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Neuropsychological markers of pro-social behavior and neuropsychological markers as indicators of asocial (criminal) behavior

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Abstract

This study includes also preparatory methodological note to the extensive research whose main goal is to confirm or reject the hypothesis that human psyche is a specific quantum phenomenon with a specific configuration of quantum waves since, in view of the fact that, by definition, it is a self-organizing, self-regulating and self-realizing living dynamic system on macroscopic level. Its specificity consists in the fact that it is just a self-containing and self-realizing phenomenon which as such is in case of need able to rotate neuronal activity of the living central nervous system structure, which is at the same time its carrier, by 180 degrees. The research is elaborated in several stages. One of the goals of the first stage is to acquire and process data about facts which are related to contrary displays of real psyche of two groups of people in precisely defined time and situational conditions. These are people with pro-social behavior as opposed to people with asocial behavior. Research strategies are, besides other things, focused on finding out the fact, what determines the changes in informational system of cytoplasm and what are the causes of these changes concerning people with various pathological displays of behavior and experience, in connection with pathology of relevant neuronal circuits. Acquired data will be compared to the results of relatively healthy people. Understanding the mechanisms and rules which are used here provides possibility of practical use of this knowledge in clinical practice and it strengthens theoretical base of neuropsychology and its heading towards deeper knowledge of human psyche nature. The research project in this direction of applied research provides simultaneously possibility to acquire and process data about differences of connectivity of psychical phenomena with changes in biochemical activity and bioelectrical reactivity in belonging neuronal structures in norm and pathology. The data about specific changes of neuronal complexity will be statistically processed as well. Then the data about morphological differences (given by pathology or developmental neuroplasticity of cortical areas) of brain structures which belong to the examined psychical phenomena concerning both research groups will be processed and their comparison will be performed.

Key words

human psyche as a specific quantum phenomenon (c-phenomenon), personality and connectivity with structures of central nervous system, distance or closeness of psychical and neurophysiological phenomenon, pro-social versus asocial behavior

Introduction to the issues

The first stage of research strategies is divided into three directions of applied research as relatively separate research activity heading towards the confirmation or refusal of the hypothesis that human psyche is a specific quantum phenomenon on macroscopic level. However, all three directions follow from one neuropsychological and neuroscience informational scientific basis, from the same findings of Czech and foreign neuropsychological researches and from one framework of research strategies. One of the practical goals of the first stage of research strategies is to constitute, on the basis of achieved results from the research in particular area of daily life of people, such original neurorehabilitation and social rehabilitation programs, which would initiate motives and effort in people to achieve relatively permanent change in favor of improving the quality of their life.

Above mentioned procedures and mainly conclusions of 3-stage research project will be followed by core research strategy focused on finding out the answer to the research question whether human psyche is a specific quantum phenomenon or completely different, still unknown, self-realizing phenomenon which we call C-phenomenon (consciousness phenomenon).

On the scientific way of neuropsychology heading towards understanding the nature of human psyche it is necessary to find the courage to such a mental step which can help us to enter the paradigm of quantum physicists' and mathematicians' thinking who try to find the answer to the questions about the nature of space and number of dimensions of time-space and quantum nature of all things etc. Basic mistake of existing elementary experiments (e.g. "quantum psychology") is that they try to follow from existing theories of multidimensional space-time and from quantum theory. But this is not the way to the shift in scientific knowledge of human psyche. Existing theories of multidimensional space (hyperspace) beginning with Kaluža-Klein theory (in this new theory of gravitation the light was supposed to be trembling in the fifth dimension), superstring theory by M. Green, J. H. Schwarz and E. Witten (1987, Cambridge Univ. Press) ending with uniting M-theory by E. Witten are "mathematical rhetorics" rather than generalization of scientific knowledge about real phenomenon. And also in no case we think about active self-realizing phenomenon which is human psyche.

For example, in M-theory there is a synthesis of five existing string theories (which are according to the author principal), which in fact describe one and the same phenomenon from different points of view. M-theory expects the existence of 12-dimensional space-time (11 dimensions plus time). The problem is that it is not possible to mathematically describe the eleventh dimension by a real number. Extremely valuable fact for neuropsychologists is the possibility to consider these theories to be rather models which provide possibility of their further development or correction and also possibility to observe paradigm of physicists' and mathematicians' thinking which was heading towards setting up these specific theories.

Such a procedure makes it easy to proceed from easier to more complicated (to human psyche) and understand phenomena, such as electromagnetic wave motion which simultaneously show both wave and particle features. This duality was denied several years ago. Another important fact is that the principle of independence of wave motion and principle of interference apply to every wave motion in given space. Every wave motion spreads as if there is no other wave motion there (even if it is there!!!!). Various wave motions form to-

gether compound wave motion (interference phenomena). This mental way simultaneously requires understanding mental way of physicists and mathematicians heading towards setting up the superstring theory (which asserts that matter consists of vibrating strings and specific frequency corresponds to specific elementary particles) and reflections about dimensions of space-time. Scientists do not know the answer to the question where the primary impulse to vibrate the strings emerged. However, they work on the assumption that before Big Bang there was 10-dimensional space which was unstable and (Big Bang) fell apart to two spaces. One is the space where we exist and which stretches (4-dimensional) and the second is 6-dimensional which curled. There could be a conclusion that human brain provides 4-dimensional space for biochemical and neuropsychological processes. Thanks to its specific architecture and through repetitive "big bangs" (that is through permanent motion of action potentials and their transformation into psychical phenomena) enables the existence of specific multidimensional (6-dimensional) space which is human psyche, where information (thought) moves without direct dependence on its material carrier and regardless its 4-dimensional space-time restriction. If we think about quantum phenomena in 4-dimensional space on neuronal level (we consider microtubules to be their carriers), then in case of human psyche it is not possible to think about six or ten dimensions. We need to go beyond the tenth dimension, to the thirteenth one, which is possible to be hypothetically considered as self-realizing dimension. We still do not know what form of quantum phenomenon it is or if it is completely new, still undiscovered and unexplored phenomenon. We call it C-phenomenon. Under contemporary state of scientific knowledge and existing means we are not able to get to the heart of other dimensions. Big hopes for neuropsychology are scientific researches in CERN where the researchers probably managed to vibrate the strings on elementary level so that some elementary particles manifested themselves. We would like to contact these scientists while solving the issue of the nature of the most complicated phenomenon in space. This phenomenon is human psyche and its potential.

Very important step is to verify a human potential (and also the degree of possible pathology) necessary for realizing the change in their existing thinking about themselves and about the world, which surrounds them, and which also manifests itself as a specific change of neuronal complexity. We suppose that this change will be reflected in behavior and experiencing of a man as a change of his/her lifestyle leading to the improvement of a life quality. We build upon the fact that every change of existing paradigm of human thinking "about things and phenomena" simultaneously represents the strain both for mind and for relevant neuronal structure. At the beginning it is not easy for brain and "I" as the core of personality to exceed stereotypical behavior. For this reason we expect that contemporary analysis of the degree of psychical and physical resistance of a man enables us to predict, whether this change will become relatively permanent, and whether it will really lead to the improvement of life quality of a particular person or whether it will be preserved only for a short time after psychotherapy, neurorehabilitation or social rehabilitation or whether nothing happens.

Therefore it is necessary to find out at first, how the degree of willingness or unwillingness of a particular person to accept new, unusual reality, necessity to change behavior etc., manifests itself. It is important to get it clear, what mechanisms and rules are applied in case of refusing something else than people have been used to so far, although it is objectively bad for them, not only on psychical level, but also on neurophysiological

and biochemical level (see e.g. psychical and physical addiction to ethanol). Despite the fascinating ability of neuroplasticity, the brain is "conservative" in its action. Metaphorically speaking, the basics of the living brain are a permanent information flow and its processing sufficiently secured in terms of energy at every moment. Without this "filling", without permanent information flow, the brain existence would lose meaning.

Brain in its activity follows, besides other things, the principles of energy efficiency. If something is presented in a different way from what the brain learned to perceive and informatively process, it can be refused by it. It is more energetically efficient for brain to process information in learned regime, than to restructure existing configurations of active neuronal circuits in neuronal networks, which interact with each other and thus represent complex information system. In this dynamic information system the inhibitive and activation mechanisms are applied in accordance with the biological meaning (see Damasio, 1999, 2000, 2004), in order the changes of neuronal complexity on biological level, which would lead to the chaos and death of the whole living organism as a result, will not happen. However, the changes in the environment cause changes in the interactions and they deviate the homeostasis into the unbalanced state. Deterministic chaos, which is the chance for the positive developmental change of the structure of central nervous system or for the change in the activity of neurotransmitter receptive areas, can generate from it. In case of the abnormality up to pathology, the stochastic chaos, which deepens instability of the living organism, on the contrary, can manifest itself. Brain defends itself against "innovations", so that e.g. it brings new, unusual information into the existing neuronal circuits. Thanks to this the information loses its newness and significance for the individuals and it is neutralized.

However, human brain "paid for" the fact that it generates, by definition, human psyche, because it runs on different principle. But human psyche is not content with uncertainty, chaos, "disorder", but it strives for set of rules. Although the premises are sometimes incorrect, in an extreme situation it rather accepts following pseudological unit based on them, in order to decrease psychical strain and higher energy output. The fascinating fact about human psyche is that "I", as the core of personality, has the "key" for getting human psyche from fixed schemes in order not to stagnate. Human mind, I as the core of personality, by means of this "key" decides as a result also on behalf of brain about the direction of further development. The key is the ability to ask questions, original thinking, creativity, intuition, desire to discover something new, will, ability to predict and self-overlap. This all enables I to decide in case of unclear and open situations to set itself a target corresponding to the motive on the basis of updated motive for the new solution. A man heads towards finding out the new and unusual solution of the old problem while preserving meaningfulness of such a procedure. This will open the way for processes, which in accordance with brain neuroplasticity simultaneously lead to the change on synaptic, modular and multimodular level in neuronal networks, mainly in those which are connected to prefrontal cerebral cortex. Structural and functional change is influenced also by ability of so called lateral thinking (see E. de Bono, 1971). In this context it is necessary to pay higher attention to the fact that brain structure in early childhood influences also prevailing positive emotional background (Trevarthen, 1990). However, positive emotional background, disposable optimism (Carver & Scheier, 2002) have a positive effect on the degree of brain neuroplasticity while getting new experience and new knowledge and also on their use for all further life of a man.

Research methodology

In the first stage of research strategies one of the goals is to acquire and process data about facts which are related to (theoretically substantiated) psychical phenomena chosen by us, demonstrating itself on the behavioral level in contrary displays of real psyche of two research groups of people in precisely defined time and situational conditions. In this case these are specifically people with pro-social behavior as opposed to people with asocial (criminal) behavior. The research project in this direction of applied research provides at the same time possibility to acquire and process data about differences of these psychical phenomena with the changes in biochemical activity and bioelectrical reactivity and connectivity of belonging neuronal structures. The data about specific changes of neuronal complexity will be processed statistically as well. Also the data about morphological differences (given by pathology or developmental neuroplasticity of cortical areas) of brain structures which belong to the examined psychical phenomena of both research groups will be processed and the comparison will be performed. All people included in the first and second research group will be exposed for a short time to a conflict stress situation and non-conflict stress situation, where the data acquired by both procedures will be compared to the data concerning psychical phenomena and their neuronal connectivity and neuronal complexity in a resting state. Understanding and recognition of mechanisms and rules of the changes of particular psychical phenomena and neuronal connectivity and the analysis of specific changes in neuronal complexity demonstrating themselves in particular interactions with external environment modified by research, make constitution of psychotherapeutic, neurorehabilitation and mainly social rehabilitation programs easy. These programs better correspond to given potential of particular people and in fact (and not experimentally) initiate their own decision to positively change their behavior. Solution of the research issue in this second direction of the applied research requires team and interdisciplinary cooperation both within the research project GA ČR at the Institute of Psychology at the Faculty of Arts of Masaryk University in Brno (the investigator of neuropsychological research doc. PhDr. Lubomír Vašina, CSc.) together with the Institute of Interdisciplinary Studies (IMS) in Brno (Tomas Bata University in Zlín) based in Brno (head of the socio-pedagogical research team and team for social rehabilitation programs Ing. Miroslav Bargel, PhD., Dipl. EBS) and with the research team from The Sam Houston State University in Texas and then with the Centre for Neurosciences (CEITEC) at the Faculty of Medicine of Masaryk University in Brno.

Newly constituted research in the stated field is based on knowledge of those mechanisms and rules, which are used in case of particular, theoretically substantiated psychical phenomena in norm and pathology confirmed by research (see Vašina & Bargel, 2011) and chosen by us and manifesting themselves in pro-social and asocial behavior of people. We will pick up the threads of this knowledge in following research, where we will focus on the analysis of differences in connectivity of chosen psychical phenomena with neuronal activity of relevant brain structures and on the analysis of related specific changes in neuronal complexity of people with pro-social behavior as opposed to people with asocial behavior. These differences and changes manifest themselves in the interactions with external environment modified by research. The essential goal of the research is to acquire such knowledge, which is of great importance for constituting particular

psychotherapeutic, neurorehabilitation and social rehabilitation programs, leading to the radical, relatively permanent change of behavior of people with asocial behavior. By means of this way we explore maximally possible reduction in relapse of their asocial behavior. Certainly, we must expect sufficient potential of a concerned person, so that any change can happen.

In the effort to initiate the change of human behavior we must, besides other things, expect also complications following from the fact, that also a living brain itself contains barriers, which obstruct bringing about any changes easily.

The framework of research project

While constituting the research project, we relied on above mentioned facts and worked on the presumption that higher incidence of negative life events and emotional stress in the course of life concern people with asocial behavior as opposed to the people with pro-social behavior. Long-acting stressors causing the stress responses above limits (often since childhood of concerned people) can lead to abnormalities in those structures of central nervous system which have the deciding role in the responses to stress. We will mainly focus on prefrontal circuits, limbic system (so called limbic irritability) and hippocampus and cortical areas directly related to them.

The research design supposes the use of modern imaging techniques enabling the analysis of particular brain structures, which are the carriers of psychical functions chosen by us. For achieving a goal of the research project we have chosen fMRI (functional magnetic resonance), EEG and quantitative EEG (QEEG – for more details see e.g. Brunovský, M. (2004): Kvantitativní EEG v psychiatrii (Quantitative EEQ in psychiatry). Psychiatrie, Suppl. 3, 57-63) from the imaging techniques. Imaging technique called fMRI requires during task change (activation-conflict stage and non-conflict stage with comparative resting phase) the cooperation of examined people. Functional magnetic resonance (Dougherty, et al, 2004): Essentials of Neuroimaging for Clinical Practise. American Psychiatric Publishing. Washington D. C.) uses the principle of classical MRI to evaluate the change of local neuronal activity after stimulus task. Simply said: increased neuronal activity is accompanied by increased supply of oxygenated blood, which starts outnumber non-oxygenated blood in particular area, which causes local increase in the intensity of MRI signal. EEG technology enables to find out the degree of abnormality of bioelectrical activity when the behavior, emotionality etc. are disturbed. QEEG technology represents multichannel scanning and software evaluation. The result is mathematical expression of the level of synchronization of two signals scanned by two different electrodes and the level of local cortical activity. By means of EEG it is also possible to get 3-dimensional visualization of the distribution of actual neuronal electrical activity in cerebral cortex in LORETA system. Sophisticated software in LORETA system enables to record the electrical activity from classical EEG record in tomographic format (similar to CT).

Long-term stress manifesting itself in stress responses above limits, psychical strain, emotional instability, intensive negative emotions and superiority of pessimistic character of a man with interacting risk features and characteristics found out by the questionnaire (GPP – I; Gordon's personality profile – Inventorium T 26) and Cloninger's

questionnaire TCI, 1994a, 1994b), besides other things, can manifest themselves in morphological changes of grey matter of brain structures. At the same time the changes are manifested in functionality of inhibitive mechanisms (e.g. GABA system) in one set of structures (e.g. limbic) and activation mechanisms in other structures (e.g. in nodal point of neurocognitive network – in hippocampus). Amygdala activated for a long period blocks, for example, the activity of hippocampus, which is manifested on behavioral level, besides other things, by deteriorating of cognitive performance.

We are also interested in the fact, to what extent the stated changes are interconnected with the abnormal neuronal dynamics of biochemical activity and bioelectric reactivity of relevant structures of the whole living human brain. This means, whether there is significantly higher occurrence of behavioral symptoms of above mentioned morphological changes and the changes in local activity accompanied by related characteristic changes of parameters of neuronal complexity under strain (conflict of non-conflict) concerning people with asocial behavior as opposed to the people with pro-social behavior. We will use the potential of above mentioned imaging techniques – fMRI and QEEG – to verify the assertion.

Then we will focus on the analysis of the components of social and emotional intelligence and on the analysis of protective characteristics (optimism test ELOT by Chang, et al., 1994) and adaptive strategy of stress management (SVF 78 questionnaire by Janke & Erdmann, 2003). We will focus also on the analysis of positive values and tendencies found out by the questionnaire of interpersonal values (SIPO, Mikšík) and on the analysis of different characteristics of neuronal connectivity of above mentioned psychical phenomena concerning people with pro-social behavior as opposed to people with asocial behavior. The same procedure will be used for finding out the risk features and characteristics by means of following diagnostic tools: questionnaire (GPP – I; Gordon's personality profile – Inventorium T 26, Cloninger's questionnaire TCI, 1994a, 1994b), inventory of personality styles and disorders (PSSI, Kuhl & Kazén, 2002). After that all people put in the first research group (with pro-social behavior) and people put in the second group (with asocial behavior) will be exposed for a short time to a conflict stress situation and non-conflict stress situation. The parameters of electrodermal activity (height of the amplitude of skin conductivity, time of electrodermal reaction, degree of total habituation, electrodermal instability etc.) will be monitored. The data acquired by both procedures will be compared to the data acquired in a resting state. The changes in dynamics of electrodermal activity signal the changes of neuronal complexity.

We have decided to carry out measurement of volume and concentration of brain matter by means of voxel-based morphometry (VBM), which is the significant parameter for finding out the differences between people with pro-social behavior as opposed to the people with asocial behavior. It is possible to use VBM without modulation and VBM with modulation for calculation of the differences in the volume and concentration of grey matter between both groups. The results are then statistic parametric maps depicting the differences. Anomalous findings acquired by imaging techniques provide us with the chance to constitute psychotherapeutic and social rehabilitation programs made to measure for particular people.

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