tests covered the abilities having prime value in that culture for which they were developed. A more current trend of development provides a fundamental integration of the two previously opposing approaches to mental measurement, represented by traditional tests of intelligence and complex batteries of abilities (Anastasi A., 1994). There comes the understanding that abilities of a person can be estimated at different levels of width and by means of various diagnostics methods.

4.1. Interpretation of MI Types

Social roles performed by a person constantly become complicated, as well as the requirements to their professional qualification. Gardner’s multiple intelligences (MI) can be represented in the form of the multicomponent profiles, which include social, emotional and cognitive components of intellectual and psychophysiological activity (see Chapter 2.1). At the same time, there is often a need for a brief characteristic
of each of 12 types of MI. Such need is caused by the fact that each type of intelligence has an oppositional type, counter to it on a particular psychophysiological sign. With the purpose to emphasize an oppositional profile of MI arrangement, a brief characteristic for each of the MI types is provided. The interpretation of MI types extends to both questionnaires Gardner_12S, and Gardner_12. We need to give brief description for the every MI type, also because we add three types to standard Gardner’s classification.

1. Intrapersonal intelligence

Internal resources in this type of intelligence are fundamental in the process of professional self-actualization. The depth of inferences and careful planning is a manifestation of self-discipline and internal control. Restraint, self-sustainability, firmness of beliefs distinguish the representatives of this type of intelligence.

2. Existential-theoretical intelligence

The manifestations of this type of intelligence include the ability to global inferences, interest in research, the ability to formulate questions about life and death, the ability to analyze existential problems. The interests of such a person are beyond ordinary and routine cases, in the field of deep aspects of the universe and fundamental theories.

3. Logical-mathematical intelligence

The dominant logical-mathematical intelligence is demonstrated by a well-developed ability to operate with numbers and to do precise forecasts, to vary abstract concepts, to solve puzzles, finely to differentiate relationships of cause and effect. The love to experiments and difficult calculations has a deep psychological meaning regardless of the chosen sphere of professional self-fulfillment.
4. Business-mercenary intelligence

The representatives of this type of intelligence most efficiently actualize themselves in the field of sales, forecasts and calculations related to them. Analytical-mathematical abilities combined with developed communicative skills intertwine with passion, which does not allow referring this type of intelligence neither to interpersonal, nor to logical-mathematical.

5. Visual-spatial intelligence

This type of intelligence is characterized by the ability to perceive the surrounding objects and phenomena in three-dimensional space, regardless of their initial position and dynamics. Visual type of perception is dominant and has major information-psychological charge. It also manifests itself in a keen perception of color hues and forms, and is characterized by excellent terrain orientation.

6. Naturalistic intelligence

A person with naturalistic intelligence is closely linked to the world around, and finely differentiates the slightest aspects of its transformation. Merging with nature for such people is a synthesis of natural and spiritual sources where man is considered not as the “apex of creation”, but as a part of it.

7. Bodily-kinesthetic intelligence

Different kinds of movements are the main source of self-expression for persons with dominant bodily-kinesthetic intelligence. Well developed might be both gross motor skills (coordination of movements, physiologic equilibration, agility, strength, flexibility, etc.) and fine motor skills (dexterous sensing fingers). A strong bodily-kinesthetic intelligence can be amounted to the inclinations of professional athletes.

8. Musical-rhythmic intelligence

The type of intelligence, characterized by increased sensitivity to sounds and phonemes. It can be manifested as the presence
of an ear for music (but not necessarily) or persistent musical interests. Music carries a deep psychological charge in the life of such a person, being a vocation or a serious hobby.

9. Ascetic-sacrificial intelligence
This type of intelligence is inherent in people with high readiness for devotion and commitment, sometimes reaching the level of self-sacrifice for the salvation of human or other life. Active position in life of such people is based on the ideas of humanity and pacifism.

10. Verbal-linguistic Intelligence
Manifestations of this type of intelligence can be attributed to the skillful mastery of all kinds of speech, both oral and written. It is not rare to find the ability for foreign languages or masterly command of the native language abilities, the ability of a public speaker. Oral speech of such people is easy, graceful, they possess the so-called “innate literacy” and literary style.

11. Arts-bohemian intelligence
The representatives of arts-bohemian intelligence personify themselves with various spheres of art. Public recognition of their exclusiveness and belonging to the sphere of art is the dominant in the sphere of professional self-fulfillment.

12. Interpersonal Intelligence
The manifestations of this intelligence include a high need for various types of communication, with the ability to different types of interaction, per se. The ability to finely feel the mood of other people through their verbal (direct speech, tongue-slips) and non-verbal (facial expressions, gestures) manifestations distinguishes interpersonal intelligence. Ease of communication, the ability to resolve conflicts are natural companions of interpersonal intelligence.
4.2. Example of an Intelligence Profile Creation

Consider a particular example of the possibility of professional identification on the basis of VibraMI program:

Anastasia, aged 21, is graduating from the Polytechnic University in the direction “Mathematics and Mathematical Modeling”. The work in her specialty she combines with coaching and teaching activities of the sports section of dance. The result of testing and creation of Anastasia’s profile of multiple intelligences is shown in figure 25.

![Graph showing Anastasia's MI profile]

Fig. 25. Anastasia MI profile indication according to Gardner_12 questionnaire

The diagnosis of professional interests implies the forced choice situation. The respondent is offered to answer 12 pairs of questions of Gardner_12 questionnaire, accompanied by the images on the monitor screen, aimed at identifying the prevailing type of intelligence (intelligences).

Each pair of questions in Gardner_12 questionnaire includes questions, counter in their essence. Testing in this mode is relatively close to classical lie detection with the presentation of the control and relevant questions, which is psychologically
less comfortable than a smooth psychological testing the sphere of interests, based on related issues within the pair. We believe that the approach with questions, counter on sense, in the pair, better reveals a person’s ability to act in a critical situation, and allows testing at a psychophysiological level the inclination to a certain type of profession and intelligence, since the ability of a person to act in a critical situation is the most informative for career orientation.

The diagnostics of a hobby, on the contrary, is as close as possible to the classical psychological approach implemented when drawing up questionnaires. In Gardner_12S questionnaire there is no “forced choice” situation of two questions having opposite information-psychological charge. Thus, diagnostics of the sphere of interests has self-estimating character of priorities in the sphere of professional choice with the emphasis on the degree of their “pleasantness”, i.e. more reflects a hobby, than a profession. At the same time, the history of mankind knows many examples when a hobby became the second profession.

The result of testing and creating Anastasia’s profile of multiple intelligences by VibraMI program (Gardner_12S questionnaire) is shown in figure 26.

\[ \text{Fig. 26. Anastasia MI profile according to Gardner}_12\text{S questionnaire} \]
According to differential (choice of profession) and summary (the choice of a hobby) Anastasia’s profiles it is seen that in stressful conditions logical-mathematical and intrapersonal intelligences (fig. 26) prevail. That specialty on which Anastasia got her education acts as the optimum sphere of professional self-actualization. Concentration and isolation are frequent companions of mathematicians, this explains the binding of intrapersonal intelligence to logical-mathematical. Bodily-kinesthetic intelligence is also included into the top three intelligences, indicating the existence of reserve areas. This fact is confirmed by the data of hobby diagnostics. In comfortable conditions bodily-kinesthetic and musical-rhythmic intelligences become dominant (fig. 26).

Logical-mathematical intelligence ranks third among the top three intelligences, emphasizing the psychological integrity of the results obtained in the diagnostics of professional inclinations and hobbies. Figuratively speaking, Anastasia, being a coach in the sports section of dancing, does not cease to be a mathematician. However, it is sport (not philosophy and other spheres) is an important component of her professional and personal self-actualization.

What does the list of specialities recommended according to the differential-stress approach to the diagnostics of multiple intelligences tell us?

The direction (wide area), the area of education (narrow area) and the profession (table 3) in the diagnostics of the professional sphere coincide with actually obtained data: mathematics and mathematical modeling.

The direction and possible profession coincided with the real ones: a coach in the sports section of dances. Since it is not about professional sports, but the work on the basis of a fitness club, then the recommended professional direction “Services” is considered by us as the coincidence with the real one. The discrepancy is obtained only in the field of education. We would
Choice of profession. Areas of specialization, recommended at a differential approach to multiple intelligences diagnostics.

Table 3

Gardner_12 questionnaire

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<td>2</td>
<td>44</td>
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<td>Agriculture, forestry, fisheries and veterinary</td>
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<th>№</th>
<th>%</th>
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<th>Narrow field</th>
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<tr>
<td>2</td>
<td>83</td>
<td>0542</td>
<td>Statistics</td>
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</table>

like to emphasize that Anastasia did not get a sports-specific education (as, for example, the graduates of Lesgaft National State University of Physical Education, Sport and Health). In the extended structure of the MI profile developed by the authors, the first sixth types should be classified as technical, and the second six types should be classified as arts types of intelligence. This approach allows estimating the overall contribution of technical and humanitarian abilities in the overall profile of the person being tested (table 4).

The comparison of the results of differential and summary approaches to diagnostics showed significant differences in the profiles, which is a rare case (less than 10% of all interviewed people) when working with this program. Thus, provided differential-stress diagnostics, technical profile prevails, which coincides with the existing specialty “Mathematics and Mathematical Modeling” (fig. 27a). Total-comfortable approach revealed
Table 4
Choice of a hobby. Areas of specialization, recommended at a total approach to the diagnostics of multiple intelligences. Gardner_12S questionnaire

<table>
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<th>%</th>
<th>Field No</th>
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<td>Services</td>
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</tr>
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<td>2</td>
<td>75</td>
<td>073</td>
<td>Architecture and construction</td>
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<td>Sports</td>
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<tr>
<td>2</td>
<td>86</td>
<td>1041</td>
<td>Transport services</td>
</tr>
</tbody>
</table>

Fig. 27. A percentage ratio of arts and technical profiles according to Gardner_12 (27a) and Gardner_12S (27b) questionnaires
the predominance of a humanitarian profile in which “sports” rather conditionally reflects the humanitarian component of a personality, but it cannot be referred to technical specialties either (fig. 27b). According to Gardner’s concept, interest in sports relates to bodily-kinesthetic intelligence (BK). Naturalistic (NL) and bodily-kinesthetic intelligences are located at the boundaries of the center, in antiphase from which humanitarian and technical profiles are located. Thus, Anastasia still has a technical profile, with a professionally oriented hobby in the field of sports.

The need to clarify professional choice is observed throughout active professional life of a person. Specification of professional choice is a need both personal and sociocultural, dictated by the changing standards of modern society. Professional self-identification in the conditions of modern society and its demands implies the modernization of the recruiting system and its tools. Development and deployment of a qualified tool into practice is the key to successful recruitment system modernization.

Psychophysiological approach and its realization availability on the basis of VibraMI program allows to consider this program as a qualified tool for modern recruiting. VibraMI program allows carrying out quickly and efficiently staff recruitment without engaging third-party experts of a narrow profile.

Differential-stress and summary-comfortable approach of VibraMI program allows to test at the psychophysiological level the propensity to a certain type of profession and intellect, as well as the existence of a formed professionally oriented hobby.

### 4.3. We Have Different Intelligences

In the history of psychology and psychotherapy (like in any science) there were many examples when scientists originally preferred experiments on themselves to experiments
on examinees. Sometimes, the entire directions and even the creation of some psychological schools are autobiographical. So for instance, Hermann Rorschach, the author of the well-known test “Rorschach ink blots” (1921), was an artist. His test is a derivative of his own creative and scientific activity, with numerous experiments. No less famous is the history of the formation of existential psychotherapy and logotherapy of Viktor Frankl. In his main work *Man’s Search for Meaning*, published in 1959, titled *From Death-Camp to Existentialism* (Frankl V., 2006), Frankl describes his personal experience of survival in a concentration camp, and states his psychotherapeutic method of finding the meaning of life even in the most severe conditions. A zealous opponent of euthanasia and one of the founders of existential psychology and psychotherapy, Frankl fully tested his method on himself in the natural conditions of the experiment.

In this small chapter, the authors also suggest that the reader become acquainted with the results of the experiments on themselves, i.e. to meet the multiple intelligences profiles of the authors. Perhaps for some readers, a visual demonstration of the authors’ profiles with autobiographical inserts will prove more convincing than mathematical calculations and statistics.

Let us consider which of the multiple intelligences appeared among the leaders, and compare the obtained data with the already existing profession (fig. 28).

The MI profile of Viktor Minkin is a classical profile of a research scientist with an apparent dominance of technical interests over humanitarian (see table 5). Predominant development of the first three types of intelligence is characteristic of scientists, engaged in developments not in a narrow area of specialization, but at the junction of several sciences. Slight development of the last three types of intelligence, primarily verbal-linguistic and interpersonal intelligences, is typical for middle managers of small teams, since
it limits the opportunities for communication with a large number of people. Compare the results obtained with biographical data: practically all his life Viktor Minkin works at the same place, in the field of IT and information-measuring equipment. He is the chief in a relatively small team (15–20 people), the developer and designer of biometric, electronic and photoelectronic systems, the author of more than 50 patents and more than 100 scientific publications in both purely technical areas (development of the CCD, and television systems) and in the field of biometrics requiring knowledge in technique, mathematics, biology, psychology and medicine (fingerprinting, vibraimage technology, the development of identification systems, and of a psychophysiological state of a person). It would be interesting to look at the profile of multiple intelligence 40 years ago and to estimate how much it has changed. Now it is only possible to assume that the change in the profile of intelligences over 40 years was not so considerable, since the author has been involved in about one direction for 40 years, and is making plans
Table 5

Interpretation of the multiple intelligences profile according to Gardner_12 questionnaire

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
<th>MI Type (Viktor Minkin)</th>
<th>N</th>
<th>%</th>
<th>MI Type (Yana Nikolaenko)</th>
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<tbody>
<tr>
<td>1</td>
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<td>IA Intrapersonal</td>
<td>1</td>
<td>100</td>
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<td>95</td>
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<td>2</td>
<td>95</td>
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</tr>
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<td>54</td>
<td>BM Business-mercenary</td>
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<td>68</td>
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<td>33</td>
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<tr>
<td>12</td>
<td>0</td>
<td>VL Verbal-linguistic</td>
<td>12</td>
<td>0</td>
<td>LM Logical-mathematical</td>
</tr>
</tbody>
</table>
for about so many years ahead. At least, for the last 20 years of work on the technology of vibraimage, the volume of issues and studies solved by the technology of vibraimage has increased significantly. The manager’s intelligence profile also determines the way business is carried out in the form of partnerships with various companies responsible for the directions, and the company partners significantly exceed the developer company (Elsys Corp.) in terms of the number of employees.

The MI profile of Yana Nikolaenko is a traditional profile for a specialist in the field of psychology and social sciences, in which well-developed communication skills are closely intertwined with professional ones. Let us compare the results obtained, with the biographical data: Associate Professor of Clinical Psychology, Candidate of Psychology, the author of numerous scientific publications.

Certainly, such an MI profile looks incomplete, and the results presented reflect only formal biographical data. For example, why the “research scientist” (MI profile data of Viktor Minkin)? Why are communication skills “well-developed”, and why are they “intertwined with professional skills” (MI profile data of Yana Nikolaenko)? Is it correct to use such language in writing a psychological profile, what is their evidence base? Not every manager is experienced and successful, not every person with advanced communication skills is a psychologist and, even more so, an expert. In order to answer these questions, it is necessary to touch upon various aspects of the biography affecting the identity of the individual and behavior. For example, a successful and experienced manager takes a long lead position and does not change equivalent positions one on another (see biographical data Viktor Minkin). An experienced manager not only directs someone (BM MI type), but also actively develops himself and allows others to develop (ET MI type), his opinion is authoritative, and he knows how to dose verbal information within the necessary (IA MI type). Excessive communication
may lead to ambivalent interpretation of the orders, which is an extremely undesirable situation in the workflow. The ability to analyze and visualize (ET and VS MI types) can be considered as professional qualities of the chief designer, and as an integral part of productive scientific activity (see scientific publications and patents).

A psychologist is always in the process of interaction with people, products of their business and creative activity (IE, VL, MI types). At the same time, the accuracy of the prognosis of behavior is closely correlated with the ability to analyze utterances, and this is an integral part of the professional activity of a psychologist (ET and BK MI types). Thorough understanding, analysis, abstraction and concretization (ET MI type) are the obligatory skills and abilities accompanying scientific psychological activity.

What does the low rating of certain MI types testify to? A formal understanding of the MI rating can produce ridiculous conclusions. Thus, 0% of distinct manifestation of LM MI will be regarded as an absolute inability of one of the authors of this monograph to logical inferences and mathematical calculations, which is totally not true. Gardner’s multiple intelligences are the concept accumulating different types of abilities, but not the “proficiency/awareness” coefficient. The MI rating is the possibility of selecting energy-consuming areas, but not ascertaining of abilities, the possibility to predict one’s own success in a particular area, with minimum energy consumption. In other words, psychologist-humanist can make certain mathematical calculations, but will spend for them much more effort and time than the chief designer, with technical MI profile (fig. 29).

Consider the range of recommended areas of professional self-actualization — wide area.

Noteworthy is the mirror location of broad areas of specialization of both authors. Natural sciences cycle (mathematics and engineering) is a priority for the chief designer in the same way
as the sphere of education and the humanities for the current teacher of special psychology (table 6).

Consider the range of recommended areas of professional self-actualization — narrow area.

The final stage of selection occurs at the stage of specification of narrow area and speciality (tables 7, 8). Mathematics and statistics is the functional core of metrology, cybernetics and any exact sciences (V. A. Minkin), educational sciences and linguistics is the functional core of psychology and human sciences (Y. N. Nikolaenko).

What do two of these different authors have in common? We hope that besides common (according to MI rating) existential-theoretical and ascetic-sacrificial MI, it is objectivity of judgments. Technical and humanitarian profiles of MI, the diversity of life and professional experience with mutual respect of an author’s position, is, in our opinion, the optimal combination in the search for truth.
### Areas of specialization: Broad field  
*(according to Gardner_12 questionnaire)*

<table>
<thead>
<tr>
<th>N</th>
<th>%</th>
<th>Field №</th>
<th>MI type (V. A. Minkin)</th>
<th>N</th>
<th>%</th>
<th>Field №</th>
<th>MI type (Y. N. Nikolaenko)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>86</td>
<td>06</td>
<td>Information and Communication Technologies (ICTs)</td>
<td>1</td>
<td>98</td>
<td>01</td>
<td>Education</td>
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<td>2</td>
<td>81</td>
<td>05</td>
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<td>77</td>
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<td>70</td>
<td>07</td>
<td>Engineering, manufacturing and construction</td>
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<td>58</td>
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<td>Services</td>
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<td>4</td>
<td>65</td>
<td>08</td>
<td>Agriculture, forestry, fisheries and veterinary</td>
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<td>57</td>
<td>02</td>
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<td>57</td>
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<td>42</td>
<td>04</td>
<td>Business, administration and law</td>
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<td>10</td>
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**Table 7**

**Areas of specialization: Narrow field**  
(according to Gardner_12 questionnaire)

<table>
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<tr>
<th>N</th>
<th>%</th>
<th>Field №</th>
<th>MI type (V. A. Minkin)</th>
<th>N</th>
<th>%</th>
<th>Field №</th>
<th>MI type (Y. N. Nikolaenko)</th>
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<td>98</td>
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<tr>
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<td>86</td>
<td>061</td>
<td>Information and Communication Technologies (ICTs)</td>
<td>2</td>
<td>98</td>
<td>023</td>
<td>Languages</td>
</tr>
<tr>
<td>3</td>
<td>83</td>
<td>073</td>
<td>Architecture and construction</td>
<td>3</td>
<td>78</td>
<td>092</td>
<td>Welfare</td>
</tr>
<tr>
<td>4</td>
<td>77</td>
<td>051</td>
<td>Biological and related sciences</td>
<td>4</td>
<td>75</td>
<td>032</td>
<td>Journalism and information</td>
</tr>
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<td>5</td>
<td>77</td>
<td>053</td>
<td>Physical sciences</td>
<td>5</td>
<td>71</td>
<td>103</td>
<td>Security services</td>
</tr>
<tr>
<td>6</td>
<td>76</td>
<td>081</td>
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<td>6</td>
<td>66</td>
<td>104</td>
<td>Transport services</td>
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<td>7</td>
<td>76</td>
<td>082</td>
<td>Forestry</td>
<td>7</td>
<td>66</td>
<td>102</td>
<td>Hygiene and occupational health services</td>
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<tr>
<td>8</td>
<td>76</td>
<td>052</td>
<td>Environment</td>
<td>8</td>
<td>66</td>
<td>091</td>
<td>Health</td>
</tr>
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<td>9</td>
<td>76</td>
<td>083</td>
<td>Fisheries</td>
<td>9</td>
<td>65</td>
<td>084</td>
<td>Veterinary</td>
</tr>
<tr>
<td>10</td>
<td>74</td>
<td>071</td>
<td>Engineering and engineering trades</td>
<td>10</td>
<td>57</td>
<td>051</td>
<td>Biological and related sciences</td>
</tr>
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</table>
Table 8

**Recommended list of detailed field**
*(according to Gardner_12 questionnaire)*

<table>
<thead>
<tr>
<th>№</th>
<th>%</th>
<th>Field №</th>
<th>MI type (V. A. Minkin)</th>
<th>№</th>
<th>%</th>
<th>Field №</th>
<th>MI type (Y. N. Nikolaenko)</th>
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</thead>
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<tr>
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<td>97</td>
<td>0541</td>
<td>Mathematics</td>
<td>1</td>
<td>98</td>
<td>0111</td>
<td>Education science</td>
</tr>
<tr>
<td>2</td>
<td>97</td>
<td>0542</td>
<td>Statistics</td>
<td>2</td>
<td>98</td>
<td>0231</td>
<td>Language acquisition</td>
</tr>
<tr>
<td>3</td>
<td>86</td>
<td>0611</td>
<td>Computer use</td>
<td>3</td>
<td>98</td>
<td>0232</td>
<td>Literature and linguistics</td>
</tr>
<tr>
<td>4</td>
<td>86</td>
<td>0612</td>
<td>Database and network design and administration</td>
<td>4</td>
<td>98</td>
<td>0321</td>
<td>Journalism and reporting</td>
</tr>
<tr>
<td>5</td>
<td>86</td>
<td>0613</td>
<td>Software and applications development and analysis</td>
<td>5</td>
<td>98</td>
<td>0415</td>
<td>Secretarial and office work</td>
</tr>
<tr>
<td>6</td>
<td>86</td>
<td>0713</td>
<td>Electricity and energy</td>
<td>6</td>
<td>87</td>
<td>1011</td>
<td>Domestic services</td>
</tr>
<tr>
<td>7</td>
<td>86</td>
<td>0714</td>
<td>Electronics and automation</td>
<td>7</td>
<td>87</td>
<td>1013</td>
<td>Hotel, restaurants and catering</td>
</tr>
<tr>
<td>8</td>
<td>86</td>
<td>0715</td>
<td>Mechanics and metal trades</td>
<td>8</td>
<td>82</td>
<td>0314</td>
<td>Sociology and cultural studies</td>
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<tr>
<td>9</td>
<td>83</td>
<td>0731</td>
<td>Architecture and town planning</td>
<td>9</td>
<td>78</td>
<td>0921</td>
<td>Care of the elderly and of disabled adults</td>
</tr>
<tr>
<td>10</td>
<td>83</td>
<td>0732</td>
<td>Building and civil engineering</td>
<td>10</td>
<td>78</td>
<td>0922</td>
<td>Child care and youth services</td>
</tr>
</tbody>
</table>
Currently in psychology and psychophysiology there is no uniform generally accepted approach to psychometrics methodology (psychometrics is the discipline that studies the theory and technique of psychological measurement, including measurement of knowledge, abilities, attitudes and personality traits). To form a correct methodology for personality profiling, the knowledge and standards accumulated in various sciences should be taken into account.

In modern psychology, a number of American and international organizations (AERA, APA, NCME, ETS) are developing standards for education and psychological testing (ETS, 2014). The last update of standards was done in 2014. However, the measurement of multiple intelligences by the vibraimage technology is based not only on psychological testing, on which the standards for education and psychological testing are oriented, but also on measuring psychophysiological characteristics of a person. The closest science that deals with the measurement of psychophysiological characteristics is biometrics, using traditional physical methods to measure biological and behavioral characteristics of a person. The majority of the existing biometric standards (ISO/IEC 2382-37, 2012) is focused on person’s identification according to certain biological or behavioral traits (ISO/IEC19784-1, 2006), while the vibraimage technology uses physiological characteristics of a person to identify his psychological state.

A separate application-oriented area, which investigates psychophysiological responses of an organism, is lie detection.
field. It is the development of lie detection, that promoted the development of theoretical approaches, techniques and tools for studying physiological parameters of a person, including when conducting psychophysiological testing. Conducting psychophysiological lie detection is rather well standardized in the USA, for instance, there are a separate general standards for psychophysiological lie detection (ASTM E1954-05, 2011), a quality control standard for lie detection (ASTM E2031-99, 2016), the standard defining terminology relating to psychophysiological research (ASTM E2035, 2012), standard for calibration and functionality checks (ASTM E2063, 2012) etc. (ASTM E2062, 2011; ASTM E2000, 2014).

For determining multiple intelligences profile, the vibraimage technology uses the latest advances in these three indicated areas. However, the main approach to a person, which the authors adhere to, is information-physical approach to a person, as to a complex cybernetic system (Wiener N., 1948). This approach is based primarily on the theory of information and traditional metrology, which measures physical values, and on the use of metrology and informatics standards for processing of measured physical values. It is the understanding of physical, chemical, biological and physiological laws that allows the authors to convert quantitative data characterizing conscious responses and psychophysiological responses of an examinee to the resulting profile of multiple intelligences.

Figure 30 shows the distribution of intelligence profile for one person, determined by the VibraMI program according to the results of 25 test measurements conducted during 3 months. Since currently there are no generally accepted standards for measuring a profile of multiple intelligences, we will try to estimate the accuracy of the measurements made by the stability of the results obtained on a long-term sample. In this case, of course, it should be understood that the measured value itself (the profile of multiple intelligences) is not constant,
and it can also change over time and from influence of external factors. In addition, the habituation to the stimuli presented also alters the psychophysiological response and affects the stability of the result. In this paper, the authors almost do not address the temporal dependence of multiple intelligences, this question deserves a separate monograph. The issues of temporary changes of psychophysiological and biological parameters are investigated within the framework of separate sciences — chronobiology and chronomedicine, the founder of which, in the modern sense, is considered to be an American scientist Franz Halberg (Halberg F., 1987), whose work in these areas was conducted from the middle of the 20th century. To minimize the influence of habituation, the results of the first 10 measurements were discarded, since the response to the first presentation is most variable and the analysis was done of the next 25 tests. The processing of VibraMI measurement results and graphs building were done by the special program VibraStatMI (VibraStatMI, 2017). The measurement result of such a complex parameter as a profile of multiple intelligences combines many errors (as any other measurement) including methodical, instrumental, systematic, progressive, random errors etc.

In modern information and measurement theory (JCGM 100:2008, 2008), it is customary to characterize the quality of measurement results not by the accuracy, but, on the contrary, by the size of the errors (JCGM 100:2008, 2008; Novitsky P. V., 1975). According to the obtained data (see figure 30), it follows that for almost all significant intelligence profiles (with the level of at least 60%), the spread of the parameters (estimates of Δ and \( \sigma \)) fall within the limits of 20%. This is quite good result, as it should be understood that not only the factors determining the accuracy of the technique (methodical error) affect the spread of intelligence profile parameters, but also the variability of the measured value itself, i. e. conscious and psychophysiological response. Assuming an approximate equality of the indicated
methodical and instrumental errors, the error in determining intelligence profile directly by the method itself becomes 2 times lower and does not exceed 10%. This is quite a good coordination with the other experiments results on determining the parameters of the psychophysiological state (in the field of safety, medicine and psychology) obtained by the vibraimage technology (Minkin V. A., Tseluyko A. V., 2014; Minkin V. A., 2016; Bobrov A. F. et al., 2016).

Fig. 30. Distribution of an intelligence profile for one person, determined by the VibraMI program according to the results of 25 measurements conducted within 3 months

Legend:
- $M$ — mean (average) value of the corresponding profile of the intelligence obtained by the results of 25 measurements;
- $\Delta$ — the mean of absolute value of an error (in our case it is equal to the value of the reduced error, since the measurement range of all profiles is the same and makes 100%) of the measurement of the corresponding intelligence profile obtained by the results of 25 measurements;
- $\sigma$ — the standard deviation (SD) of the corresponding intelligence profile values obtained by the results of 25 measurements.
What made it possible to achieve an instrumental error of 10% (about 90% accuracy) in determining the profiles of dominant intelligences during such a short testing, within 5 minutes, and with the questionnaire of only 24 questions? We highlight the main points of the proposed approach, which, in our opinion, allow such high accuracy in determining the dominant profiles of multiple intelligences.

— Conducting a short testing does not result in fatigue of an examinee and does not create additional errors from the changes in psychophysiological state of an examinee in the course of the experiment. One of basic rules of metrology is that it is pointless to measure a value with the accuracy exceeding its change in process of measurements. That is why long-term psychophysiological tests often give ambiguous results, as the examinee’s PPS (fatigue, irritation, response rate) changes significantly in the course of testing, which affects the measured physiological parameters. A repeated presentation of the same or similar questions only worsens the situation from the point of view of PPS changing. Of course, fatigue is not so important when detecting lies, other tasks are prioritized in this area, and many hours of testing can have a certain meaning, since an examinee may try to hide information. While in determining the profile of multiple intelligences, the person being tested should be interested in obtaining the correct result, it makes no sense for him to deceive himself and the system, therefore, multiple repetition and presentation of identical questions will not lead to an increase in accuracy, but, on the contrary, will lower it.

— Optimal formation of the questionnaire structure (actually tied to the developed structure of MI) makes it possible to identify an adequate response of an examinee to the stimuli presented, and to increase the amount of information used in analyzing the psychophysiological response to the stimuli presented. In modern psychophysiology, it is known that the sequence
of stimuli presentation significantly affects the psychophysiological response of an examinee (Baur D., 2006; Varlamov V. A., 1998). We suggested that it is advisable to establish the sequence of stimuli presented to an identical intelligence structure, and for results processing it is necessary to use the method of comparative zones of testing, used in psychophysiological detection of deception (Zone Comparison Test ZCT) (Backster C., 1963; Baur D., 2006). ZCT allows obtaining and analyzing comparative response of an examinee when answering the presented questions, and to enhance the significance of these psychophysiological responses, the questions and stimuli presented have opposite orientation in every pair of questions corresponding to every type of MI. This approach makes it possible to achieve the maximum response of the examinee to the presented stimulus, and to reduce the influence of different noises on the statistics of the results obtained.

— Optimization processing of the obtained responses data to the stimulus being presented, is in the fact that for the opposite types of multiple intelligences, not only the questions aimed at revealing the response to the given type of intelligences, but also to the intelligence type opposite to it are informative. For example, a psychophysiological response to the questions aimed at identifying interpersonal type of intelligence, can also be used to determine intrapersonal type of intelligence, and they should be counted with the opposite sign. This approach allows us to process the information of 4 questions for the extreme types of each of the 12 intelligences, while the total number of questions remains 24. The lack of such an approach to the results processing would require the presentation of 4 questions for each type of intelligences, then the total number of questions would make 48, and the duration of testing would exceed 10 minutes. However, it was found that the majority of examinees tired after 5 minutes of testing, and the response to the second part of the questions will be markedly
different from the first one, which makes it senseless to simply increase the number of questions for each multiple intelligence. The proposed combination with increasing informative value due to combining the processing of the response to opposing types of intelligences, does not increase the duration of testing, resulting in a noticeable increase in accuracy by reducing random error when averaging results.

— A joint presentation of textual information of the questionnaire and a visual picture that enhances conscious perception of the stimulus and stabilizes psychophysiological perception of the stimulus, allows the user to concentrate more on the stimulus presented and be less distracted by extraneous factors.

— The informativeness of the vibraimage technology in obtaining psychophysiological data due to the vestibular-emotional reflex exceeds the informative value of other physiological signals, reflecting the response of the tested person to the stimuli presented.

Consider the results of the measurements accuracy (error) analysis obtained from the same sample of 25 tests, and verify that the accuracy of determining the MI profile increases after each proposed operation on data processing. Figure 31 shows the distribution of the intelligence profile for one person, determined by the VibraMI program based on the results of 25 measurements conducted during 3 months, obtained without taking into account the averaging of the results of the opposite intelligence profiles. In this case, the distribution pattern of the profiles is almost the same as that shown in figure 30, which is quite logical, since the result is obtained from a large sample. However, the values of the absolute error $\Delta$ and the RMSD $\sigma$ have increased noticeably. If in the final calculation the average value is $\Delta = 15,2\%$ and $\sigma = 19\%$, then disregarding opposition bonds, the spread increases by more than 10% ($\Delta = 17,8\%$ and $\sigma = 22,2\%$).
By switching to the analysis of only conscious response to the presented questions in Yes/No format, the instability of results also increases (fig. 32) for the leading types of MI.

In this case, there is also a certain changes in the MI profile of the dominant intelligences in relation to the final result. It is interesting to note the fact that the variability of the dominant types of intelligence exceeds the variability of poorly developed types of intelligence (fig. 32), which is especially unpleasant since the main task of the intelligence evaluation system is the high accuracy in precisely determining the dominant types of intelligence. At the same time, the mean values of the spread of the values of the intelligence profiles increase noticeably and make $\Delta = 19,8\%$ and $\sigma = 26,8\%$, which exceeds the achieved result by more than 20%.

A similar picture is observed with a separate examination of the psychophysiological response to the presented stimuli, obtained from the same results base (fig. 33).

The obtained distribution profile of multiple intelligences bears little resemblance to the final result, although the main type of intelligence in a separate calculation of the psychophysiological responses and the final version coincide. In this case, there is a minimal difference in the values characterizing the error and instability with respect to the measured values, i.e. among the provided graphs (fig. 33) it is characterized by the maximum relative error of measurement.

Considering the given results of a relatively simple experiment, from the information theory point of view, allows drawing interesting conclusions. However, before proceeding to the measurement of human intelligence, let us consider a simpler example of current measurement. On the basis of the well-known Ohm’s law, it seems obvious that 1 mA flowing through a resistance of 1 kΩ creates a voltage drop of 1 V. In this case, referring to the indicated values, we mean the mean values, and the results of the voltage measurements can
5. Analysis of Accuracy in Intelligence Profile Determining

**Fig. 31.** Distribution of an intelligence profile for one person, determined by the VibraMI program by the 25 measurements

**Fig. 32.** Distribution of an intelligence profile for one person, determined by conscious responses (25 measurements)

**Fig. 33.** Distribution of an intelligence profile for one person, determined by psychophysiological responses (25 measurements)
be in the range \((0,999 \text{ V}; 1,000 \text{ V}; 1,001 \text{ V} \text{ etc.})\), the spread of the measured values being determined by the probabilistic characteristics of the current and voltage (Novitsky P. V., 1975). Man is a more complex object than the example given. The number of information signals exchanged by a person’s physiological systems for every second exceeds the amount of information that all computers in the world process for the same time. Naturally, the measured characteristics of a person always contain the uncertainty of the transformation, manifested, in particular, in the form of measurement errors. At the same time, the distribution of measurement errors in accordance with the theory of information obeys the known laws, no less obligatory for execution than Ohm’s law. One of such laws determines the summation of errors from several transformations. Despite the complexity of the measured psychophysiological processes, the conscious human response to the stimulus and the psychophysiological response should be considered as two conditionally independent measuring transformations. Generally (Brillouin L. N., 1962; Novitsky P. V., 1975), it is known that the total error (SD or RMSE) of two transformations is determined by the equation (4), which is valid for correlated and uncorrelated processes

\[
\sigma_\xi = \sqrt{\sigma_1^2 + 2\rho\sigma_1\sigma_2 + \sigma_2^2}. \quad (4)
\]

However, if these processes are not correlated with each other

\[
\sigma_\xi = \sqrt{\sigma_1^2 + \sigma_2^2}, \quad (5)
\]

\[
\rho = 0.
\]

Only in one case, the total SD, when measuring two processes, may be less than one of the values, values if the processes have a correlation coefficient \(\rho\) equal to \(-1\) or near it. In this case, the total root-mean-square deviation is determined by equation (6)
\[ \sigma_\Sigma = \sqrt{\sigma_1^2 - 2\sigma_1\sigma_2 + \sigma_2^2} = |\sigma_1 - \sigma_2|, \quad (6) \]

\[ \rho = -1. \]

Let us return to the SD shown in figures 31, 32, 33. The analogical regularities in SD distributions received in our experiments provided not only in this concrete case, but also in the other experiments provided as for one person as for groups of people combing in different attributes, like social groups. The value of errors shown in figure 31, obtained by summing conscious and unconscious responses, turned out to be approximately 50% lower than the errors obtained by measuring each of these quantities separately (figure 32 — conscious response, figure 33 — unconscious response). It was shown above that it is possible only if both parameters (unconscious and conscious responses of a person) have a rigid functional connection with the measured parameter — the profile of multiple intelligences, and the conscious and unconscious responses have an inverse correlation. The conducted development showed that the ratio (correlation, difference) of the conscious-unconscious is one of the most important psychophysiological characteristics of the personality. Further investigations of the conscious-unconscious relationship can be used to obtain additional information, both on the intelligences profile and in other areas of psychophysiological research.

The provided information-metrological proof of correctness of the proposed method for determining the structure of multiple intelligences profile can also be explained by a logical description, without the use of equations. If a proposed model of any phenomenon is correct, then the accuracy of calculations carried out with the correct model will always be higher than the accuracy of calculations made by the erroneous model. In biometrics and psychometrics, as well as in modern physics, most of the processes are of a probabilistic nature, and one should not strive to obtain absolute 100% accuracy or zero
error; it is unreasonable and illiterate (Novitsky P. V., 1975). One should not measure or estimate the measured value with an error less than the variability of the measured value itself. As shown by the conducted experiment, the profile of multiple intelligences for a particular person is a quasi-stationary concept. It is a function including the current psychophysiological state, which varies considerably depending on many external and temporal factors. Therefore, in this paper we consider the evaluation of multiple intelligences profile in an inseparable connection with the methods of assessing the current psychophysiological state of a person.
6.
ADDITIONAL POSSIBILITIES OF MULTIPLE INTELLIGENCES RESEARCH

We should not expect that the work done puts the final point in the study of multiple intelligences. On the contrary, we consider the current stage as the next step in the process of the abilities and capabilities cognition. The conducted studies showed the following bottlenecks of the proposed technique, which require further work and refinement:

— A significant dependence of the result (intelligence profile and specialization) on a certain choice of a question and stimulus (picture). Even thematically related questions can give the opposite result of both conscious and psychophysiological responses. Indirectly, it is confirmed by the reduced spread of conscious response, because depending on the mood, fatigue or other external factors, a person can respond in different ways to the same question. The existing version of the VibraMI program questionnaire gives each user the opportunity to change questions and stimuli at their own discretion. Perhaps, after carrying out extensive statistical research in various target groups, the current questionnaire will be significantly revised. At this stage, we considered the main task to develop a testing technique and tools, which provide maximum opportunities to researchers with not only for collecting statistics according to the existing methods, but also for its development.

— Increasing the effectiveness of registration a psychophysiological response. The given data of the signal-to-noise ratio (the ratio of the profiles of dominant intelligences to the spread of the corresponding profile), obtained by the psychophysiological response are much inferior to similar
data obtained by a conscious response. Of course, there are many objective reasons for this, since the reproducibility of unconscious processes in humans is likely to always be lower than the reproducibility of conscious processes. However, the authors hope that the limit in the algorithms for registration of a psychophysiological response has not yet been reached, and even more accurate processing of the results in the information-energy (I-E) scale will allow for greater accuracy. For example, in the current version of VibraMI program, the processing of the changes in psychophysiological response takes a fixed time for each stimulus presented, and does not take into account the reaction rate when answering a question. This approach gave the best accuracy rate in a statistical sample. At the same time, the program fixes the reaction rate when answering questions, and in the future this additional parameter can be used if its effectiveness is proved statistically. The vibraimage technology used to register psychophysiological response makes it possible to obtain more than 10 informative parameters of a person’s psychophysiological state change, of which only the information coefficient (almost efficiency coefficient) and the energy expenditure are used in this processing. Perhaps, maybe in future there will be other physiological parameters that more informatively reflect a person’s response to a stimulus.

— The technique developed by the authors suggests using two almost independent approaches to determining the profile of multiple intelligences of a person, the first — for work, the second — for hobbies. This dual approach to a person in a critical situation (business) and a favorable situation (hobby), definitely, has certain grounds, but so far, it is based more on the theoretical reasoning of the authors than on practical and statistical confirmation. It is necessary to conduct large-scale statistical studies to confirm or reject the proposed hypothesis.

— Of particular interest is the research of the multiple intelligences of one person over a long time. The authors of this method assumed that the profile of multiple intelligences can
undergo significant changes from time and various factors. This assumption also requires experimental confirmation. Perhaps, it is necessary to develop a set of quasi-identical questionnaires in order to reduce the effect of habituation in long-term measurements. However, the identity of such questionnaires should be proved on separate statistically reliable samples, while the development of similar (quasi-identical) questionnaires is the subject of a separate research.

— With all the objectivity of mathematical calculations of multiple intelligences profile, the binding of the calculated profile of multiple intelligences to specialization was made expertly with the help of subjective author’s evaluation. Of course, the VibraMI program allows adjusting the binding using simple changes in the Excel table. Advanced users can enter their connections between the profile of multiple intelligences and specialties in the ISCED-2013 format, or even change the format of specialties and add new professions to the table. Currently, the developed technique only makes the first steps in statistical approbation. The authors do not exclude that after gathering statistics, some provisions can be corrected and most likely, it will be necessary to increase the objectivity of binding tying the multiple intelligences to professional orientation.
CONCLUSION

The structural line-opposite reorganization of the multiple intelligences theory carried out by us allow to consider the obtained personal profile of multiple intelligences as the most complete characteristic of an individual responsible not only for the possibilities of professional growth of a person, but also for the majority of behavioral, emotional, social and other characteristics that determine personality development.

This work reveals new possibilities of the vibraimage technology for the study of multiple intelligences and other personal characteristics of man using the feedback principle in the synchronous analysis of conscious and unconscious (psychophysiological) responses of a person to the stimuli presented. The first monograph on the vibraimage technology (Minkin V. A., 2007) was written about 10 years ago, and described a direct conversion of motor activity into the characteristics of psychophysiological state on the basis of the vestibular-emotional reflex. As the author suggested, the direct conversion of motor activity into the characteristics of psychophysiological state turned out to be in demand, primarily in security systems to identify potentially dangerous people by means of vibraimage systems. Such systems have shown their effectiveness during the Olympic Games in Sochi (Minkin V. A., 2014), and are actively used in Russia and other countries to identify terrorists and prevent crimes. This work shows that vibraimage technology can open a new page in research of correlation between conscious and unconscious responses in psychophysiology.
Similar programs for security systems can be built on the principle of PPS analysis when stimuli are presented, which is described in this paper. Programs of the loyalty analysis to the principles and values of any state, society or production company can be based on the suggested method. Passing such a test of loyalty or human variability (National Academies of Sciences, Engineering, and Medicine, 2016) may be in the future an integral part of obtaining a visa, along with scanning fingerprints. Not so long ago it seemed that biometric identification of a person is a pure fiction, but the next step in improving security will inevitably be the biometric identification of a psychophysiological state. Loyalty to the principles and values of the state is the same characteristic of a person as fingerprints, and its biometric identification is a very specific technical problem that has a unique solution, for example, using the vibraimage technology.

However, the results presented in this monograph and the other publications (Bobrov A. F. et al., 2016; Minkin V.A., 2016) show that the use of the vibraimage technology with a synchronous analysis of the various stimuli presented allows us to significantly expand the range of problems solved by the technology of vibraimage. The introduction of programs for determining the profile of multiple intelligences in the processes of primary schooling and vocational guidance will allow qualitatively to distribute human resources and to contribute to the actualization of the capabilities of each tested person.

The results of theoretical and experimental studies presented in this monograph allow us to evaluate the relationship between conscious and unconscious processes taking place in the human body somewhat differently. The proposed technique gives different researchers a simple practical tool for analyzing complex psychophysiological processes. Now, practically, every person can act as a researched dog, and as Academician Pavlov (Pavlov I. P., 1967) since all that is needed for psychophysiological experiments is a computer and a web camera that everyone currently has; and the VibraMI program
described in this work has a test mode for conducting research without buying software.

The principles described in this paper can be used not only to determine the profile of multiple intelligences. Another scientific value of this work is the theoretical development and experimental confirmation of a general method for determining the degree of positivity (or negativity) of a conscious and unconscious response to a stimulus in analyzing the change in the information and energy characteristics of the person being studied. It is the internal processes of information-energy exchange, continuously occurring in every person, that determine our personality, and the technology of vibraimage allows us to visualize and decipher these processes.

The authors openly talk about the principles of building their own methodology and do not fear that someone will be able to prepare for the test, having preliminary information about the questions and stimuli, since nature itself provides the necessary feedback protection for obtaining true information. If to determine one’s own profile of multiple intelligences, such an approach is unquestionable, then in the case of loyalty tests, we foresee the objections of many opponents to the openness of the tests. However, the very hypothesis proposed and proven by the authors that constant adjustment of conscious responses with the help of an unconscious psychophysiological response makes preliminary preparation for passing the test a meaningless procedure. It is the correct testing technique, based on physical laws, that should be an objective evaluation of both the profile of multiple intelligences and other personal parameters. Meaningless coding, protection and storage of insignificant subjective information create more security gaps, and do not solve problems, but creates them. Person is the only carrier of unique biometric information, and the means of copying it are physically meaningless. It is necessary to solve the problems of biometric identification of a person and a psychophysiological state of a person in real time, only this approach contributes to the optimal development of both the individual and society.
REFERENCES


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Appendix

GARDNER_12 QUESTIONNAIRE

1. Being alone with my thoughts is enjoyable

2. Talking to strangers is usually a comfortable task
3. A philosophical way of thinking prepares for any change in life

4. A person must act and not debate in any situation
5. I can solve complicated mathematical equations

6. Numbers are worthless, I prefer words
7. My wealth is important, the rest is not important

8. Charity is more important than profit
9. Charts help me better understand information

10. It's easier to understand information when I hear it
11. Wild nature is the true definition of beauty & greatness

12. Smooth asphalt is better than picturesque landscape
13. I am well coordinated and constantly on the move

14. Hammering a nail into a wall is a challenge for me
15. Memorizing melodies is an easy task for me

16. Karaoke & singing in public are not my cup of tea
17. Making the world better & more kind is important

18. Helping others is absolutely meaningless
19. Words express everything unlike numbers

20. Equations are easier to understand than words
21. I easily adapt to what is necessary

22. Standing out from the crowd isn't an interest of mine
23. Live communication is better than correspondence

24. People usually tire me out
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<tr>
<th>ACRONYMS AND ABBREVIATIONS</th>
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<tr>
<td>Arts-Bohemian</td>
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<td>Ascetic-Sacrificial</td>
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<td>Bodily-Kinesthetic</td>
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<td>Business-Mercenary</td>
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VIBRAIMAGE
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